COMMODITY FLOW FORECAST UPDATE AND LOWER COLUMBIA RIVER CARGO FORECAST

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COMMODITY FLOW FORECAST UPDATE

FINAL REPORT

For:

PORT OF PORTLAND

METRO

OREGON DEPARTMENT OF TRANSPORTATION

PORT OF VANCOUVER

REGIONAL TRANSPORTATION COUNCIL

Submitted by:

In Association with:

BST Associates

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Commodity Flow Forecast Update

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EXECUTIVE SUMMARY

The report documents freight flow forecasts to 2030 for the Portland/Vancouver metropolitan area by transportation mode and commodity group. Although comprised of commodities growing at different rates, this study forecasts that the total of all commodity tonnage in the metropolitan area will double between 1997 and 2030.

These long-term commodity demand forecasts were prepared in the context of the underlying regional, national and international economic development trends. Because many of the commodity flows in the region are destined for or are originating in other parts of the country, or even overseas, the future of freight transportation demand in the region is influenced by economic conditions outside the Portland/Vancouver area. Most importantly is the condition of the national economy, now just starting the recovery from the recession in 2001. In the years after the recover period in 2002 and 2003, there are several long-term trends that will shape the future path of demand for commodity shipments. Globally, these trends include:

- Globalization will continue to increase via trade links, increasing the importance of longer distance freight transportation.
- Economic growth will be more rapid in the developing countries among U.S. trade partners than in the advanced countries of Asia and Europe.
- Within Asia, the center of manufacturing capacity for export is shifting to China and South Asia with Japan's export manufacturing peak now past.

From a national level, long-term trends that will affect the future demand for commodity shipments include:

- U.S. population growth will slow from 1% to 0.8% annually, which will slow growth in the civilian labor force.
- Manufacturing employment will continue to decline as a share of total employment, while service sectors will generate an increasing share of job growth.
- The potential output of the economy will slow relative to recent historical rates due to slower growth in the labor force, while productivity growth will remain steady.
- Growth in the U.S. trade deficit will slow due to a decline in the value of the dollar and a reduction in U.S. real unit labor costs relative to the rest of the industrialized world.

These trends will influence the demands by producers and consumers for particular commodities and will shape the level of production in the economy and international trade. There are also specific factors working at the national level that directly influence future freight flows in the Portland/Vancouver region. These include:

- Logistics management and supply-chain optimization efforts to lower costs will reduce average shipment sizes and increasingly demand for reliable delivery times. This favors faster transportation modes such as air and truck.
- Increasing cost pressures on asset owning transportation carriers will mean continued pressure to achieve economies of scale and efficiency of operations. Larger containerships and air cargo hub concentration are but two of the consequences.

- Demand for bulk goods such as food, energy and construction materials continue to grow in line with population and income. The sources of these goods will shift due to changes in relative production costs and delivered transportation costs.
- By 2030 the tonnage of freight in the U.S. will roughly double, with the international share of total tonnage slightly increasing.
- If one divides the U.S. into broad regions, with the West being the region from the Rockies to the Pacific, this region will see faster growth than average for the rest of the U.S. The Portland/Vancouver growth will not be quite as fast as Western average, yet it will be faster than average for the country as a whole.

The demand for commodity transportation in the Portland/ Vancouver region will be influenced as well by several factors affecting the region. These include:

- Portland/Vancouver's unique position on the West Coast, that of an export dominated port, will continue to shape the outlook for international cargo in the region. Ocean carriers can fill otherwise-empty containers back to Asia across the Pacific by serving the exporters shipping through Portland.
- Especially in the Pacific Northwest, a greater share of domestic production will be sold for domestic consumption, which will reduce the available production capacity for exports.
- The region's traditional ties to North Asia, especially Japan, has reduced potential trade growth as those economies have lost out to Southeast Asia, and Southern China in share of trans-Pacific trade with the U.S.

The Portland/Vancouver economy has suffered in recent years from the downturn in the high technology sector and the strength of the U.S. dollar, which made many U.S. exports uncompetitive in world markets. The metropolitan area economy is now beginning to see signs of recovery, though some sectors such as semiconductor manufacturing will remain weak in 2002. The forecast for the area economy to 2030 includes the following characteristics:

- Based on DRI-WEFA metropolitan area model forecasts, the area's population growth is forecast to grow 1.3% over the forecast, contributing to slow civilian labor force growth.[1]
- With recovery from the recession, employment growth will resume, averaging 0.6% in 2003–2010, with few sectors ever reaching 1.0% growth, followed by an average of 0.5% growth over the 2010-2030 period. This is consistent with the growth in population and net migration for the area.
- Real output in the metropolitan area is expected to range within 2.7% to 3.0% over the 2010-2030 period.

[1] Metro Portland's own metropolitan area population forecast for the same period averages 1.6% compound annual rate of growth, using estimates of updated U.S. Census data for 1991-2000 and slightly different geographic area coverage.

The resulting forecast of a doubling of the demand for commodity tonnage shipments is made up of projections for individual commodities and transportation modes that will grow at varying rates. Truck will have the greatest absolute increase in tonnage over the forecast followed by rail tonnage. Air cargo tonnage will grow the fastest, averaging 3.8% per year. The waterborne and pipeline tonnage will grow much more slowly averaging less that 1% over the forecast.

From a commodity perspective, the top eight categories together comprise 74 percent of all tonnage volume in the region in 1997. These commodities include petroleum products and fuel, non-metallic mineral products, grains, wood products, gravel and crushed stone, foodstuffs and base chemicals. Of these categories, only the foodstuffs and nonmetallic mineral products are among the fastest growing commodity categories over the forecast period. The fastest growing commodity category over the forecast is the broad machinery category, averaging 4.1% annual growth through 2030. The higher value manufactured goods categories are generally those that are forecast to grow most rapidly. These categories include the meat, fish, seafood groups, milled grain products and preparations and bakery products, foodstuffs and alcoholic beverages, mail and express traffic, electronic and other electrical equipment and components, and office equipment, and precision instruments and apparatus, printed products, and nonmetallic mineral products.

A significant volume of traffic using the transportation networks in the Portland/Vancouver region is traffic not originating or destined for the region. This is "pass through" traffic for elsewhere in the country, an example of which is traffic headed to or from Puget Sound from points south or east of Portland. This traffic will double by 2030 with total pass through tonnage increasing from 48 million tons to 98 million tons. Rail and truck traffic are forecast to grow fastest with barge and pipeline pass through tonnage increasing much more slowly.

The value of commodities shipped to, from, through and within the Portland / Vancouver region will triple between 1997 and 2030, increasing from $352 billion dollars in 1997 to $824 billion dollars per year in 2030. This increase reflects the increase in demand for commodities as well as forecast inflation and commodity price changes over 33 years. The value of commodity demand shipped by air will increase most rapidly over the forecast at a compound average annual rate of 4 percent. However, most of total commodity value shipped goes by truck. The value of trucked commodities demanded will grow at a compound average annual rate of 2.8 percent, increasing the truck share of total commodity value from 79 percent in 1997 to 84 percent by 2030.

The implications of the forecasts of increased demand for commodities and the consequential demands on the Portland/Vancouver transportation system are significant. Decision makers in the region will need to address several questions that derive from this study. These questions include:

- Does the region have adequate capacity to meet increasing demands efficiently?
- All modes rely on roadways as the glue linking them together. How are the region's industrial areas linked to the regional transportation facilities? How will these links function in the future?

- Economic development efforts in the region will have implications for freight transportation. What new industries is the region trying to attract? What freight will they generate or depend upon? What transportation modes will they use?
- How will the transportation system and services be positioned to meet future economic requirements?
- How will the region handle new cargo attracted to the region or re-routing of existing cargo within the region due to new transportation services or improved frequencies of service?

1. INTRODUCTION

Overview of the Project

The purpose of the Commodity Flow Forecast Update and Lower Columbia River Cargo Forecast is to produce two related long-term 2030 forecasts with reconciled assumptions, baseline data, and forecasts of all commodities moving to, from, in and through the Portland/ Vancouver metropolitan area[2] by any mode of transport. Because the end uses and the requirements for data from the two studies differed, they were conducted as separate studies linked through common coordination and reconciliation tasks. This report covers the Commodity Flow Forecast Update project.

Overview of the Commodity Flow Forecast Update

The purpose of the Commodity Flow Forecast Update was to update the 1997 commodity baseline and forecasts to incorporate data from the 1997 national U.S. Commodity Flow Survey (CFS), improving upon its structure and methodology. The baseline and forecast was for the Portland-Vancouver metropolitan area and use the Standard Classification of Transported Goods (SCTG) classification of commodities, as introduced by the U.S. Bureau of the Census with the 1997 CFS.

The project was a joint effort with the consulting team acting as auxiliary staff with the project Technical Team. Port staff contributed data on marine and air terminal operation and provided the results of research into regional pipeline movements. This project also produced data for input to Metro Portland's truck travel forecasting tool and to the Oregon Department of Transportation statewide freight model. To improve upon the methodology of prior studies, other data sources were used in establishing the new 1997 baseline. The forecasting methods were improved through the application of industry and consumer sector modal commodity flow forecasting techniques.

The end result of this effort is a compilation of baseline data and a forecast of the annual commodity volume by mode and market for the metropolitan area.

Overview of the Lower Columbia River Cargo Forecast

Completed in parallel, the Lower Columbia Waterborne Commerce Forecast was produced to assist the lower Columbia River ports and transportation agencies in better understanding the flow of commodities on the river. The results of this study will assist the Ports of Portland and Vancouver in planning marine terminal and inland transportation improvements. It is also helps demonstrate for local, regional and state agencies the importance of how commodity flows on the River impact and are impacted by marine, rail, highway and other freight transportation systems.

[2] Portland / Vancouver PMSA: Multnomah, Washington, Clackamas, Yamhill, Columbia and Clark counties.

The geographic range of the Lower Columbia River Cargo study is different from that of the Commodity Flow Forecast Update. The Lower Columbia River Cargo study covers the deep draft section of the Columbia River from the mouth of the Columbia River up to Portland and Vancouver. This includes public and private marine terminals in Oregon and Washington on the Columbia River and the Willamette River. However, it excludes Oregon and Washington coastal ports (e.g., Coos Bay and Grays Harbor). The resulting forecasts for the Lower Columbia River study are for the deep draft portion of the Columbia River as a whole without sharing to the individual port level.

The result of this effort is a compilation of baseline data and a forecast of the volume of various commodities moving on the Columbia River between the Pacific Ocean and Portland and Vancouver. This comprehensive data includes all domestic and international waterborne commerce that may transit the Lower Columbia River. The forecasts were prepared in ten-year increments (2010, 2020 and 2030) in a separate document. The Lower Columbia River Cargo forecasts were reconciled with the commodity flow forecast update.

2. BASE YEAR 1997 COMMODITY FLOWS

INTRODUCTION

For use as a foundation for forecasting commodity flows, a new baseline of commodity flow activity in the region was developed for the base year of 1997. The Standard Classification of Transported Goods (SCTG) was established as the classification system for use in organizing the commodity data in order to be consistent with the 1997 U.S. Bureau of Transportation Statistics' Commodity Flow Survey. The development of the base year commodity flow data included fusion of commodity flow data from several sources and validation against other data sets such as establishment and reload facility data bases. Vehicle load factors were also used in order to validate the base year data against existing truck traffic counts for commodities shipped by truck.

This chapter presents a summary of the baseline data. The detailed description of the methodology of the development of the base year data is in the appendix.

The historical 1997 commodity data sources used in construction of the base year flows include:

- U.S. Census - Bureau of Transportation Statistics Commodity Flow Survey
- Reebie Associates TRANSEARCH commodity flow data
- U.S. Census Vehicle Inventory and Use Survey
- U.S. Department of Agriculture Crop Production and Shipments
- U.S. Department of Energy, Energy Information Administration energy commodity data
- U.S. Army Corps of Engineers Waterborne Commerce Statistics
- The Journal of Commerce PIERS commodity trade statistics
- Port of Portland maritime cargo and air traffic statistics
- Port of Vancouver maritime cargo statistics
- Oregon Census of Agriculture statistics
- Oregon Department of Geology and Mineral Industries commodity data
- Oregon Department of Environmental Quality municipal waste and scrap data

There were additional historical data sources used in the identification and classification of goods shipment activity in the base year. Most of these sources contained related industry or consumption characteristics related to the flows of the commodities themselves. These sources included information from the U.S. Department of Commerce, the U.S. Bureau of Transportation Statistics, the U.S. Bureau of Economic Analysis, the U.S. Department of Labor, trade associations among others.

BASE YEAR COMMODITY TONNAGE BY MODE

In the base year of 1997, there were 260 million tons of commodities shipped in the Portland / Vancouver metropolitan area. Of this total, truck carried 167 million tons, or almost 64 percent of the total tons in the area. Of internal commodity shipments, the truck share of total commodity tonnage was 97 percent while trucks carried only 44 percent of inbound tonnage to the area. Rail, here broken out into rail carload traffic and rail intermodal (container on flat car and trailer on flatcar) carries ten percent of total tons including 17 percent of the inbound tonnage. Overall, about ten percent of total tons are carried on ocean vessels, with a 21 percent share of outbound tonnage shipped by ocean vessel. Pipeline is only significant on the inbound, where the petroleum products and natural gas make up 26 percent of inbound tonnage.

Table 1 – 1997 Tonnage by Mode and Direction

Million short tons

Mode	Internal	%	Outbound	%	Inbound	%	Total	%
Truck	61.2	97.1%	57.3	65.3%	48.0	43.7%	166.6	63.9%
Rail	0.2	0.4%	1.7	1.9%	12.7	11.6%	14.6	5.6%
Intermodal	0.0	0.0%	5.6	6.4%	6.1	5.6%	11.8	4.5%
Barge	1.6	2.6%	4.7	5.3%	7.8	7.1%	14.1	5.4%
Ocean	0.0	0.0%	18.2	20.8%	7.0	6.4%	25.3	9.7%
Air	0.0	0.0%	0.2	0.2%	0.2	0.1%	0.3	0.1%
Pipeline	0.0	0.0%	0.0	0.0%	28.1	25.6%	28.1	10.8%
Total	63.1	100%	87.7	100%	110.0	100%	260.8	100%

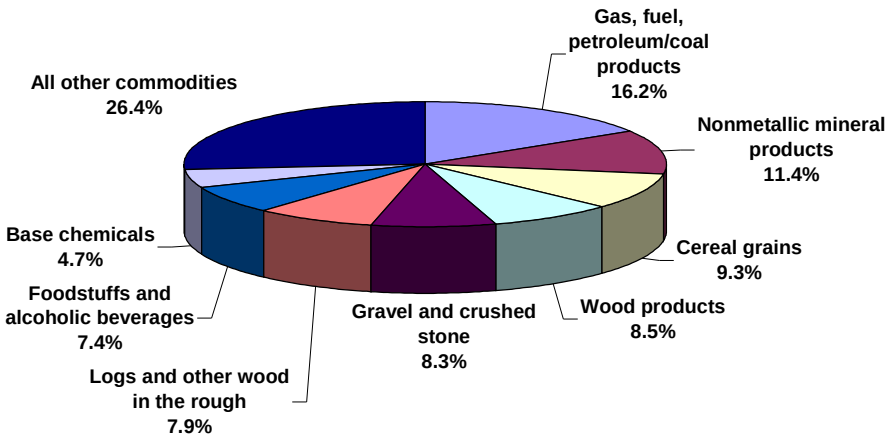
BASE YEAR COMMODITY TONNAGE BY COMMODITY

The commodities that are produced and consumed in bulk are unsurprisingly those with the largest tonnage moved in the Portland / Vancouver area.

The chart below shows that 74 percent of the total commodity tonnage shipped in the area in 1997 is made up by the top 8 tonnage commodity categories. The Gasoline, fuel and petroleum products category is the largest tonnage group while non-metallic mineral products, grains, wood products and gravel and stone are large tonnage categories as well.

Figure 2-1 Commodity Share of Portland/Vancouver Tonnage

Percentage Share of Total Tonnage 1997



Total 1997 tonnage by commodity category and primary mode are presented in the following table.

Table 2 – 1997 Tonnage by Commodity Category

1000 short tons

Description	Truck	Rail	Barge	Ocean	Air	Pipeline	Totals
Live animals and live fish	224	12	0	3	0	0	239
Cereal grains	2,384	5,878	4,885	11,155	0	0	24,301
Agricultural products, n.e.c	3,610	232	39	345	19	0	4,244
Animal feed & ingredients, cereal, straw, eggs	610	19	42	688	0	0	1,360
Meat, fish, seafood, and preparations	510	20	0	27	14	0	570
Milled grain products and bakery products	4,534	598	7	67	0	0	5,206
Foodstuffs and alcoholic beverages	18,165	1,011	0	89	4	0	19,269
Tobacco products	610	1	0	1	0	0	611
Monumental or building stone	123	139	0	0	0	0	262
Gravel and crushed stone, Sand	17,188	0	4,492	8	0	0	21,688
Nonmetallic minerals, n.e.c.	399	0	3	851	0	0	1,253
Metallic ores	0	631	0	952	0	0	1,583
Coal	1	0	0	0	0	0	1
Crude Petroleum Oil	0	0	40	343	0	0	383
Gas, fuel, petroleum/coal products	7,245	478	3,087	3,297	0	28,131	42,238
Base chemical	5,192	4,018	31	2,977	10	0	12,228
Pharmaceutical products	187	0	0	0	1	0	188
Fertilizer and fertilizer materials	464	751	139	1,033	0	0	2,387
Chemical products and preparations, n.e.c.	1,797	0	0	43	3	0	1,843
Plastics and rubber	1,200	47	0	76	8	0	1,331
Logs and other wood in the rough	20,299	0	17	225	0	0	20,541
Wood products	19,055	2,385	114	581	4	0	22,139
Pulp, newsprint, paper, and paperboard	3,870	1,626	611	622	2	0	6,731
Paper or paperboard articles	2,871	0	45	12	4	0	2,932
Printed products	1,005	28	0	0	11	0	1,044
Textiles, leather, and articles	4,612	20	0	15	11	0	4,659
Nonmetallic mineral products	28,064	977	0	583	3	0	29,627
Base metal in primary or semifinished forms	2,746	772	0	349	0	0	3,868
Articles of base metal	3,300	38	43	89	8	0	3,477
Machinery	918	62	0	50	49	0	1,080
Electronic equipment and components	787	28	0	42	51	0	908
Vehicles	2,597	751	0	480	20	0	3,848
Transportation equipment, n.e.c.	757	0	0	0	2	0	759
Precision instruments and apparatus	301	0	0	0	12	0	313
Furniture, mattresses & supports, lighting	645	20	0	13	1	0	679
Miscellaneous manufactured products	986	75	0	73	4	0	1,139
Waste and scrap	4,621	896	108	167	0	0	5,792
Mixed freight	4,322	4,345	0	9	19	0	8,695
Mail and Express Traffic	126	291	0	0	50	0	467
Empty Containers, etc	252	263	379	0	0	0	894
Totals	166,574	26,414	14,082	25,265	313	28,131	260,779

SUBMODE SHIPMENTS

For the base year, an estimate of secondary or "submode" shipments was made for the tonnage in the Portland / Vancouver region. In the context of the rest of the study, the transportation mode is the mode associated with the shipment's primary market. A "submode" is any other mode used in the region during a shipment. For example, a grain export from Montana would have "ocean" as its mode and "rail" as its submode. The grain ultimately is an outbound shipment for export and the mode on which it travels as an outbound shipment for export is "ocean". Since rail conveyed the grain from Montana to the Portland / Vancouver area elevator, "rail" is the "submode".

The submode detail for international shipments were estimated separately from domestic and intra-regional. Truck dominates the submode tonnage of all shipments, with significant secondary shipments that are 'truck-to-truck". Rail and barge are also used as submodes, though for much less tonnage. Reflecting their inherent transport characteristics, air, ocean and pipeline are not submodes for commodity transportation, as defined for the region. The statistics in the following table show that while truck is the dominant submode, there is significant rail share of the imports and exports by the ocean mode of primary transportation.

Table 3 – 1997 International Submode Tonnage

(1000 of short tons by primary mode)

	Imports						Exports					
	Ocean	Barge	Air	Truck	Rail	TOTAL	Ocean	Barge	Air	Truck	Rail	TOTAL
Submode												
None	-	183	-	687	946	1,816	-	23	-	325	1	349
Ocean		-		-	-	-	-	-		-	-	-
Barge	486			-	-	486	4,898	-		-	-	4,898
Air			1	-		1			1	-		-
Truck	4,775	73	8	-	202	5,058	5,732	8	8	-	266	6,014
Rail	1,754	15		-		1,769	7,620	2		-	-	7,622
Pipeline	-	-		-	-	-	-	-		-	-	-
Total	7,015	271	9	687	1,148	9,130	18,250	33	9	325	267	18,884

Commodities shipped to or from the Portland / Vancouver area within the United States which have secondary shipments by submodes have primary carriage on all modes except for ocean. As with international and intra-region traffic, truck is the dominant submode for domestic transport, for inbound and outbound shipments. The following table documents the base year tonnage by mode and submode for 1997 domestic shipments to and from the Portland / Vancouver area.

Table 4 – 1997 Domestic Submode Tonnage

(1000 of short tons by primary mode)

	Inbound						Outbound				
	Barge	Air	Truck	Rail	Pipeline	TOTAL	Barge	Air	Truck	Rail	TOTAL
Submode											
None	3,072	-	35,787	9,342	25,318	73,519	1,803	-	23,891	2,148	27,842
Ocean	-		-	-	-	-	-		-	-	-
Barge	-		-	-	-	-	-		-	-	-
Air		18	-			18		17	-		17
Truck	1,024	128	3,758	2,880	2,813	10,624	561	146	20,087	4,798	25,576
Rail	205		-	-	-	205	112		-	-	112
Pipeline	-		-	-	-	-	-		-	-	-
Total	4,301	146	39,545	12,222	28,131	84,366	2,476	146	43,978	6,947	53,547

The intra-regional shipments that rely on multiple transportation modes are limited to those modes that are efficient for the short distances of transport within the region. Consequently, truck transportation is the only submode used for intra-regional shipments, the majority of which is truck-to-truck shipments. As shown in the following table, barge and rail are the other primary modes with truck secondary shipments within the region.

Table 5 – 1997 Intra-Region Submode Tonnage

(1000 of short tons by primary mode)

	Barge	Truck	Rail	TOTAL
Submode				
None	-	55,568	225	55,793
Barge	-	-	-	-
Air	-	-	-	-
Truck	1,618	5,678	-	7,296
Rail	-	-	-	-
Total	1,618	61,246	225	63,089

VALUE OF SHIPMENTS

The total value of all commodities shipped in, to, from and through the Portland / Vancouver area in 1997 is estimated to be $363 billion dollars. This includes $74 billion in textiles, apparel, footwear, and leather products and $47 billion in motor vehicles and parts.

Reflecting the large tonnage share and the high average value of the goods carried by truck, it is trucking which carries the largest value of goods shipped in the area. At $278 billion dollars, the value of trucked commodities is seven times the value of that carried by rail, the mode with the next largest share. Ocean borne trade accounts for almost $26 billion in commodity shipments while air cargo shipments are valued at $3.5 billion in 1997. The next table shows the dollar value and modal share of 1997 base year commodity flows.

Table 6 – 1997 Value and Share of Goods Shipped by Mode

(Billions of dollars and percent share by mode)

	Billions	Percent Share
Truck	$278.2	79.0%
Rail	$37.2	10.6%
Barge	$6.8	1.9%
Ocean	$15.4	4.4%
Air	$3.5	1.0%
Pipeline	$11.2	3.1%
Total	$352.3	100.0%

BASE YEAR METROPOLITAN AREA TO REST-OF-OREGON COMMODITY FLOWS

The Portland metropolitan area to rest-of-Oregon 1997 base year commodity flows have data produced with origin-destination detail assembled for all the state of Oregon at the other end of each Portland metropolitan area shipment. Data produced are by commodity type and mode for volumes as of 1997. For truck, rail and barge traffic, the tonnage between the counties in the metropolitan area and the rest-of-Oregon was estimated both inbound and outbound. Tables summarizing this baseline tonnage (in thousands of short tons) in 1997 follow:

Table 7 – 1997 Metro Area to Rest-of-Oregon by Truck

1000s of Short Tons by Truck	METRO COUNTIES TO REST OF OREGON					
Commodity Group	**Clackamas**	**Clark, WA**	**Columbia**	**Multnomah**	**Washington**	**Yamhill**
Agricultural products, animals, and fresh fish	261.7	6.4	2.4	601.8	206.5	39.1
Grains	242.1	4.5	1.0	557.4	183.6	26.1
Prepared meat & fish, and prepared food products	1,985.0	27.1	0.1	4,838.9	1,554.1	197.6
Alcohol, Tobacco	241.0	3.3	0.0	567.8	183.3	21.8
Stone, sand, fertilizers	0.5	0.0	0.1	21.8	0.4	0.2
Nonmetallic minerals, metallic ores, coal, nonmetallic mineral products	469.3	2.4	227.2	2,816.1	547.6	92.7
Petroleum, gasoline, fuel, petroleum products	379.6	5.1	7.9	1,364.0	287.9	34.4
Pharmaceutical products	19.2	0.3	0.0	45.6	14.6	1.7
Base chemicals, chemical products, plastics & rubber	66.0	1.9	0.2	335.8	54.0	6.6
Logs and wood products	1,444.6	159.7	227.2	2,537.7	1,274.5	879.9
Pulp, newsprint, and paper and printed products	234.9	5.2	15.5	600.8	175.4	26.8
Textiles, leather, and articles	615.8	8.5	0.0	1,454.8	468.4	55.7
Base metal and articles of base metal	83.4	2.3	0.0	293.3	72.6	12.1
Machinery	15.5	0.7	0.0	39.3	12.5	1.3
Electronics and precision instruments	62.3	0.9	0.0	154.2	50.4	5.7
Vehicles and transportation equipment	70.0	1.0	0.0	287.0	54.4	6.6
Furniture, mattress, etc.	42.5	0.6	0.0	103.0	32.7	4.0
Miscellaneous manufactured, waste, and mixed freight	351.7	1.1	42.6	1,032.6	451.9	86.2
Mail, empty containers	0.2	0.2	0.0	82.3	0.2	0.1
Totals	6,585.3	231.1	524.1	17,734.2	5,625.0	1,498.7

Table 8 – 1997 Metro Area from Rest-of-Oregon by Truck

1000s of Short Tons by Truck	REST OF OREGON TO METRO COUNTIES					
Commodity Group	**Clackamas**	**Clark, WA**	**Columbia**	**Multnomah**	**Washington**	**Yamhill**
Agricultural products, animals, and fresh fish	50.3	4.2	7.3	190.3	54.1	31.8
Grains	20.8	1.6	4.4	78.0	20.7	20.3
Prepared meat & fish, and prepared food products	200.3	7.9	37.0	1,207.0	240.1	155.6
Alcohol, Tobacco	13.4	0.5	3.7	80.6	15.8	16.6
Stone, sand, fertilizers	1.1	0.5	0.1	23.0	1.5	0.2
Nonmetallic minerals, metallic ores, coal, nonmetallic mineral products	296.1	0.2	38.4	1,476.9	379.6	74.3
Petroleum, gasoline, fuel, petroleum products	27.3	2.3	7.9	181.1	31.9	27.8
Pharmaceutical products	1.1	0.0	0.3	6.8	1.3	1.3
Base chemicals, chemical products, plastics & rubber	8.0	1.6	1.1	306.2	10.7	5.2
Logs and wood products	2,406.4	4.1	285.7	8,319.6	3,118.3	656.7
Pulp, newsprint, and paper and printed products	28.1	2.8	4.4	368.2	32.3	19.3
Textiles, leather, and articles	34.2	1.3	9.5	193.7	40.1	42.3
Base metal and articles of base metal	8.4	0.7	1.2	150.2	10.4	5.9
Machinery	1.6	0.2	0.3	50.5	2.0	0.9
Electronics and precision instruments	4.1	0.2	0.9	59.5	4.9	4.2
Vehicles and transportation equipment	5.8	0.2	1.1	87.9	6.8	5.0
Furniture, mattress, etc.	3.4	0.1	0.7	46.4	4.5	2.9
Miscellaneous manufactured, waste, and mixed freight	23.9	0.2	0.6	1,139.1	32.7	3.4
Mail, empty containers	0.0	0.0	0.0	73.9	0.0	0.0
Totals	3,134.3	28.8	404.6	14,038.9	4,007.7	1,073.8

Table 9 – 1997 Metro Area to Rest-of-Oregon by Rail

1000s of Short Tons by Rail	METRO COUNTIES TO REST OF OREGON						
Commodity Group	**Clackamas**	**Clark, WA**	**Columbia**	**Multnomah**	**Washington**	**Yamhill**	
Agricultural products, animals, and fresh fish	-	-	-	109.4	-	-	
Grains	-	-	-	-	-	-	
Prepared meat & fish, and prepared food products	-	-	-	214.0	-	-	
Alcohol, Tobacco	-	-	-	-	-	-	
Stone, sand, fertilizers	-	0.1	-	7.0	-	-	
Nonmetallic minerals, metallic ores, coal, nonmetallic mineral products	-	7.7	-	619.8	-	-	
Petroleum, gasoline, fuel, petroleum products	-	1.0	-	76.7	-	-	
Pharmaceutical products	-	-	-	-	-	-	
Base chemicals, chemical products, plastics & rubber	-	21.3	229.5	231.5	-	-	
Logs and wood products	-	-	-	1,770.0	-	-	
Pulp, newsprint, and paper and printed products	-	-	-	-	-	-	1,073.2
Textiles, leather, and articles	-	-	-	8.6	-	-	
Base metal and articles of base metal	-	-	-	519.8	-	-	
Machinery	-	-	-	19.8	-	-	
Electronics and precision instruments	-	-	-	3.4	-	-	
Vehicles and transportation equipment	-	-	-	322.6	-	-	
Furniture, mattress, etc.	-	-	-	0.1	0.2	-	
Miscellaneous manufactured, waste, and mixed freight	-	-	-	814.5	1,159.3	-	

Mail, empty containers	-	-	-	117.8	-	-
Totals	-	30.0	229.5	4,835.3	1,159.5	1,073.2

Table 10 – 1997 Metro Area from Rest-of-Oregon by Rail

1000s of Short Tons by Rail	**REST OF OREGON TO METRO COUNTIES**					
Commodity Group	**Clackamas**	**Clark, WA**	**Columbia**	**Multnomah**	**Washington**	**Yamhill**
Agricultural products, animals, and fresh fish	-	27.6	-	185.0	-	-
Grains	-	-	-	-	-	-
Prepared meat & fish, and prepared food products	-	-	-	26.4	-	-
Alcohol, Tobacco	-	-	-	-	-	-
Stone, sand, fertilizers	-	-	-	-	-	-
Nonmetallic minerals, metallic ores, coal, nonmetallic mineral products	-	-	21.1	179.5	-	-
Petroleum, gasoline, fuel, petroleum products	-	-	-	-	-	-
Pharmaceutical products	-	-	-	-	-	-
Base chemicals, chemical products, plastics & rubber	-	-	-	-	-	-
Logs and wood products	-	37.6	-	28.4	-	-
Pulp, newsprint, and paper and printed products	-	-	-	56.8	8.0	-
Textiles, leather, and articles	-	-	-	-	-	-
Base metal and articles of base metal	-	-	-	-	-	-
Machinery	-	-	-	-	-	-
Electronics and precision instruments	-	-	-	-	-	-
Vehicles and transportation equipment	-	-	-	4.3	-	-
Furniture, mattress, etc.	-	-	-	-	-	-

Miscellaneous manufactured, waste, and mixed freight	-	-	-	3.1	-	38.9
Mail, empty containers	-	-	-	-	-	-
Totals	-	65.3	21.1	483.6	8.0	38.9

Table 11 – 1997 Metro Area to Rest-of-Oregon by Barge

1000s of Short Tons by Barge	**METRO COUNTIES TO REST OF OREGON**					
Commodity Group	**Clackamas**	**Clark, WA**	**Columbia**	**Multnomah**	**Washington**	**Yamhill**
Agricultural products, animals, and fresh fish	-	-	-	-	-	-
Grains	-	0.0	-	0.0	-	-
Prepared meat & fish, and prepared food products	-	-	-	-	-	-
Alcohol, Tobacco	-	-	-	-	-	-
Stone, sand, fertilizers	-	0.6	0.9	1.2	-	-
Nonmetallic minerals, metallic ores, coal, nonmetallic mineral products	-	-	-	-	-	-
Petroleum, gasoline, fuel, petroleum products	-	0.0	-	2.5	-	-
Pharmaceutical products	-	-	-	-	-	-
Base chemicals, chemical products, plastics & rubber	-	-	-	0.0	-	-
Logs and wood products	-	-	0.1	-	-	-
Pulp, newsprint, and paper and printed products	-	-	-	0.0	-	-
Textiles, leather, and articles	-	-	-	-	-	-
Base metal and articles of base metal	-	-	-	0.0	-	-
Machinery	-	-	-	-	-	-
Electronics and precision instruments	-	-	-	-	-	-
Vehicles and transportation equipment	-	-	-	-	-	-
Furniture, mattress, etc.	-	-	-	-	-	-

Miscellaneous manufactured, waste, and mixed freight	-	218.0	-	-	-	-
Mail, empty containers	-	-	-	0.3	-	-
Totals	-	218.7	1.0	4.2	-	-

Note: These values may include overestimates of some barge flows because some may be between ports internal to the region.

Table 12 – 1997 Metro Area from Rest-of-Oregon by Barge

1000s of Short Tons by Barge	**REST OF OREGON TO METRO COUNTIES**					
Commodity Group	**Clackamas**	**Clark, WA**	**Columbia**	**Multnomah**	**Washington**	**Yamhill**
Agricultural products, animals, and fresh fish	-	-	-	0.2	-	-
Grains	-	485.0	-	485.0	-	-
Prepared meat & fish, and prepared food products	-	-	-	0.0	-	-
Alcohol, Tobacco	-	-	-	-	-	-
Stone, sand, fertilizers	-	0.0	0.0	1.4	-	-
Nonmetallic minerals, metallic ores, coal, nonmetallic mineral products	-	-	-	0.0	-	-
Petroleum, gasoline, fuel, petroleum products	-	0.2	-	0.1	-	-
Pharmaceutical products	-	-	-	-	-	-
Base chemicals, chemical products, plastics & rubber	-	-	-	-	-	-
Logs and wood products	-	0.0	-	0.0	-	-
Pulp, newsprint, and paper and printed products	-	0.0	-	0.7	-	-

Textiles, leather, and articles	-	-	-	-	-	-
Base metal and articles of base metal	- 0.0		- 0.0		-	-
Machinery	-	-	-	-	-	-
Electronics and precision instruments	-	-	-	-	-	-
Vehicles and transportation equipment	-	-	-	-	-	-
Furniture, mattress, etc.	-	-	-	-	-	-
Miscellaneous manufactured, waste, and mixed freight	- 0.0		- 210.0		-	-
Mail, empty containers	- 0.1		- 0.3		-	-
Totals	- 485.3	0.0	697.7		-	-

Note: These values may include overestimates of some barge flows because some may be between ports internal to the region.

3. FORECAST OF COMMODITY FLOWS TO 2030

The commodity flow forecast is a long term projection of the demand for goods through the year 2030. The long-term commodity flow forecasts use the 1997 base year commodity flow data as their foundation. The forecast was developed in the context of national models both driven by forecasts at the macroeconomic, regional, producing sector, purchasing sector levels.

DEVELOPMENT OF 2010, 2020, AND 2030 FORECAST COMMODITY FLOWS

The commodity flow forecasts project the demand for freight flows for 2010, 2020, and 2030 for domestic and international freight flows, by origin, destination, and commodity category. The forecast was developed using industry sector classified activity, which were then mapped to the study's SCTG commodity categories. The general methodology involved taking the base year values for 1997, and growing these values based on appropriate growth rates. The results represent the demand for transportation of desired goods either as shipments or purchases of a commodity in a particular region of the country. The shipments growth rate was determined based on the growth rate in output in a particular region of the country and commodity group, from DRI·WEFA's Business Demographic Model (BDM). The purchases growth rate was determined based on DRI·WEFA's Business Transactions Matrix (BTM), which measures the purchases of a product made in one industry by industries in all other industry sectors, as well as the retail sector, in a particular region of the country. Finally, the forecasts of commodity shipments were controlled to purchases by commodity group and region, and were required to be consistent with national estimated freight flow control totals by commodity. Additional detail on the commodity forecast methodology is provided in a separate appendix.

The forecast was produced in several steps. The first was preparation of underlying macroeconomic, regional, trade, industry and price forecasts for input to the commodity flow forecasting models. A forecast of national commodity demand and shipments was produced to act as a control on the metropolitan area's shipments. And finally, the commodity flow forecast for the Portland / Vancouver region was prepared with modal Origin-Destination shipment detail at the region-to-region and metropolitan area level, for each level of geography required.

Underlying economic forecasts for 2010, 2020, 2030

As important inputs to the commodity flow forecasts, separate forecasts of economic variables were produced for 2010, 2020 and 2030. The DRI•WEFA international, national, regional, industry, and commodity forecasts were the source for these external forecasts. Industry sector and DRI•WEFA commodity classifications were mapped to the study's commodity classifications for purposes of the commodity forecast models. Similarly, the DRI•WEFA US international commodity trade forecasts were mapped to the same study commodity classification.

Overview of the World Economy and Forecast Assumptions

The United States, Oregon and Washington are not isolated within the world's economy. Instead commodity trade provides economic links to foreign customers and suppliers throughout the world. For a region such as Portland / Vancouver that serves as a gateway to foreign trade for the country, what is happening in U.S. trade partner countries will also affect the future demand for commodity transportation in the metropolitan area. Even many products produced and consumed within the United States today are subject to competition and influences from outside the country. This next section discusses the baseline economic conditions and likely future development and growth of foreign economies. This is intended to help provide an understanding of the forecasts for countries and regions outside the U.S. that affect the study's commodity demand forecasts.

Along with the U.S., the world went through recession in 2001 after strong U.S. growth throughout most of the 1990s and into 2000. The economies of many major U.S. trade partners had less steady growth during this period. Asia, and especially Japan, had a much more difficult time during the last half of the previous decade, with an economic downturn that earned the name "the Asian crisis" in 1997 and 1998, and two recessions in Japan during the decade even before the 2001 recession.

The long term economic and trade outlook is influenced by the structural, political and demographic shifts occurring in the economies of U.S. trade partners, with the trans-Pacific trade so important to Portland being most heavily affected by the rapid development of China and the continued economic problems in Japan.

WORLD COUNTRY AND REGION MACROECONOMIC OUTLOOK

CURRENCY EXCHANGE RATES

A key factor affecting the level of commodity trade at any point in time is the relative currency exchange rates between the U.S. dollar and the currencies of its trade partners.
For several years, the United States has had an exchange rate policy that has not attempted to reduce the strength of the U.S. dollar. The reasons for the sustained strength of the dollar in recent years are many, but fundamentally were tied to the willingness and the desire on the part of foreigners to invest in the United States and to hold U.S. currency.
From the perspective of the U.S. dollar demand from abroad, much of it in recent years can be described as foreigners making investment in private capacity and industrial production in the country.

A consequence of the strong U.S. dollar was that purchases of imports were relatively cheaper for the U.S. while U.S. exports were made less price competitive on world markets. The impacts within the U.S. of a strong dollar are not evenly distributed across industry sectors, the population and the geography of the country. Export-dominated industries and areas, such as in the U.S. Pacific Northwest, suffer from lower export sales and the resulting slowdowns in

production and employment. Industries depending on imported materials as inputs to their own production benefit from the lower dollar prices of imported goods. For example, low dollar-priced foreign electronic and communications equipment benefit those companies and individuals that purchase these imports due to lower expenditures and potentially higher productivity from the ability to afford the foreign-made equipment.
Looking back over the last decade, the dollar reached record highs year after year. The robust expansion up until 2001 drew funds to the U.S. from around the world. The buildup of the current account deficit indicated that America's obligations to foreign economies have risen to a very high level. Not only has the U.S. economy faced huge outflows of interest payments overseas, the large current account deficit also foretells problems now that foreign investors are reducing their appetite for investments in the United States.

The problems that came with a strong dollar are now starting to diminish, now that the dollar exchange rate has begun to soften. It has taken a long time for the weakening of the dollar to begin, considering that the U.S. economy dipped into recession in 2001. The U.S. Treasury has not encouraged foreign investors into leaving the dollar. Indeed, with the United States' strong position in the global economy, investors worldwide seemed to expect that the U.S. would have a sustained edge over foreign economies, regardless of good times or bad times.
The recent drop in the U.S. Dollar-Yen and U.S. Dollar-Peso exchange rates may see some reversal in the near-term, but the long term fundamentals still point to a reduction in the U.S. dollar exchange rate, as trade imbalances and consequential import financing demands exhaust the rest of the world's willingness to support them. The U.S. dollar exchange rate with the Japanese yen may be limited in its fall due to the hesitancy of the Japanese government in hindering their exports due to a stronger currency in the face of their own country's recession.

With the U.S. economy serving as the global recovery engine out of the 2001 recession, the forecast is for the U.S. dollar exchange rate to fall over the long term. The Canadian dollar, yen, euro, and British pound will all strengthen against the dollar in 2002, as foreign investors begin to question the invincibility of corporate America. Ironically, those doubts will help export businesses in America, which has seen exports slide as a result of the dollar's strength. This will benefit U.S. exports of goods, such as in agriculture, where the U.S. still has substantial production capacity. However, even a decline of 20% in the dollar (back to the levels of the early 1990s) would not to turn U.S. goods exports into a substantial growth engine, because so much manufacturing production has been moved offshore in the interim. The long-run forecast is for a continued moderate decline in the dollar exchange rate over the forecast period.

CANADA

Canada - U.S. trade is the largest between any two countries in the world. Following the North American Free Trade Agreement, the economies of the two countries are linked more closely than ever, with many companies following production and distribution plans that treat these countries as one market. Due to the link between the economies, Canada also suffered an economic downturn during 2001. However, the Canadian economy suffered only one quarter of negative growth in 2001. Their recovery is starting strongly in 2002, with annual gross domestic product forecast to be a bit above to 3%.

Over the next ten years Canada is well positioned for economic growth of about 3% with modest inflation. Canada's economic prospects are very strong relative to other countries with the exception of the United States. Canada is well positioned to compete in the "knowledge-based economy" with low inflation and a reduced tax structure by 2005. Canada will continue to have opportunities to lower unemployment and improve training and job mobility, though the forecast is not for aggressive policies to reduce the high level of structural unemployment, particularly in eastern Canada. There are good opportunities for energy development off both coasts. A major long-term risk to Canada's growth would be appreciation of the Canadian dollar relative to the U.S. dollar because Canada's current level of exports to the U.S. are due partly to the competitiveness of producing in Canada for the U.S. market.

Over the longer term, Canada will still be well positioned for non-inflationary economic growth, with low unemployment, and a low debt burden. The standard-of-living gap between Canada and the United States will likely widen further, but at rates less than in the past decade. This gap is primarily due to the fact that Canada's technology sector is neither as large, as complete, nor as productive as that in the U.S. This is also a major reason why the long-term sustainable growth rate for Canada has not risen as much as it has in the United States. Canada's population growth rate has also slowed, and fallen behind that of the United States. Over the longer term, Canada's strong economic and fiscal performance, particularly its strong trade position, especially when accounting for the large U.S. trade deficit over the longer term, will move the Canadian dollar upward.

JAPAN

For most of the last twenty years, Japan was the second largest U.S. trading partner country after Canada. Recently however, due to the economic problems in Japan, and the success of the North American Free Trade Agreement in increasing U.S. – Mexican trade, Japan has fallen to third place behind Mexico. Nevertheless, Japan is still the most significant overseas U.S. trade partner in the world. The outlook for Japan as a U.S. trade partner country is not strong, when compared with faster growing Asian economies, especially China. The primary reasons for this are Japan's continued problems with the structural and regulatory aspects of their own economy. The forecast is not all negative however. Japan is expected to gradually recover from its current slump. Japanese exports and their trade surplus are forecast to increase later in 2002. There has been a permanent structural change in Japan that has permanently increased import penetration into Japan, making a return to the large trade balances in previous years very unlikely. The manufacturing of goods consumed in the domestic Japanese market to mainland Asia, especially China. The boost from external demand in the form of increased Japanese exports will help end the 2002 slide.

Further moderate economic restructuring is expected for Japan, and it will improve the performance of the financial sector. Japan's continual monetary stimulus will eventually feed into the general economy as well. The impacts will be tempered by increases in bankruptcies and unemployment, which, coupled with Japan's relatively inflexible labor and capital markets, will keep the economy slow until almost 2005. The gross domestic product growth over this time will average less than 2%. Structural improvements should begin to have a positive impact around 2004-06, as market forces necessitate bankruptcies and bad-loan write-offs, while normal attrition will gradually shrink the excess employment in Japan's construction and manufacturing

sectors. As the financial sector returns to normal functioning, the high level of liquidity generated by the Bank of Japan should begin to feed through into the wider economy and yield further stimulus. Thus, GDP growth rates for are forecasted to rise above 2% before 2010. These trends are all positives for the yen, which should follow a course of gradual appreciation against the U.S. dollar.

Longer term, a key issue for the Japanese economy will be the aging of its population. With a low birth rate, high longevity, and a relatively early retirement age, transfer payments by the government to the elderly will become extremely burdensome during the next decade. Allowing or even encouraging increased immigration could alleviate this problem, but Japanese policymakers have shown little interest in this option. Thus it is an open question whether or not the government will deal openly with this problem, by adjusting spending and taxes, or will ignore it and fund the imbalance via deficit spending.

CHINA

After Japan, China is becoming perhaps the most important Pacific Rim trade partner for the U.S. This is not so much from the size of the Chinese economy or the current volume of trade, but the fact that China has been growing rapidly as a U.S. trade partner, especially as a source for U.S. imports of manufactured goods. The potential for further growth in trade is significant, as the Chinese economic development has been rapid in recent years, driven partly by large foreign investment in China. China is the one economy in Asia that was least affected by the "Asian crisis" recession of 1997 –1998, with sustained growth in gross domestic product of over seven percent annually.

China's economic conditions are forecast to remain positive in the near term. Export performance should continue to be strong, aided by global demand recovery. The Chinese government has engaged in deficit spending, partly to build needed infrastructure, which will also help boost growth in 2002. During the period 2002-2007, China will pursue economic structural reforms to address increasing foreign competition resulting from their entry into the World Trade Organization (WTO). These reforms will result in increased unemployment, which will dampen domestic demand growth. There is also a risk they will generate social unrest as they force changes on the economy. If these negative effects persist, economic growth could be much slower than in recent years, as the government is unlikely to continue the massive infrastructure spending to support growth indefinitely.

In the long term, the pace of China's long-term growth depends on how successfully the government is in reforming the country's massive and inefficient state companies and their banking system that is plagued by bad loans. With WTO membership, the government is taking on the pursuit of these reforms aggressively. These reforms will also transform the Chinese economy into one that is more market oriented and, ultimately, more efficient.

Aside from these structural problems, China possesses some very favorable factors for long-term growth. The country has an extremely high saving rate, at around 40%, which makes aggressive capital accumulation possible. China has also become very successful in attracting foreign investment, especially from the developed Chinese economies of Taiwan and Hong Kong, which facilitates technology transfer. In addition, WTO membership will further increase the country's openness to trade. As a result, the forecast is for the productivity gains following reform will be

substantial, though less than the initial market opening gains achieved after Deng Xiaoping's reforms in 1978.

SOUTH KOREA

South Korea was able to avoid recession in 2001 though their exports sent exports down 20% at one point, and consequently lowered industrial production for the year. Korean auto exports have remained strong and, because they are more labor-intensive than high-tech goods, have kept manufacturing employment relatively steady. Korean domestic demand—especially retail sales and construction—has grown at a fast pace, offsetting the loss of exports. Korea will see a return of export growth during 2002, leading to a GDP growth rate of over 5%. In 2003-2004, with the industrial sector responding to increased export demand, GDP growth is forecast to clime to just over 6%. The forecast is for domestic demand to moderate somewhat, as consumers catch up for the unusually low spending of the post-Asia crisis years, and as higher housing prices cool the real estate market. Inflation will accelerate, but will be limited to the 4–6% range due to central bank rate hikes and excess capacity in manufacturing.

In the long term, with relatively high educational attainment, South Korea's attractiveness to foreign investors, and progress in high-tech industries, will enable the country to sustain growth rates in the 4–6% range through 2010. Much of this growth will be internally generated, with the external balance declining as a percentage of South Korean GDP; it is even possible that Korea could see a return to trade deficits, if capital inflows are high enough to appreciate the won significantly. Few new problems are expected from the large conglomerates (chaebol) that caused so much trouble during the late 1990s. The previous mistakes of the chaebol—incurring excessive debt to fund inefficient expansion—are unlikely to be repeated, and under the government's leadership, they will continue to become more market-oriented. Korean banks as well were chastened by the Asia crisis, and will have clearer accounting and more realistic loan valuations in the future. Lastly, though the population growth rate will decrease over time, current demographic trends do not indicate as rapid aging of the citizenry as will be found in Japan in the future, thus Korea should avoid the problems associated with social spending imbalances. Long-run unemployment will remain low, averaging around 3%, however, the unemployment rate is forecasted to gradually rise, as Korea shifts to a service-based economy with a greater structural mismatch between job requirements and workers' skills during the transition. This structural shift will affect the goods trade of Korea with fewer low value manufactured goods production for export and a greater percentage of imported goods as a share of domestic goods consumption.

HONG KONG

Between 2002 and 2010, Hong Kong's economy will move beyond the recovery from its 2001 economic slowdown. During this period, improving global demand, following the revival in the U.S. and world economies, will continue to boost the territory's total exports and, in turn, its export-oriented economy. In addition, China's strong growth is likely to benefit Hong Kong's economy as well. Meanwhile, the property market and overall prices will rebound along with the economic recovery. Also, the government will reduce the current large fiscal deficit and balance the budget. Moreover, through its healthy financial system, the territory has served as the

gateway to China, which is likely to continue and provide some help to Hong Kong's economy, after China's accession to the World Trade Organization.

Growth in Hong Kong over the long run is unlikely to repeat its superior performance in past decades. The economy has already matured, with annual per capita GDP well above $20,000. Nevertheless, the territory has several favorable characteristics for its long-term outlook: openness to trade, a high saving rate, a government with a long history of noninterventionist policy, and a massive and fast-growing economy next door—China. There are also factors that will limit Hong Kong's prospect for growth. In particular, fast-rising wages and real estate prices have deteriorated Hong Kong's competitiveness. The currency board system that pegs the Hong Kong dollar to the U.S. dollar will not only makes Hong Kong vulnerable to mismatches between its business cycle and the U.S. monetary policy, but also creates inflexibility in its business-costs adjustment. Moreover, as China's major cities develop, Hong Kong needs to address the likely loss of its unique status as the main trade gateway into China, which has been crucial to the territory's economic success since China opened up in the late 1970s.

SINGAPORE

Singapore's economy was hurt by the global recession in 2001 with lingering impacts into 2002. Singapore's GDP fell 1.9% in 2001, compared with strong 10.2% expansion in 2000, but is forecast to recover in 2002, to 3% growth. Singapore will continue to experience relatively strong growth through 2010, as both the global economy and domestic technology sector return to growth. While it is unlikely that Singapore will get back to the rates of growth achieved during the expansion of the 1990s, the forecast is for annual GDP growth to average almost five percent the rest of the decade. Domestic savings will average slightly above 43% in this period, lower than the 1997-2001 average of 49%, as Singaporeans increase their rate of consumption. Investment will also recover, although at a slower rate than private consumption. In spite of the improvement in growth, employment will not return to its pre-recession level. The jobless rate should average 4.4% annually by 2010.

Singapore's long-term economic outlook remains positive. A move toward expanding the financial-services industry and the announcement that the industry will be deregulated should encourage a renewal of foreign investment in Singapore. Although the government is likely to move slowly, these changes will significantly improve the country's long-term prospects. Singapore's aggressive moves to achieve free-trade agreements with its trading partners, most recently the United States and New Zealand, should also ensure strong export growth in the next decade. Exports will continue to be important for Singapore's growth, but domestic demand will most likely become more relevant to long-term growth. Singapore has good infrastructure and a highly educated work force. A risk to the forecast and sustained long-term growth, however, is the outflow of skilled labor. However, the forecast assumes the government will attempt to reverse this trend by allowing more freedom and encouraging innovation. The government is stable and has always followed prudent economic policy. The chance of sharply reduced growth in the long term remains low.

TAIWAN

Now in recovery after a three-quarter downturn in 2001, Taiwan will enjoy favorable long-term growth. The country's manufacturing sector has successfully been transformed from a low value-added producer, e.g., textiles and toys, into a high valued-added one, e.g., electronics and computers. Taiwan's persistently high saving rate will allow the country to continue investing aggressively. There is some risk that Taiwan could suffer as Japan has, from shifts in domestic investment to mainland China, reducing domestic employment and consumption. However, the openness of the Taiwan economy and strong links to China will prevent it from falling to the same fate. The forecast is for the population's high level of education and increasing research and development efforts will sustain productivity growth. Another positive factor is the island's openness to trade, which will be bolstered further by entry into the World Trade Organization. The island's resources, however, have been highly concentrated in the high-tech industries and export sectors. The distortion of resources and the government's policies will likely restrain the island's further economic transformation and development. In addition, Taiwan's continued concentration on export sectors will make it difficult for the island to avoid being pulled into any global cyclical slowdown by its trade partners.

THAILAND

Following a continued slowdown in 2001, Thailand's economy began to recover by year-end. Higher private domestic consumption, boosted by continued spending on government stimulus funds and loosened monetary policy, was the main factor behind the return to economic growth. The government has spent heavily on village development funds, pubic projects, and other emergency stimulus measures to promote the return to growth in the last year. Increasing rural income and a rebounding local stock market, coupled with lower interest rates have led to higher domestic demand for durable goods, which led to higher consumer spending and a boost to the economy. Domestic investment is lagging along with still low industrial capacity utilization. Additionally, due to the global slowdowns, Thailand's exports have not recovered yet, which has slowed the economic recovery, as exports account for some 62% of real GDP at the end of 2001. The forecast is for exports to pick up later in 2002, following the recovery in the U.S and global economies, yet in the longer term, increasing competition from China will limit the extent of Thailand's export recovery. Meanwhile, as public debt has soared, so the government will have little room for further fiscal expansion in support of the economy. On top of that, restructuring of nonperforming loans by the Thai Asset Management Corporation has slowed and led to still high bad loans in the financial system, which also dampens the revival in the economic growth. As a result, although rebounding, the economy is unlikely to show a strong recovery during 2002, with solid growth not expected until 2003, as exports accelerate with stronger global demand.

The ongoing reforms in Thailand's financial system, as well as a structural reform to counter the increasing external competition, remains the main constraint to the rate of Thailand's further development. Additionally, the government's progress in privatization of state enterprises will benefit the economy during this and subsequent decades.

The long term outlook for Thailand's economy remains positive, but is dependent on the continuation of reform, especially the restructuring of the financial sector. A stronger and more

transparent banking sector will improve the domestic investment profile and ensure continued growth. Thailand has substantial modern infrastructure and a large labor pool, which is forecast to continue to attract foreign firms and investors. Also, in the long term, Thailand will continue to attract long-term foreign direct investment (FDI) from companies keen to position themselves not only for the country's domestic growth potential, but also for its role as a gateway to the Asian market, although it will continue to face strong competition from China. Thailand's long-term position will likely be limited by the degree to which China successfully reforms and advances the development of its own financial system.

MALAYSIA

Malaysia was affected by the global recession during 2001 with GDP for the year growing only 0.4%, with GDP decreasing at an average annual rate of 0.9% year during the last have of 2001. Starting in 2002, Malaysian output has returned to moderate growth, most of the growth has come from government consumption, while private consumption also has started to increase as well. While the economy is still sluggish, the decline in the economy has bottomed out. Entering 2002, industrial production was still falling after rapid declines toward the end of 2001. Manufacturing output has also continued to decline, though is expected to recover later in 2002. Both exports and imports also slowed sharply at the end of 2001, although the outlook is now improving. The value of Malaysian exports fell by 10.2% in 2001, but have started to increase in 2002, the first increase since early in 2001. Meanwhile, imports fell by 10.1% in 2001 and a return to growth is slow so far in 2002. The forecast is for Malaysia's economic output to grow 3.1% in 2002. Inflation has stayed relatively subdued, averaging just 1.4% in 2001 and is expected to average 1.6% in 2002. Following a 5% decline in 2001, producer prices started to increase slowly again in 2002, the first increase since 2000. Interest rates have also remained low.

Malaysia will continue to enjoy relatively strong growth through 2010. While it is unlikely that the country will go back to the strong growth levels of the 1990s, the forecast is for growth to average almost 5 percent annually during this period. Domestic savings will average a bit above 41% through 2010, slightly lower than the average during the later part of the 1990s, as Malaysian consumers increase their rate of consumption. Investment will also recover somewhat and average 2.6% growth over this time. The current account surplus is projected to decline, as imports start to grow faster, but the current account will remain in surplus through 2010.

The forecast for Malaysia in the long-term remains positive, yet it is highly dependent on the continuation of the reforms in the financial sector, as well as stable capital-market policies. A strong and transparent financial sector will improve the domestic investment profile and ensure continued growth. In the long term, Malaysia's ability to continue its impressive growth of the 1980s and 1990s assumes it will ease labor constraints and reduce discriminatory policies that favor Malays over other minority ethnic groups.

Malaysia has strong infrastructure, as well as an educated labor pool, which will continue to attract foreign investment. There will still be vulnerability to political disruptions, however, as long as the current government lasts. As a consequence of the draconian capital constraints imposed during the Asian crisis in 1998, Malaysian leader Mahathir is still seen as a loose cannon whose statements and policies can discourage foreign investment. Still, given his

domination of Malaysian politics, a succession of struggles after his departure could generate a leadership vacuum and instability for a few years.

INDONESIA

Indonesia has the largest population of any Southeast Asian country and has the single biggest economy in the region. And benefiting from having the world's fourth-largest population and an endowment of energy resources, Indonesia's economy developed rapidly in the 1980s and into the mid-1990s. Unfortunately Indonesia was severely impacted by the Asian economic crisis in 1997-1998, with massive disruption to its economy and effects that lingered into the global recession of 2001. Recovery has begun in 2002, with projected economic growth at around 3.2%. Yet slow consumer and investment spending in the context of still-soft external demand will hamper the rate of growth of the economy. Private and public consumption are recovering and will grow at a modest pace through the rest of 2002. New price hikes, rising unemployment, and declines in overseas worker remittances will constrain consumer spending growth in the remainder of 2002. This economic recovery has begun even with consumer confidence, as measured by the consumer confidence index (CCI) in broadly negative territory. Government spending will continue to extend some support to economic growth, although to a lesser degree than in 2001, when public consumption rose a massive 8.2%.

Gross fixed investment is expected to be flat and could even contract in 2002, as the bounce-back from the dramatic declines witnessed after the Asian crisis has now run its course. Investment outlays contracted in 2001, and the forecast is for the retrenchment to continue through 2002. Waning Foreign Direct Investment approvals and recent falls in capital goods imports reinforce this view of investment. Although nominal interest rates should start to come down later in 2002, the projected slowdown in inflation means that borrowing costs will remain high in real terms.

In the long-term, the global recovery is forecast to lift export demand, while high world oil prices will increase export revenues. Domestically, political stability and debt relief can lift business and consumer confidence, laying the foundation for the recovery in investment after the decline in 2001. These forces should then set the stage for much stronger growth in 2003, when the economy is expected to expand by 5.0%.

Assuming the structural reforms are adopted, foreign investment will revive and the domestic economy will stabilize. Indonesia is forecast to achieve 5% average annual economic growth by 2003 and sustain this throughout the decade. Ongoing efforts towards decentralization are expected to result in persistent fiscal deficits in this decade, as the newly empowered provinces engage in fiscal expansion. The private sector will likely lag behind, as lingering effects from price and political instability (the 2004 election is already on the horizon) weaken consumer confidence and preclude robust near term gains. Long-term growth rates could be even higher, however, depending on Indonesia's ability to attract additional foreign investment. Ever since the Asian crisis ended the previous direct investment flows of the mid-1990s, it is difficult to imagine that foreign investment inflows will recover entirely any in the future. The heightened political risks and legislative uncertainty following the end of Suharto's rule will deter some

investors, particularly if Islamic militancy, ethnic violence, or pro-independence movements in the provinces become widespread.

Indonesia's shaky transition to democracy, after more than three decades of authoritarian rule, has an important role in determining the country's long-term potential for growth. Nevertheless, Indonesia is on the verge of fundamental change; indeed, a number of structural changes are being set in motion that will have significant long-term economic impact. For example, the distribution of power between the central government and the provinces could eventually be re-drawn in ways that have deep-seated fiscal and distributive implications.

The country is rich in natural wealth and has significant, albeit declining, deposits of oil and gas, mineral, and agricultural resources. With its large population, Indonesia has abundant labor supply. An increasingly outward orientation and export diversification during the 1980s and early 1990s ushered in above-average growth, which is what enabled Indonesia to become the single biggest economy in dynamic Southeast Asia. Its ability to retain openness in trade, deregulate its markets, engender savings growth, and provide a suitable environment for technology transfer and investment will determine its future pace of advancement.

PHILIPPINES

The Philippines' near-term economic outlook has improved considerably since 2001. The forecast for 2002-2003 is for industry and agriculture to both see modest gains, and a recovering U.S. economy will boost Philippine electronics exports, one of the key drivers to the economy. Coupled with better-than-expected growth of 3.4% in 2001, 2002 growth is also projected to reach 3.6%.

Restored political stability combined with aggressive monetary policy has supported economic growth in the Philippines. This loosening monetary trend, improving demand conditions, and stable political environment will bolster investor sentiment in the 2002-2003 period.

The Philippine economy is expected to register annual gains averaging 5% in this decade. Achieving this higher rate requires sustaining growth in the agricultural sector, a recovery in industrial exports, and an improvement in the level of (and environment for) investment. The forecast is that the Philippine economy will reap the returns from ongoing economic and fiscal reform efforts. Investment is expected to increase to 18-19% of GDP by 2007. Improvement of physical infrastructure is crucial to raise investment in the economy. The uncertain outlook for ongoing privatization efforts increases the difficulty of estimating when the Philippines achieves their deficit targets. Progress in the privatization program will foster higher growth and investment, increase revenues in the near term, and reduce expenditure demands on the government. As 2001's cyclical global slowdown recedes, greater Philippine exports and remittance inflows will propel the Philippines back towards higher trend growth.

Long-term prospects for the Philippine economy are generally bright; substantial economic reforms undertaken in the 1990s position the country on a path of sustainable expansion. The strong consensus required for fiscal and structural reform in this open democracy supports stability on policies. Robust growth, however, is contingent on increasing domestic savings and

investment from their currently low levels. The country's saving rate is less than 20% of GDP, lower than that of other Asian countries, in part because of weak capital markets. A high dependency ratio (the birth rate is greater than 2%) and weak capital markets diminish the prospects for a sizable increase in the saving rate. Under-investment in rural regions, agriculture, and human capital, together with a stymied land-reform program has led to poverty and inequality. These structural weaknesses constrain the long-term growth outlook.

INDIA

A rebound from last year's manufacturing slowdown will raise growth in India's economy in 2002 to about 5.5%. Although industrial production has slowed from the strong increase of 7.4% in 2000, the recovery is forecast for 2002 with 2.4% growth forecast for industrial growth. Gains in Indian software exports will bolster the recovery. There is also a strong recovery in the agricultural sector, which still accounts for nearly one-quarter of India's economy.

Inflation is not an issue in India now, as consumer prices have remained relatively low. Slowed economic growth and stable consumer price inflation propelled the central bank to lower interest rates starting in 2001. The outlook for further near-term interest rate cuts remains poor, however, due to the looming fiscal deficit. Although the current budget restructures the tax system, boosts privatization, and lowers borrowing, the reform budget is unlikely to be radical enough to revive growth and lure back foreign investors. Inflows of portfolio investment and rising foreign-exchange reserves are likely to continue.

India's long-term growth prospects depend critically on efforts made by the government to deregulate a broad swathe of the economy and rid it of burdensome regulations stemming from the "license raj." The ability to control the country's nettlesome fiscal deficit will be key in reducing the high cost of capital for the country's private sector. Rapid urbanization rates will act as an important force of change in the long term. India's transformation from a largely autarkic state towards a progressively greater outward orientation will raise the contribution to GDP from net exports, although the pace of change will be gradual and nowhere near the rates that are forecast for East Asian countries.

RUSSIA

Russian economic performance will be solid, but more modest in 2002 in the wake of the global economic slowdown and the squeeze on energy sector profits in early 2002. The Russian economy demonstrated resilience in 2001 despite the global downturn. A number of key producing sectors displayed relatively strong economic momentum in 2001. It is assumed that the worldwide economic slowdown will continue to transition towards a full rebound, led by the rapid turnaround in U.S. economic activity already in evidence at the end of the first quarter of 2002. The quickening pace of growth in industrialized countries, together with supply management by both OPEC and non-OPEC oil producers and a high degree of political uncertainty in the Middle East, will result in higher oil prices and recovering profitability in Russia's energy sector. Continued progress in legislating market reforms and improving the business and investment environment, including a renewed emphasis on the rule of law, will take

place. Together with steady but moderate progress in bringing down inflation rates, Russia will become more attractive to investors, both domestic and foreign, going forward.

Industry and trade are the two largest industry sector contributors to Russian GDP and will be chiefly responsible for the modest decline in growth of aggregate gross valued added in 2002, and will restrain the rate of expansion in the next five years, along with incomplete reform and restructuring in several key areas, such as banking and natural monopolies. Russian industry will face increasing competitive challenges both at home and abroad, as the currency continues to strengthen and the costs of energy and transport are adjusted upward toward cost-recovery levels. More modest gains in real wages and tighter fiscal constraints will slow growth of consumption and, hence, the trade sector. Other market services, including transport and communications services, will also reflect the slower growth in industry and the trade sector. The forecast for GDP growth is to slow modestly, to 3.8% in 2002, then rebound to 4.2% in 2003. GDP growth is forecast to slow more significantly in 2004, to 2.9%, due to the impact on the real sector of an anticipated bail out of the state-owned commercial banking sector. We project GDP growth to reaccelerate in 2005-06 to 4.1-4.2%

The pace of growth in Russian output is forecast to continue to moderate over the long term, as the gains in productivity most readily obtained from reform and restructuring will have been achieved already. Russia will remain primarily an exporter of energy and other raw and processed material inputs to industry, while its manufacturing sector will continue to depend largely on the domestic market and some key export markets in the CIS countries. Even in the formerly captive markets of the CIS, though, consumers and enterprises alike will prefer more sophisticated goods from the industrialized West and Southeast Asia, especially as the strengthening of their currencies over time in real effective terms makes these higher-quality imports more affordable. Thus, we project Russian GDP growth at 4.1% annually in 2006-10, moderating to 3.3% in 2011-15 and further to 2.8-2.9% to 2025.

AUSTRALIA

Among all developed country economies in 2001, Australia best escaped the broad global recession with economic growth sustained during 2001. This achievement was more remarkable with declines in exports due to the decelerating world demand due to the slowdown in the United States, Europe, and Japan, and the resulting weakness in the rest of Asia. It was domestic demand that helped boost Australian economic growth in 2001, with overall growth reaching 2.4% in 2001, following 3.2% growth in 2000. The forecast is for the economy to improve in 2002, growing at 2.9%. Because of continued positive signs from the domestic economy and a moderate 2.9% inflation rate in the first quarter of the year.

Australia will continue to enjoy relatively strong growth during the long term. The domestic economy will take a gradually less cyclical lead, with a rising contribution from net trade as the rest of the world's economy continues to expand. Unemployment should average close to 6.5%, about its structural level, with slowing employment coming in line with increases in the Australian labor force. Domestic savings will average a bit above 21% in this decade, in line with the average in the last part of the 1990s. The current account deficit will also begin to abate, and will average around 2.9% of GDP over the longer term.

NEW ZEALAND

New Zealand has begun to see recovery following 2001 when annual growth in the economy was 2.8%. The increase in interest rates in 2002 has led to a strengthening currency, with the New Zealand dollar now at its highest level since mid-2000. The domestic economy is showing signs of rebounding, as business and consumer confidence surges. Investment expectations, particularly in business, still are lagging the recovery in 2002 owing to the slow pace of recovery of economic activity in much of the rest of the world, which places further pressure on investment. Gross domestic product growth will pick up to 2.8% in 2002.

Over the long term, the New Zealand economy is forecast to achieve growth at rates above the average growth compared with the last decade. Unemployment will continue to fall as economic activity expands, with steady employment advances outstripping slowing labor-force growth. While the currency will most likely regain some of its value, the current account deficit should begin to improve over the period to 2010. The deficit may not be eliminated completely, but it should return to the more sustainable level it held before the 1997 Asian crisis.

EUROPE

Following the recession in 2001, Western Europe's outlook has stabilized and recovery is getting underway. The region's overall GDP is forecast to grow modestly in 2002, after stagnating for most of 2001, where regional GDP was up only 0.5% at an annual rate at the end of 2001. The forecast for Western Europe's average annual GDP growth is 1.5% growth in 2002, but the annual figure masks a substantial acceleration in the second half of the 2002. The forecast projects regional GDP growth will approach 3.0% at an annual rate by the end of 2002. The recovery will be led by exports, but it should also get a big boost from rebuilding of inventory levels, which were reduced sharply during 2001.

The major obstacles to a more robust recovery are the cautious policies of the monetary and fiscal authorities in most of Western Europe, but particularly in the countries that have adopted the common Euro currency, and the expectation of a slower rebound in the rest of the world. Furthermore, the strength of the recovery will be dampened by high unemployment and high world oil prices.

Europe's economic growth could potentially outpace that of the United States over the next five years because its economy suffers from fewer macroeconomic imbalances than the U.S. economy. The forecast projects Western Europe's average annual GDP growth to be 3.1% in 2003 and 2.7% in 2004. Thereafter, the pace is projected to gently approach the region's trend growth rate of less than 2.5%. However, the U.S. economy's structural superiority is forecast to return to its long-term trend growth rate (which is at least 0.5% per year above Europe's). Also, Europe's fiscal and monetary policies are now limited by their own multi-country growth and stability pact. In fact, European economies have become so dependent on the U.S. since the Asian crisis of 1997-1998 that Europe would probably slow down in line with the U.S. economy in case U.S. imbalances became a major problem during the next decade.

Europe's long-term growth prospects are constrained somewhat by structural rigidities of its markets, burdensome social-welfare programs, and demographic factors. The forecast projects trend growth rate for Western European GDP at less than 2.5%, compared with the average annual rate of about 2.0% experienced during the 1990s.

While significant structural improvements have occurred in many of the region's economies, much more will have to be done if the region as a whole is to achieve sustained, high growth in line with that of the United States. The areas that could benefit most from major reform include the Europe's over-regulated and inefficient labor markets, costly social security programs, large state subsidies and protection of politically sensitive sectors, and immigration and political asylum policies.

According to the European Central Bank (ECB), there is no clear evidence that the growth potential of the countries with the common currency the Euro (which accounts for 70% of the region's GDP) has increased as a result of technological improvements or "new economy" developments. The ECB believes these countries' trend growth rate is 2.0-2.5%, because it has not yet achieved the level of U.S. advances in productivity.

As with Japan, a serious long-term problem facing Western Europe is the rapid aging of its population, which will put its labor markets and pension systems under increasing stress during the next several decades. The IMF has estimated that by 2050, both Germany and France will have as many pensioners as workers. With no change in their pension systems, it would take more than 40% of the two country's wage bill to keep them solvent. Despite efforts to increase the workforce through immigration and increases in the retirement age, countries such as Germany, France, Italy, and Spain will probably be hit hard by the demographic shifts in the long term, with the United Kingdom and Ireland less affected. Without measures to counter the emerging pension problem, the European Union's per-capita GDP would fall by about 19% by 2050. On average, EU citizens now retire at 58 compared with the statutory retirement age of 65.

LATIN AMERICA

The global recession hit Latin America hard in 2001, with return to growth not assured for 2002. Due to political trouble in Argentina and Venezuela, there has been considerable disruption to the economies of the region, affecting trade and foreign direct investment. The region will benefit from higher world economic growth in 2002, but the return to growth in these economies will ultimately depend on the developments on the political landscape and their effects on capital flows. If capital flows continue to dry up, the region will likely continue to show weak economic growth for the next few years, which will further reduce opportunities for output and productivity gains for the long term. The political arena is controlling the agenda in Latin America, which reduces the influence of business in achieving potential economic growth. Meanwhile, the Mexican economy is still depending on U.S. economic growth to pull it out of its 2001 recession. There are serious concerns, however, that the maquiladora industry's "splendid" growth years are a thing of the past. The reason for this below-par recovery performance is the consistent increase in maquiladora workers' real wages, which is making the Mexican industry less competitive than those of other countries, such as China, even with the difference in transportation costs to serve the U.S. market.

For the long term, Latin American countries are now facing one of the toughest periods in their history. After a decade of progress, reforms are faltering, and all the countries are slowing the pace of reform. The region is experiencing a backlash from the decade of reforms in the 1990s that transformed the economic relationships in these economies and between the economies and the political system. But while the economies have been transformed and modernized, the political systems are still reminiscent of times gone by. All the political clientelism and the nepotism that characterized these countries remain in place. The only difference now is that fewer of the economic resources are still in the hands of the political system to abuse. Now, politicians have to negotiate and deal with rational consumers and businesses that resent the political system's intervention in their affairs. In some countries, such as Venezuela, this backlash has already produced the resurgence of populist governments. Other countries could share this fate, if economic conditions continue to deteriorate or do not improve considerably. The two probable exceptions to this are Chile and Mexico.

There are important differences between these two countries, however. Chile is one of the most stable countries in Latin America, with only one episode of political instability in its recent history. Economic and social policy is rational, and the country has a high degree of institutionalization of its political, social, and economic structures. Mexico, meanwhile, has much greater proximity to the United States than the rest of Latin America, and is a member in the North American Free Trade Agreement (NAFTA). The NAFTA membership has been a strong stabilizing force in the Mexican political environment. While there is no guarantee that this force will be a permanent feature, so far "membership has its privileges" and the Mexican economy is a good example of the benefits of being part of a larger community of countries. It is still not clear, however, how the political system will react if the PRI wins the next presidential elections, or how the political system would evolve. Nevertheless, the medium to long-term prospects remain positive for the Mexican economy, tied ever more closely to the U.S. economy.

MIDDLE EAST AND AFRICA

Long-term prospects for growth in the countries of the Middle East and Africa are not bright, particularly when compared with the countries of emerging Asia. Among the reasons for lack of acceleration in growth are expectations of decline in real long-term oil and other commodity prices over the next decade; the high degree of vulnerability to commodity price shocks and other external events; and the low level of the region's attractiveness to foreign investment. According to the forecast, real oil prices in 2010 will be lower than the 2000 level. Given expected demand conditions and forecasts of an increase in non-OPEC oil supply, output from Middle Eastern oil exporters will have to decline to maintain oil prices above $20 per barrel. Although non-oil exports will fare relatively better, recovery in the prices of those commodities will be lackluster, particularly coming from very low levels. For countries of the region that signed the recent EURO-MED trade agreement, market penetration for agricultural commodities will be constrained by the remaining restrictions in the early phase of the agreement. Economic growth in the Middle East and Africa will average 4.4% in the long term.

EASTERN AND CENTRAL EUROPE

The long-term growth forecasts for Eastern and Central Europe assumes that all countries in the region will continue to record average annual rates of economic growth in excess of those expected for the developed economies. Only in this way will the substantial income gap be narrowed more rapidly than in the past. Among these countries, three groups of economies will find themselves in slightly different economic environments in the long term. By 2005, eight of the Central European countries will become members of the EU and, most likely, by 2008-09 most of them will adopt the Euro currency, putting the European Central Bank in charge of their monetary policy. Growth in these countries, both pre- and post-accession, should exceed that recorded for the more developed EU economies, as evidenced by past examples of other accession countries such as Spain, Greece, and Portugal. The forecast, however, is that following the initial period of compliance with the Maastricht inflation-target criteria, consumer price inflation will rise rapidly in all of those countries. As shown by the recent acceleration in inflation in the Czech Republic, as soon as solid growth resumes, consumer price inflation surges. The increase is driven by sizable increases in nominal wages made possible by rapid gains in export sectors. These increases spill over into price pressures in household services, government, and other sectors serving the domestic economy. These increases in nominal wages are the means by which the transition economies will narrow the Euro income gap with Western Europe and cannot be artificially stopped without choking economic growth.

The second group of countries includes the less developed economies of the Balkans. While omitted in the first round of accession, these countries are cleaning up their markets and are creating better business environments in order to attract foreign direct investment and restructure their economies. Once the leading economies in the region become EU members, the interest of the international investors will shift towards the low-cost economies of the Balkans, providing a strong stimulus to growth.

Finally, the economies of the former Soviet republics are also likely to enjoy strong growth in the long term. While many of them will remain commodity providers, countries such as Russia, Ukraine, Belarus, and Kazakhstan are likely to benefit strongly from economic integration with the rest of the world and from WTO membership. The annual growth rates will stay above levels recorded by more developed economies. Following an initial period of adjustments in administratively controlled prices to cost recovery levels, inflation will moderate in the high single digits. These countries will remain vulnerable to changes in international prices for key fuels and commodities

Overview of the U.S. Economy and Forecast Assumptions

The U.S. economy is the largest in the world and future economic conditions within the country will greatly influence the future economic growth both in the rest of the world and in the Portland / Vancouver area. Because the detailed commodity flow forecasts depend on the DRI•WEFA U.S. Macroeconomic and U.S. Regional forecasts, a summary of the key underlying assumptions and drivers are discussed here. It should also be noted that the study was undertaken in the midst of an economic downturn, in a post-9/11 environment. Short-term effects on passenger and freight transportation were clearly adverse. The cyclical response of the

U.S. economy and the disruptive influences of terrorism are reflected in the short-run paths of key macroeconomic variables, notably real GDP and employment. The decline in real GDP just for the fourth quarter of 2001, made for a short and muted recession and is reflected in the national economic forecast.

The story of 2001 was one of collapsing investment and inventory liquidation even before 9/11. Business investment fell in the United States and overseas. As the effects of the U.S. slowdown were felt abroad, trade replaced investment as the weakest sector in the short term. Since a rebound is starting in the U.S. before our trading partners' economies recover, imports are rising in advance of any recovery in exports. Only late in 2002 with a lower dollar and a gathering foreign recovery, will there be a significant upturn in exports.

Between falling investment and sluggish consumer spending, manufacturing activity also fell in 2001. The protracted decline in factory output – falling in most months in the last two years – is the steepest since the 1982 recession. Inventories shrunk from February 2001 through the end of the year, though they began to rebuild during the first half of 2002. During this period production will need to be stepped up, even to meet a sluggish order flow.

The federal government has given the recovery a boost. Although the ramp-up in spending took some time, the fiscal 2002 budget contains a huge amount of fiscal stimuli. The impact of this stimulus on the long-term forecast is slight. The measures adopted supported spending in the short term, but not have done much to speed the actual recovery. The real stimulus is in the tax cuts and the increased spending on education, security, defense, and intelligence.

State and local governments would like to be part of the cure for the ailing economy, but major revenue shortfalls are severely limiting their ability to help. To make matters worse, escalating demands for additional security at public facilities and expanded monitoring of public health are forcing difficult budget choices. Most states accumulated some reserves during the recent boom, but these are rapidly depleting. Public construction continues apace, though, as governments struggle to keep up with infrastructure needs and environmental requirements.

The U.S. Federal Reserve is still pushing liquidity into the monetary system. At 1.75%, the federal funds rate target has reached the lowest level in 40 years, while the real rate is zero or even negative, depending on which price index one uses. The Fed has stopped lowering rates and now is under watch for increases to fight any threat of inflation with recovery. Long-term rates have already begun to rise in anticipation of recovery, a return to federal deficits, and higher inflation.

The forecast assumes that the federal funds rate will be held down for the first half of 2002 but there is a concern that higher federal deficits and inflation could prompt the Fed to begin hiking rates early, perhaps even before a strong recovery is certain. Nominal federal purchases are expected to increase by 7.1% in calendar 2002, up from a 3.9% increase in 2001.

Long Run U.S. Outlook and Assumptions Relevant to the Study

The longer-term trend effects of the macroeconomic and regional economies reflect steady-state levels and growth rates appropriate to the context of the supporting analysis. In particular, total U.S. population growth and employment serve as key drivers for overall growth as well as an important component in aggregation. The DRI•WEFA forecast for U.S. employment is determined within the context of the macroeconomic forecast, which integrates influences from external factors and across industry sectors. The long-term growth rate in employment depends directly on key labor market variables and influences from outside of the labor market, such as interest rate policy and corporate profits.

The DRI•WEFA macroeconomic model incorporates the many influences on the labor market and the growth in employment. There are however particular influences that more directly affect employment in the long run, the growth rate of real output, productivity growth, labor force growth, and projections in labor force participation rates. Over the forecast horizon for this study the U.S. employment growth ranges within 1.3% to 1.5%, which represents a full-employment growth rate, which leaves the unemployment rate between 4.2% and 4.4% during the forecast period. This long-run growth in employment is consistent with real GDP growth of 3.2% to 3.5% and national productivity growth in the range of 2.2% to 2.5%.

Background and Overview to the Oregon/Portland Economy and Forecast Assumptions

More closely influencing the Portland/Vancouver commodity flow forecast are the economic forecasts for the region and the states of Oregon and Washington. A summary of the outlook for these geographic regions follows. Following its robust expansion during 1993-97, Oregon's economic growth decelerated sharply in 1998, as exports and foreign investment dropped off during the Asian crisis. Since then, Oregon has continued to struggle, as the national recession kept it from firmer ground. Indeed, in 2001, Oregon had the largest percent decline in employment in the United States. Total employment contracted in every quarter in 2001 and year-over-year growth languished in negative territory beginning in May 2001, dragged down by a precipitous drop in the manufacturing sector. Manufacturing was particularly hampered by losses in transportation equipment and wood products industries. Heavy truck producer Freightliner, for example, reduced its Oregon workforce by 1,000 in 2001. The services, trade, and construction sectors fell victim to lower consumer spending. Fire, insurance, and real estate was one of the few sectors that avoided an employment contraction. Consequently, the unemployment rate leapt from 4.7% in the first quarter to 7.5% in December 2001.

The future holds only tepid growth for Oregon. The state's economic performance will hit bottom in 2002, as job growth declines further, from –0.8% in 2001 to -1.5% in 2002. In addition to the national slowdown, Oregon's economy is suffering from another dip in semiconductor chip prices, as investment in high-tech equipment declines and companies consolidate operations. Employment in the manufacturing sector will continue to retract throughout 2002, even as production levels off because employers will be slow to hire until they are sure of recovery, favoring adding overtime to existing workers before hiring new workers. The lumber, wood products, and paper industries will also continue to stagnate throughout the forecast period,

but the transportation equipment sector is expected to begin to rebound in 2003, and show stronger growth in 2004.

Overall job growth will recover in 2003, as export-related markets regain some ground, and both high-tech and consumer spending rebound, boosting the construction and services sectors. Although employment growth will accelerate over the next five years, Oregon will not ramp up to strong gains until towards the end of the decade; the unemployment rate will remain at or above 7.8% through 2006. Trend growth in employment through the entire forecast period defined by the study is expected to range between 1.1% and 1.4%.

Traditional industries, such as timber, agriculture, fishing, and tourism, as well as a leading high-tech industry are key to the state's economy. Oregon has the fourth-largest concentration of semiconductor chip companies in the nation. High-tech companies are concentrated in the Portland metro area, the state's commercial center (making up roughly half of the population and employment), as well as in the Willamette Valley and beyond to the south, stretching down to Eugene-Springfield and Medford. Traditional resource-based industries remain an important component of the state's economy, dominating the southern and western parts of the state.

Business costs in Oregon are roughly on a par with the rest of the nation, and slightly lower in some areas. Oregon, like the rest of the region, benefits from relatively low energy costs. Moreover, the state has the lowest tax burden in the Pacific Northwest region, with state and local taxes amounting to 10% of personal income. Land is still fairly inexpensive and abundant, except in the Portland area, in which available land is becoming scarce, pushing up the cost of housing and industrial and commercial building. Wages have increased in the last decade, and are roughly commensurate with the national average. The price of skilled labor is high owing to its scarcity, however, especially in the Portland area.

The long-term view for the Oregon economy sees growth in real Gross State Product in the range of 2.5% and 3.0% over the 2010-2030 study horizon. Consistent with this view is total employment growth in the range of 0.2% to 0.3%, although greater employment growth is expected in service industries, such as healthcare and business services.

Outlook for the Portland Metropolitan Area

The Commodity Flow Forecast Update focused on commodity flows in the six-county Portland metropolitan area that includes Clark County in Washington. This metropolitan area serves as the commercial and industrial center for most of the state of Oregon, as well as much of southern Washington. With 1.9 million residents, the metro area is home to more than half of the state's work force. Portland's influence stretches 110 miles south to the Eugene/Springfield area, including Salem and the entire Willamette Valley. Portland's rapid and diverse growth during most of the 1990s has resulted in a modern, diversified economy. High-technology companies, many medium-to-light manufacturers, business services, and foreign trade are now key components of the metropolitan area economy, supplanting the former timber and agriculture-industry dominance of the past. Employment in the electronics industry alone is now comparable to that in the lumber and wood-products sector. With its geographic location on the Columbia River and its position at a cross roads in the national transportation network, the metro area is a key gateway for goods to and from Pacific Rim markets.

Portland's business costs have risen rapidly in the last decade, as land and housing costs increased with the influx of new residents and high-tech manufacturing plants. Relative to the rest of the nation, however, business costs are roughly on a par, and the region benefiting from relatively low energy costs and a business-friendly tax environment. Wages have risen about one percentage point faster than the national pace in the last decade, and are now roughly 5% above the U.S. average. The price of skilled labor is relatively high, especially in the Portland area.

Portland's economy did not live up to expectations during the late 1990s; total employment growth averaged only 2.4% annually in 1996–2000, while the regions neighbors from Seattle down through California were posting well into 3–4% gains during the e-commerce boom. Unfortunately, the Portland area has not proved to be immune to the economic slowdown affecting the rest of the country, either. Total employment contracted slightly in 2001, hurt by declines in manufacturing, construction, business services, trade, and transportation, communications, and utilities. The manufacturing sector sustained losses due to cuts by transportation equipment makers and semiconductor manufacturers, while services and trade were suffering the impacts of lower spending. The only good news came from the health and "other" services sectors, which posted 3.5% and 3.1% growth, respectively.

The recovery in the economy is underway but some sectors are lagging, particularly the manufacturing sector, which contracted over 10% in 2001, which helped push the metropolitan area's unemployment rate up. Indeed, the increase in Portland's jobless rate was dramatic in 2001, increasing from 4.0% in January 2001 to almost 8.0% in December 2001.

Portland's outlook in 2002 is for only moderate improvement. The market for semiconductors has not recovered, and high-tech investments are still weak, particularly in the area serving the telecommunications industry. High unemployment and recession fears had driven down consumer spending, and nearly every sector is struggling to recover. As a result, total employment will decline by 1.8% in 2002. A slower rate of population increases (1.3% annually[3]) will also restrain overall economic growth, which may prove to be partly beneficial if it helps to reduce the strains on infrastructure, housing, and the environment. A minor rebound in 2003 will precede several years of lackluster growth; employment gains will average 0.6% in 2003–2010, as few sectors ever reach 1.0% growth.

Real output in the Portland metropolitan area is expected to range within 2.7% to 3.0% over the forecast horizon, 2010-2030. Long-term employment growth is projected to be somewhat flat for the Portland area with growth expected to average 0.5% over the study forecast horizon. This is consistent with the growth in population and net migration for the area.

National Commodity Flow Control Forecasts

To assure consistency with total national potential production and consumption of commodities, a national-level freight demand forecast was prepared to be able to estimate the Portland Vancouver commodity flows in the context of national freight activity. This approach is important for the forecast as most of the commodity flows in the area originate or are destined

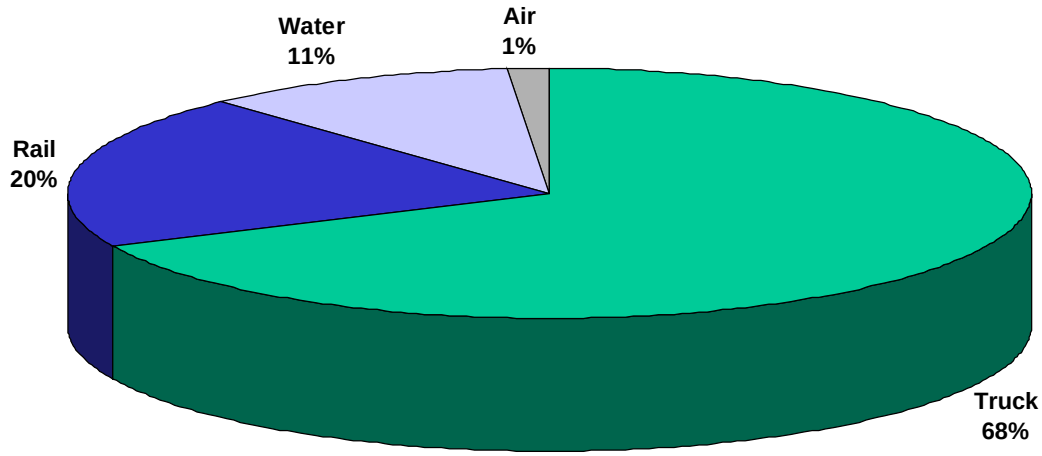
[3] Metro Portland's own metropolitan area population forecast for the same period averages 1.6% compound annual rate of growth, using estimates of updated U.S. Census data for 1991-2000 and slightly different geographic area coverage.

for a location outside the metropolitan area. This means that economic conditions in areas outside the Portland / Vancouver region will have a significant impact on both the supply and demand for goods that will be shipped in, to, from, or through the region. By producing a national freight flow demand forecast by commodity, it was possible to have a top-level control over the forecasts of freight flows at the state, metropolitan area and county level.

Nationally, trucking is the largest transportation mode used to carry commodities, and this will become increasingly so in the future. As also discussed elsewhere in this report, the trends in logistics and in commodity consumption patterns have favored truck in comparison with the other major transportation modes. As shown in the figure below, of the forecast new tonnage that will be demanded in the country in the future, over two-thirds will be carried by truck. Railroads still carry substantial tonnage, especially bulk cargoes, and the rail share of new tonnage during the 1997 to 2030 period will be 20 percent. Growth in the demand for the relatively lower value bulk tonnage commodities shipped today by water transport will be slower during the next three decades, resulting in waterborne modes capturing 11 percent of newly demanded tonnage by 2030.

Figure 3-1 U.S. Commodity Transportation Forecast by Mode

Percentage Share of Growth in Tonnage 1997 - 2030



At the national level, total domestic freight flows are expected to increase at an average annual rate of two percent from 1997-2030, with the tonnage of U.S. international trade increasing at average rates of three percent over the forecast period. The fastest growing sectors in the national commodity flow forecast include manufactures such as machinery and electrical machinery, equipment and components, as well as food products and clothing and apparel. This is consistent with the evidence that the nation's high standard of living shifts commodity consumption increasingly towards higher value added goods, often shipped in smaller shipment sizes than traditional bulk energy and raw food commodities.

Forecast of Origin-Destination Commodity Flows at the County and Metropolitan Area Level

With national commodity flow forecasts completed, commodity-specific region-to-region growth rates were applied to the 1997 base year modal commodity data established earlier. The commodity group and direction-specific base line data was matched against the forecast growth rates for the origin-destination pairs. Necessary aggregation of the out-of-area regions was performed to align with the direction or origin-destination information in the Portland/Vancouver and Oregon baseline 1997 commodity flows. The resulting Portland / Vancouver metropolitan area and county commodity flow forecast growth rates reflect the forecast growth in number of establishments, employment, and output for each county in the region, on an industry-by-industry basis. These demand forecasts reflect the assumption that necessary infrastructure and productivity gains will become available to meet projected freight demands. Where these assumptions did not apply, a further step to constrain the forecasts was made for the county and metropolitan area commodity forecasts. Reconciliation with the river cargo forecasts further modified the resulting forecasts before finalization.

COMMODITY FLOW FORECAST RESULTS

The commodity flow forecast for the Portland/Vancouver metropolitan region is for sustained growth over the long term to 2030. The volume of commodity flow demand for the Portland/Vancouver metropolitan area is forecast to double from 260 million tons to 520 million tons between 1997 and 2030. This total tonnage volume growth will be at a compound average annual rate of 2.1 percent over the period. All modes of transportation will see growth, though at different rates, reflecting the mix of commodities they carry and the routes on which they operate. A summary of the commodity flow forecasts is presented next by mode and commodity.

Commodity Forecast Results by Transport Mode

The largest volume of commodities shipped in, to, from and through the Portland/Vancouver area moves by truck. Truck tonnage is forecast to grow from 166 million tons to over 380 million tons by 2030, at a compound average annual growth rate of 2.5 percent. Total rail commodity tonnage is forecast to increase from 26 million tons to 59 million tons by 2030, overtaking pipeline volumes to become the second largest volume transportation mode in the area. Off of a very small tonnage base, air cargo is forecast to increase the fastest at an average annual rate of 3.77 percent, more than tripling volume to 1.1 million tons by 2030. Ocean cargo is expected to see average annual growth of less than one percent increasing from 25 million tons in 1997 to 34.8 million tons by 2030. Barge and pipeline are expected to see the slowest growth, with small increases averaging less that one half of one percent per year over the forecast period. The following table summarizes the forecast commodity tonnage by mode over the 1997 to 2030 period for the Portland / Vancouver metropolitan area.

Table 13 – Portland/Vancouver Commodity Flow Forecast by Mode

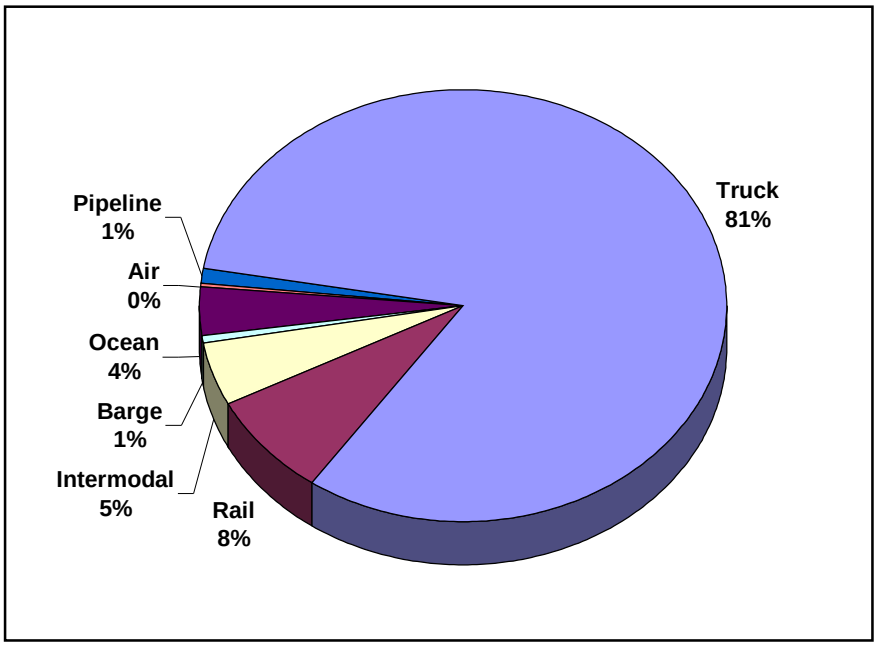
(Millions of Tons and Compound Annual Growth Rate)

Mode	1997	2000	2010	2020	2030	CAGR 1997-2030
Truck	166.6	197.2	223.1	315.6	380.0	2.53%
Rail	26.4	32.9	33.6	47.6	59.2	2.47%
Barge	14.1	15.1	14.6	15.4	15.5	0.29%
Ocean	25.3	28.4	28.7	32.3	34.8	0.97%
Air	0.3	0.4	0.5	0.8	1.1	3.77%
Pipeline	28.1	22.2	30.2	30.7	31.2	0.31%
Total	260.8	296.3	330.8	442.5	521.6	2.12%

The Portland/Vancouver area will see a significant further increase in truck tonnage volumes on the highways as the truck share of tonnage increases from 64 percent to 73 percent of total tons by 2030. Of the new tonnage over what is already shipped today, truck will capture 82 percent. Total rail (rail carload plus intermodal rail) will capture 13 percent of new tonnage by 2030.

The modal shares of the new tonnage forecast for the metropolitan area can be seen in the figure below.

Figure 3-2 Mode Share of New Tonnage in 2030 (Percent of Tons)



Commodity Forecast Results by Direction

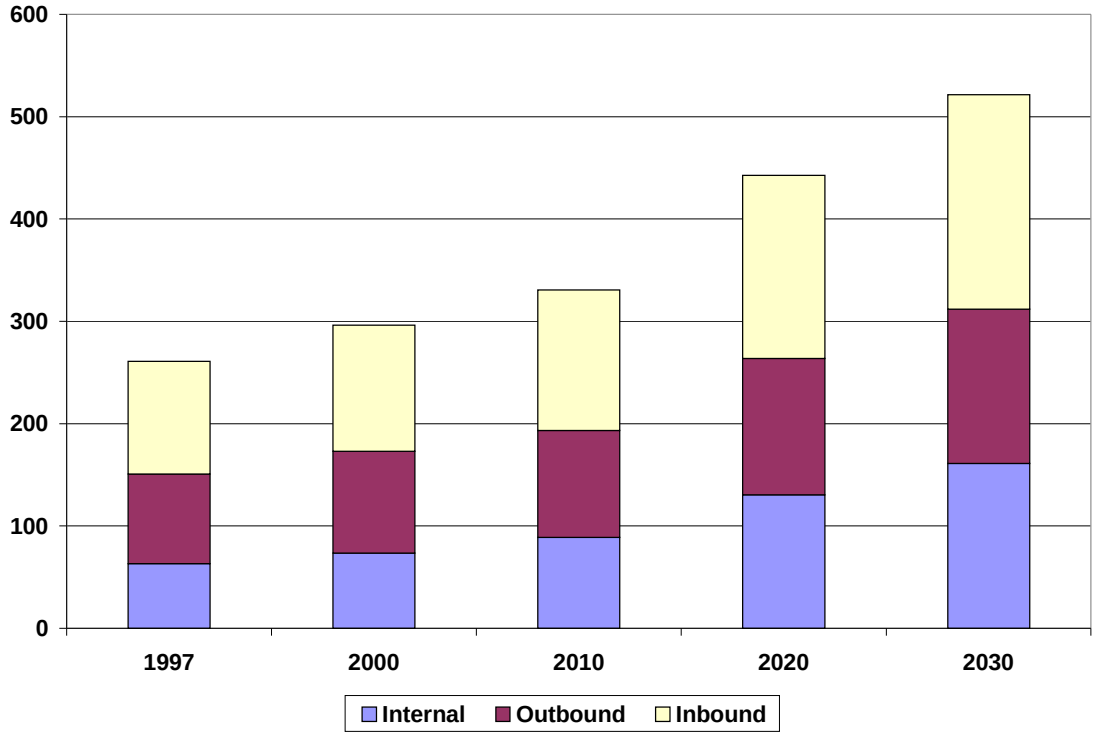
The commodity flow forecast for the Portland/Vancouver metropolitan area predicts that internal traffic demand will grow more rapidly than either inbound or outbound shipments over the forecast period. The intra-region, or internal traffic is forecast to increase at a compound average annual growth rate of 2.9 percent growing from 63 million tons in 1997 to 161 million tons by 2030. This growth rate is due in part to the fact that a greater percentage, 97 percent, of internal tonnage is carried by trucks, the second fastest growing mode in the study overall, behind air transport. The largest growth in tonnage is forecast for the non-metallic mineral products, the category which includes, among other things, construction materials as well as glass, cut stone and pottery. Outbound tonnage is forecast to increase at a compound average annual growth rate of 1.7 percent, increasing from 88 million tons in 1997 to 151 million tons by 2030. Inbound tonnage is forecast to increase at a compound average annual rate of 2 percent over the period, growing from 110 million tons to 210 million tons by 2030. The forecast of commodity flows by direction for the metropolitan area are displayed in the following table and figure.

Table 14 – Portland/Vancouver Commodity Flow Forecast by Direction

(Millions of Tons and Compound Annual Growth Rate)

	1997	2000	2010	2020	2030	CAGR 1997-2030
Inbound	110	123	138	179	210	2.0
Outbound	88	99	104	133	151	1.7
Internal	63	73	89	130	161	2.9
Total	261	296	331	442	522	2.1

Figure 3-3 Direction Share of Tonnage 1997- 2030 (Million Tons)



Commodity Forecast Results by Commodity Group

Forecast growth by commodity group in the Portland/Vancouver metropolitan area will vary by commodity over time. The slowest growing commodities are generally the lower value bulk commodities while the fastest growing commodities are the relatively high value goods seeing most rapid growth in demand. Of those commodities forecast to have above-average tonnage growth in demand, machinery and foods will grow fastest, followed by mail and electronics. The top ten commodity categories, ranked by growth 2000 to 2030 are in the table below.

Table 15 – Portland/Vancouver Fastest Growing Commodity Groups

Commodity Category Description	CAGR (%) 2000-2030
Machinery	3.7
Meat, fish, seafood, and preparations	3.5
Foodstuffs and alcoholic beverages	3.3
Mail and Express Traffic	3.3
Milled grain products and preparations and bakery products	3.3
Electronic and other electrical equipment and components, and office equipment	3.2
Precision instruments and apparatus	3.1
Printed products	2.9
Nonmetallic mineral products	2.9
Miscellaneous manufactured products	2.7

Pipeline Traffic

There is no petroleum refining in the Portland/Vancouver area, so all gasoline and fuel oil in the region is brought in from refineries elsewhere. Much of the current demand in the region is met by Puget Sound refinery products carried to the Portland/Vancouver region by the Olympic pipeline. Onwards from the Portland/Vancouver area, the Kinder Morgan pipeline carries product through the Willamette Valley south towards Eugene.

The forecasts for refined petroleum products assume that the overall market for refined products in the region grows at average annual rate of near 1.4% for the period 2000 to 2010, then slows to about 0.8% average annual growth for the next decade and on until 2030. This forecast includes the assumption that alternative technologies and/or conservation (through high CAFÉ standards and other factors) will increasingly affect demand growth over time.

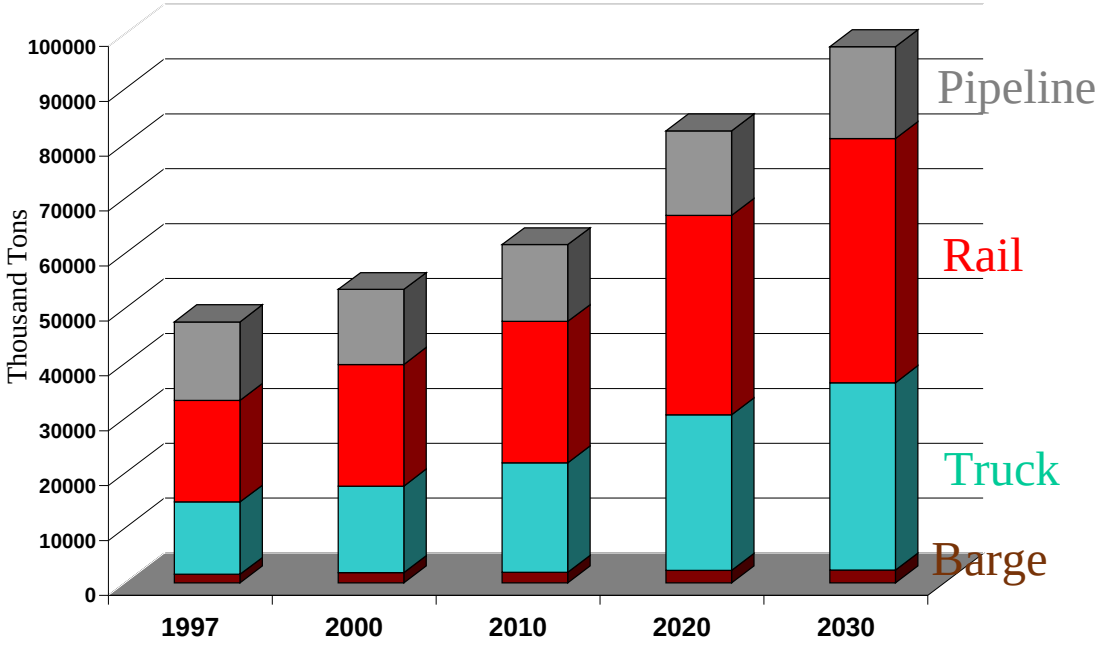
There was a shutdown of the Olympic pipeline during 1999 and into 2000 that disrupted historical patterns of refined product supply to the region. When this happened, Puget Sound refined products were shipped to the Portland/Vancouver area by tanker vessels on the Columbia River. After repair of the pipeline and its return to operation, Puget Sound-originating petroleum product shipments returned to using the pipeline, though not to full capacity initially. For the forecast, it is assumed that the Olympic pipeline is constrained to modest throughput growth back towards full capacity. Future demand not met by pipeline will be met by waterborne shipments that will be equal to the residual of the total market growth less the volumes carried by the pipeline. Under these assumptions, total pipeline tonnage is expected to rebound through 2010 and then increases at 0.2% during the period 2010 to 2020, and grow more slowly, at less than one percent annually for the remainder of the study period. To supplement pipeline capacity, petroleum products will continue to be carried by tanker vessel on the Columbia River from external sources. Of the waterborne petroleum product volumes forecast, imports are expected to grow slightly more rapidly than domestic shipments by water from outside the region.

Pass Through Traffic

A significant volume of commodities today are moving through the Portland/Vancouver area but are not destined for nor are originating in the area. This cargo, which is just passing through the area between external regions. This traffic still relies on the metropolitan area's transportation network capacity to carry it. The forecast for pass through traffic is for1997-2030 growth rates to average 1.2% annually for pipeline to 2.9% for truck with overall pass through growth averaging 2.3% over the entire period.

As seen in the Figure below, the most significant tonnage is in truck and rail today and will still be in 2030.

Figure 3-4 Pass Through Traffic Forecast (Tons by Mode)



Commodity Flow Value

For the Portland / Vancouver area, the value of all commodity shipments demanded in the future will increase from $352 billion in 1997 to $827 billion by 2030 at a compound average annual growth rate of 2.8 percent. This tripling of value of demand for commodities between 1997 and 2030 reflects the increase in demand for the physical quantity of the commodities combined with the expected affects of inflation and commodity price changes over 33 years. Put in perspective, this means that there are already one billion dollars worth of commodities moving on the area's transportation networks every day today and that this will increase to three billion dollars a day by 2030.

The modal shares of the value of commodity demand will shift over time reflecting the underlying distribution of the quantity demanded and the expected changes in unit prices. Those modes carrying the higher unit value goods today, truck and air, will increase their share of total

value, while the other modes' shares either stay relatively flat or decline. The value of commodities demanded that are shipped by air will increase most rapidly over the forecast at a compound average annual rate of 4.4 percent. The value of air cargo demand will increase from $3.5 billion to $12.6 billion over the forecast. However, most of total commodity value shipped goes by truck. The value of trucked commodities demanded will grow at a compound average annual rate of 2.8 percent, increasing the truck share of total commodity value from 79 percent in 1997 to 84 percent by 2030. The forecast of the value of demanded commodity shipments is shown in the following table measured in billions of U.S. dollars.

Table 16 – Forecast Value of Commodity Shipments by Transport Mode

(Billions of U.S. Dollars for Portland / Vancouver Area)

Mode	1997	2000	2010	2020	2030
Truck	$278	$371	$405	$575	$697
Rail	$37	$48	$45	$62	$74
Water	$22	$25	$26	$29	$31
Air	$3	$5	$6	$10	$13
Pipeline	$11	$9	$12	$12	$12
Total	$352	$457	$494	$688	$827

The value of commodities demanded that will be shipped internal to the Portland / Vancouver metropolitan area will increase from $67 billion to $207 billion over the forecast at a compound average annual growth rate of 3.5 percent. This relatively rapid growth reflects the fact that 99.7 percent of the value of commodities shipped within the region are moved by truck, and a greater percentage of internal commodity value is in commodities with higher growth expected during the forecast period. Inbound commodity value is projected to increase at an average rate of 2.7 percent annually, while outbound commodity value demanded will increase at an average rate of 2.1 percent annually. This reflects the much greater proportion of inbound commodity value carried inbound by rail than outbound and the substantial outbound rail shipments of high value motor vehicles. The forecast of the inbound, outbound and internal commodity demand in the next table shows this pattern of growth.

Table 17 – Forecast Value of Commodity Shipments by Direction

(Billions of U.S. Dollars for Portland / Vancouver Area)

Direction	1997	2000	2010	2020	2030
Internal	$67	$92	$108	$164	$207
Outbound	$162	$210	$214	$282	$325
Inbound	$123	$155	$172	$242	$295
Total	$352	$457	$494	$688	$827

Forecast of Submode Shipments / Secondary Traffic

The growth in tonnage of commodity demand in the future will have an impact on the submodes used for secondary commodity shipments in the Portland / Vancouver area. As in the base year of 1997, the majority of secondary commodity shipments will continue to be handled by trucks, with some rail and barge secondary shipments also in the area. Throughout the forecast there are no secondary shipments by ocean, air or pipeline. As in other aspects to the forecast, the truck share will increase over time, with the total secondary shipments by truck increasing from 78 percent of tonnage in 1997 to 86 percent of secondary commodity shipments demanded by 2030.

As seen in the following table, truck shipments increase from 55 million tons to 117 million tons by 2030 while rail will grow at an average annual rate of just over one percent from 10 million tons to 14 million tons by 2030. Secondary movements by barge will remain at about the same level as 1997 at about five million tons.

Table 18 – Forecast Tonnage of Secondary Commodity Shipments

(Millions of short tons and annual percent change for Portland / Vancouver Area)

	1997	2000	2010	2020	2030	CAGR 1997-2030
Ocean	0.0	0.0	0.0	0.0	0.0	0.00%
Barge	5.4	5.0	5.0	5.1	5.4	0.02%
Air	0.0	0.0	0.0	0.0	0.0	0.00%
Truck	54.6	65.4	72.5	98.6	116.9	2.33%
Rail	9.7	10.8	10.5	12.2	13.8	1.07%
Pipeline	0.0	0.0	0.0	0.0	0.0	0.00%
Total	69.7	81.2	88.0	115.9	136.1	2.05%

4. Reconciliation and Coordination with River Cargo Forecasts

Before they were finalized, the forecasts from the Commodity Flow Forecast Update were reconciled with the maritime commodity projections produced by the Lower Columbia River Cargo Forecast for all commodities moving on the Lower Columbia River and to, from, in and through the Portland/ Vancouver metropolitan area. Because the structure of the two forecasts was different in coverage, mapping between the commodity and geography used in each of the two studies was required in order to be able to compare the preliminary forecasts. The Lower Columbia River Cargo forecast has low and high forecast scenarios for individual types of marine cargo such as dry bulk, break bulk and container. The Commodity Flow Forecast Update categorizes waterborne traffic into either ocean or barge and is a baseline, or 'most-likely' forecast across all modes and commodities.

The reconciliation process included matching the commodity groups together and then comparing forecast growth rates by direction and year. Based on the additional commodity- and facility-specific information used in the Lower Columbia River Cargo forecast, the result of the reconciliation was the adoption of the mid-point between the high and low river cargo scenario or the high alternative Lower Columbia River cargo forecasts for most of the commodities

compared. To be most consistent with the commodity demand forecasts for the other modes in the Commodity Flow Forecast Update, the high alternative from the Lower Columbia River cargo forecast was used in most cases to best reflect the demands for commodities minimizing the effects of the supply constraints. The reconciliation resulted in the Commodity Flow Forecast Update forecasts of petroleum products moving in pipeline being adopted for the pipeline traffic shipments into the area. The pipeline forecast directly affects the waterborne forecast of petroleum products because without refinery capacity in the Portland/ Vancouver region, petroleum products are carried primarily by water when the pipeline network cannot handle demand.

5. IDENTIFICATION OF FACTORS, TRENDS, ADVANTAGES AND LIMITATIONS

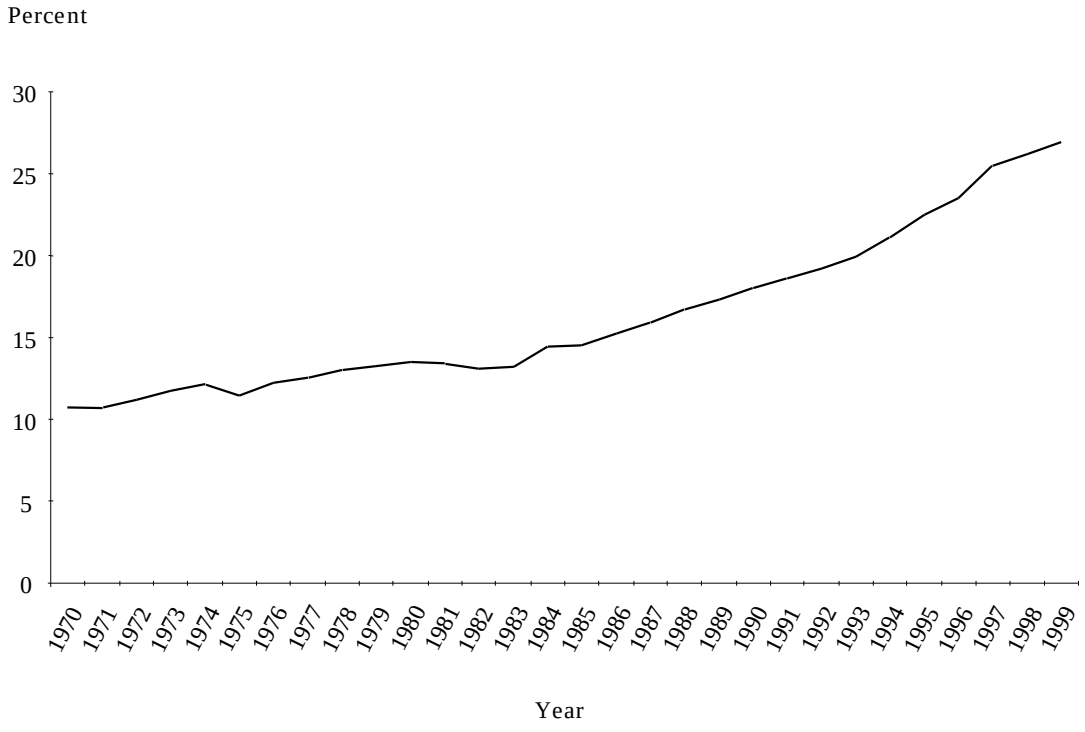
This chapter describes major national and international factors, trends, advantages and limitations that are likely to impact the future of commodity movement in the Portland metropolitan area.[4]

ECONOMIC GLOBALIZATION TRENDS

General Trade Trends

Over the past several decades, one of the fastest growing sectors of the U.S. economy has been international trade. Between 1970 and 1999, U.S. trade in goods and services as a share of gross domestic product (GDP) grew from 10.7 percent to 26.9 percent (in constant 1996 dollars). This trend is illustrated below.

Figure 5-1 U.S. Trade (Goods and Services) as Share of U.S. GDP



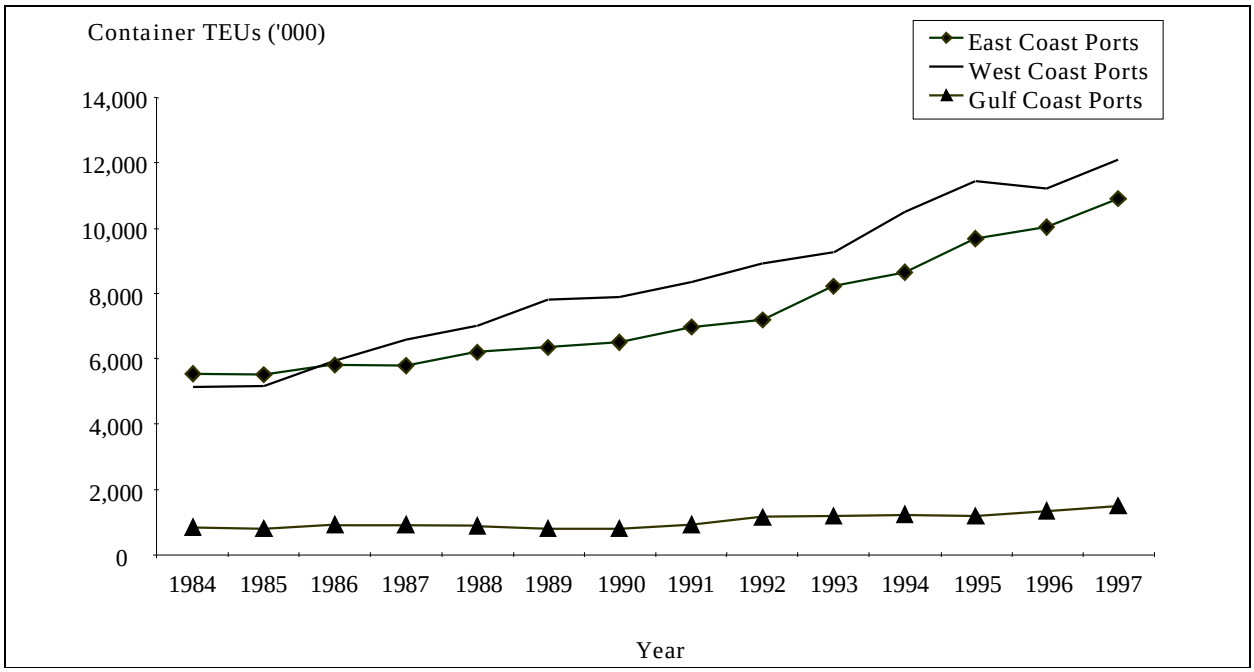
Source: U.S. Department of Commerce, Bureau of Economic Analysis

[4] Some of the information contained in the chapter is drawn from a series of white papers prepared by Cambridge Systematics and Reebie Associates for the Federal Highway Administration, Office of Freight Management and Operations.

This trend is expected to continue over the next several decades which will put increasing demands on already congested gateway facilities, inland trade corridors, and the connectors between the gateways and trade corridors.

Several factors in the political economy of international trade are expected to influence the pace of future economic globalization as well as influence which gateways and trade corridors will feel the greatest impacts. The first of these factors is the development of multi-national trade blocks and the integration of the national economies within these trade blocks. This trend coupled with industrial development in Asia, Africa, and the Americas should influence the nature of trade flows in the U.S. over the next 30 years. Growth in the economies of South Asian countries and the emergence of the Asia Pacific Economic Cooperation (APEC) countries as a trade community has already had significant impacts on West Coast ports. During the 1980s, the Far East became the largest foreign trade area for the U.S. This occurred at the same time that container shipping emerged as the dominant method of shipping for many commodities traded along the east-west trade lanes. The figure below shows that during this period, growth in container shipping from West Coast ports outstripped container traffic growth elsewhere in the U.S.

Figure 5-2 U.S. Port Container Traffic



Source: American Association of Port Authorities

While high levels of growth in Pacific Rim container trade is expected to continue, especially with China, the emergence of Western Hemispheric trade blocks is likely to emerge as another major trade story for the United States. In Central and South America, before the recent economic unrest, steps were being taken to further develop hemispheric trading blocks, including the Central American Common Market, the Caribbean Common Market, the Andean Pact, and the Common Market of the Southern Cone (MERCOSUR). A Free Trade Area of the Americas

is also still under discussion, with specific goals set by the leaders of all the countries to achieve steps towards integration. Shifts in trade towards Latin America would clearly have major implications for Southeastern and Gulf Coast ports, with the development of trade lanes and new potential load center ports. Development such as this would be of interest to port communities throughout the U.S., especially bulk ports, like the Lower Columbia River ports, that have limited current competition with the bulk ports of the Gulf Coast

Of perhaps greater significance to the Portland Metropolitan Area is the growth in North-South trade associated with the North American Free Trade Agreement (NAFTA). Oregon and California are major trading partners with Western Canada and the impacts on traffic into, out of, and through the Portland area is likely to grow in the future. Currently, the trade routes to Canada in the west have been oriented to and from Vancouver, British Columbia. This reflects both the early stages of free trade agreements between the U.S. and Canada and the political climate in British Columbia of the recent past. Initially, Canadian exporters in the West have limited their U.S. distribution to destinations closest to them. However, as these firms increase their trade experience, as Vancouver, B.C. immigrant communities strengthen their trade ties with the Asian countries of their origins, and with a more pro-business climate in the British Columbian provincial government, Western Canadian exporters may begin to seek out a wider market in the U.S. This could influence both the total flow of Canadian goods along the West Coast of the U.S. and the creation of stronger east-west trade lanes linking to the Pacific Northwest. It should also result in greater competition with the Port of Vancouver, B.C. and Canadian primary manufacturing firms in the North American marketplace. The most significant transportation impact for the Portland area would be an increase in truck traffic flowing south from Canada. The competition from Vancouver, B.C. will most directly affect the Puget Sound ports, putting downward pressure on prices at these ports, and less directly, on some maritime traffic through Portland.

Impact of Trade Trends on Freight Transportation

Clearly, as international trade increases its share of total freight moved, the impacts will be felt first at the gateway facilities (e.g., ports and international airports). Many of these facilities are already experiencing serious congestion problems and landside access to these facilities is likewise threatened by continuing growth. The three largest West Coast maritime ports, Los Angeles, Long Beach, and Seattle are all facing congestion problems on both the wharf side and the landside. The San Pedro Bay ports (Los Angeles and Long Beach) actually gained market share and continued to grow following the Asian economic crisis of the late 1990s, as carriers and shippers chose to concentrate activities both to take advantage of the huge internal market of the region and the economies of scale in port and distribution facilities. Expanded use of post-Panamax vessels that serve these markets, with attendant needs for deep-water ports, could contribute to further concentration of cargo at deepest draft ports with further congestion of freight transportation in already congested landside corridors. The San Pedro Bay ports have made major investments in new terminal capacity and the development of the Alameda Corridor. However, landside access continues to be a problem for these ports and the cost of making substantial further improvements to landside connections exceeds local financial resources.

Changes in freight transportation technology, such as increased use of containerized shipping, larger truck trailers, and post-Panamax size ships have created other challenges at West Coast ports. For example, the operation of larger trucks on older access routes with short signal cycles, inadequate roadway geometry, and other local operational problems is contributing to major operational problems. The introduction and sale of the new large Airbus model 380 aircraft for use for air cargo operators will also put pressure on airports to have capacity that these aircraft will require to be operated profitably. Airports such as Portland that have had Boeing 747 cargo service could see air cargo further consolidated to larger hub airports served by these Airbus air freighters. The peak effect of diversion from consolidation is greatest in the medium term because the continued growth in markets and growing congestion at the largest hubs will eventually see a reverse trend back towards diversification of services as markets such as Portland grow to volumes that are once again efficient for direct service.

Port communities are also facing significant land use problems. Expansion of facilities in existing locations at some maritime ports and airports creates serious environmental justice concerns. Many ports are under pressure to resolve their access problems without creating additional disruptions to local communities. Land problems are not confined to terminal needs, or runways at airports. The need for ancillary facilities such as warehousing and distribution sites at reasonable cost is making it hard for many ports to expand to meet growing trade demands. There are also increasing concerns, particularly in Southern California, about the environmental and capacity burden from the pass through traffic handled by gateway port areas. Some are questioning the desirability of having substantial truck and railroad freight traffic on the local networks to serve the rest of the country.

Are these trends an opportunity or a problem for the Portland Metropolitan Area? The answer to this question is ambiguous. On the one hand, the trend towards load centering and consolidation seen in the 1990s may continue to impact Portland container business. However, the congestion problems at other West Coast facilities could provide an opportunity if the right types of land use policies are in place. An additional concern for Portland is what types of financial resources may be available at the federal and state level and among private shippers and carriers to address the myriad capacity needs around gateway facilities. The cost of addressing these needs is likely to be substantial and all indications are that new funding resources in the next federal surface transportation bill are unlikely to appear without new revenue sources. Thus far, federal agencies have been reluctant to overtly designate "winners and losers" for investment resources. But as costs mount, the competition for limited federal and private investment capital will stiffen.

Harmonization of Trade Regulation in the Free Trade Era

Another issue that will face the Portland Metropolitan Area and the states of Oregon and Washington related to the new era of North American free trade is the internationalization of surface transportation carriers. Canadian and U.S. truckers increasingly operate on both sides of the border. Existing limitations to this internationalization of operations include the constraints imposed by immigration and cabotage laws, and delays and complications associated with border crossing, especially with added security concerns after September 11, 2001. Today, after delivering a truck load to a final destination point in the U.S., a Canadian truck trailer can legally haul a load en route to Canada, but the Canadian driver cannot pull it. Where cabotage rules have been changed to promote transborder movements of goods, immigration laws have not. Full integration over the borders is not yet realized, and this sustains inefficiencies in service and raises the costs of shipping. Over time, as these regulations are harmonized to promote greater access to markets for carriers, the Portland Metropolitan Area may see several changes in truck flow patterns. Reductions in empty backhauls and new demands for regulatory enforcement of size and weight limits are examples of the types of changes that may be in store.

DOMESTIC ECONOMIC TRENDS AND IMPACTS ON FREIGHT TRANSPORTATION

Over the past 20 years, there has been a major shift in the U.S. economy from manufacturing orientation to service orientation. In 1980, manufacturing was roughly equal to both services and "FIRE"(finance, insurance, and real estate) in terms of contribution to GDP. By 1997, manufacturing was a distant third, barely ahead of the rapidly growing trade sector.

The impact that this has on commodity movements in the U.S. has often been misunderstood. Shipments of manufactured commodities are still expected to see tremendous growth on domestic trade lanes. Growth in manufacturing is expected to occur through continuing growth in productivity. In recent years, cheaper freight rates and reliance on dependable transportation as a substitute for inventory holding have been major contributors to the growth in manufacturing productivity. Better transportation and information services have allowed manufacturers to reach wider markets and ship over longer distances. These trends should continue to be reflected in future commodity flow patterns.

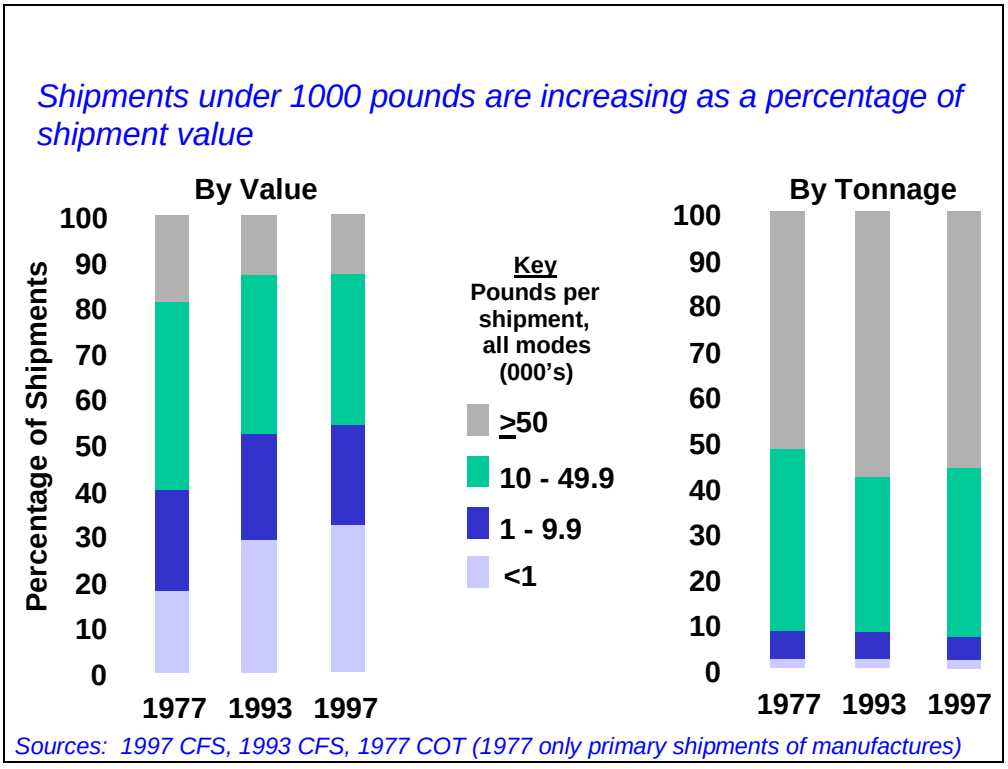
Another way that manufacturers have been able to expand markets and realize significant growth is through greater customization of consumer products. This is facilitated by effective real-time information about consumer demand and high speed, relatively inexpensive, and very reliable transportation. Customized production leads to shorter restock cycles in smaller, higher value shipments. This shift in commodity flows should be expected to continue over the next 30 years.

The shift towards a service-based economy has other impacts on the nature of local pickup and delivery traffic. In some cases, it is possible to view transportation as part of the service. Home grocery delivery services, web-based or catalog shopping, pizza shops, and Dell computers all tout home delivery as part of their service.

The major freight transportation implications of the shift towards a more service-oriented economy can be summarized as follows:

- Demand for more flexible, reliable, on-time service – This will push many shippers to seek out transportation options at the higher value end of the transportation service spectrum.
- Traffic growth is greatest for smaller shipments - This trend has impacts for all freight modes. CSX Intermodal reports that they are seeing a decline in direct container loads shipped business-to-business with an increase in shipments in the small package market (e.g., UPS). Clearly, air shipping is one of the fastest growing segments of the freight transportation industry. The figure below illustrates the significant growth in small package shipping that has occurred in recent years.

Figure 5-3 U.S. Freight Shipments



- Employees expect better working conditions – With a shift away from traditional manufacturing jobs, employees are developing different expectations about work conditions. Night shift work and work away from home for long periods of time is much less acceptable today than it has been in the past. This has serious implications for ports and warehouses that are considering 24 hour/7 day a week operations as a way to increase operational capacity without major infrastructure investment as well as for the ability to recruit long haul truck drivers.
- Society is more concerned with freight transportation's effect on the environment and local quality of life – As fewer people work in manufacturing and distribution, they are less likely to see the positive economic relationship between freight transportation and their quality of life. This has made it increasingly difficult to develop constituencies for major freight

infrastructure investment projects and has created greater opposition to cargo hub expansion. In an era when most decisions about transportation investment are made at the state and local level, this has made it very difficult to meet freight transportation needs.

- Demand for traditional, high volume transportation service will continue to grow, but account for a smaller portion of the transportation industry's revenues and volume – Despite all of the hype about e-commerce and the shift to service orientation of the economy, the market for bulk commodities continues to be a very critical element of the national freight transportation picture. Grain, energy, and other types of bulk commodities account for more than half of rail freight and are even more important for water carriers. Whatever the growth in services, there will still be steady growth in demand for energy, food, and construction materials. And unlike the trends in other sectors of the economy, these commodities will be shipped in even bigger loads on larger ships, unit trains, and trucks.

LOGISTICS TRENDS AND IMPLICATIONS FOR FREIGHT TRANSPORTATION

"Pull" vs. "Push" Logistics

Over the past several years there have been various reports of a major shift in business logistics practices away from conventional inventory-based systems ("push") towards replenishment-based systems ("pull"). This shift is reported to be greatly facilitated by the increased adoption of information technology and by e-commerce in particular. The implication of this approach to logistics in terms of the types of commodities shipped, the types of shipping services required, the size and frequency of shipments, the modal choices, and the performance requirements for transportation networks could be significant in the Portland metropolitan area. So it is important to understand what these logistics system models imply for freight transportation and to see what the evidence suggests about the rate of adoption of pull systems.

In conventional inventory-based systems, inventory is stored in warehouses or distribution centers at either the place of production or "forward-placed" near the consumer. Inventory is held in storage and is replenished based on fixed production cycles that anticipate demand. Stocks are replenished from inventory that acts as a buffer between customer demand and supply. Transportation can be arranged for larger shipments, and transit time and reliability is not critical because the inventory acts to protect against running out of stock.

With the advent of advanced information technology and real-time information about stocks and customer demand, some producers have moved to replenishment-based models that coordinate manufacturing to actual point-of-sale transactions. In the most extreme cases, manufacturers ship directly to customers with no stocks held in buffer inventory. The protection against running out of stock is a highly reliable and high-speed transportation system. Pull systems result in smaller package shipments on a more frequent basis and emphasize the higher-service transport modes (air freight, overnight and same day trucking).

In research conducted for the Federal Highway Administration, Reebie Associates found little evidence of pure pull systems in high-volume logistics applications and most companies that were interviewed did not anticipate a major shift in this direction over the next decade. Those companies that are likely to adopt this model will be smaller shippers in niche markets. Most

heavy manufacturers are not using pull systems at all on the retail side of their operations. However, most shippers and carriers expect elements of pull logistics to be increasingly adopted by high-volume shippers, particularly at the beginning and the very end of the supply chain. This trend will continue the shift to small package, high-service transportation that has been observed in recent years.

Logistics executives interviewed by Reebie pointed to several trends that could accelerate the migration to pull logistics. These trends include (1) growth in e-commerce, (2) the general shift to smaller shipping quantities, (3) the migration to customer-direct delivery, and (4) the growth of 3rd and 4th party logistics services.

There was much hype surrounding e-commerce over the last two-three years, but most analysts now believe the growth in the retail side of e-commerce (business-to-consumer or B2C) has been and will continue to be relatively slow. On the supply side (business-to-business or B2B), however, e-commerce continues a trend towards electronic data interchange (EDI) and the adoption of information technology that is at the very heart of much of the productivity gains that have been brought about in logistics over the last decade. The biggest impacts have been in shipment visibility and higher efficiency. The continuation of these trends should lead to greater cross-modal coordination (and a consequent increase in intermodal services managed with a high level of shipment visibility) and a reduction of empty miles for carriers who can achieve better utilization of their assets. The faster the adoption of these types of systems, the faster the migration to pure pull logistics systems will be.

One impediment to the more rapid adoption of information-based logistics systems is the high investment costs to both shippers and carriers. This has tended to favor consolidation on both the supply and the demand side of the logistics flow and is another factor that has led to mergers, alliances, and consortia among shippers and carriers. There can be serious implications for small-to-medium sized freight markets as this type of consolidation occurs, and Portland's recent experience with the impacts of carrier consolidation efforts may be a harbinger of what lies ahead. In the next ten years, consolidation of operations by carriers can mean replacement of direct services with indirect, or "feeder", service as carriers try to maximize density to benefit from economies of scale. In the long run, the growth of the business of the consolidated carriers will call for expansion of their own networks to include more direct services and facilities to the small-to-medium sized freight markets.

The carrying cost of inventory and more rigid customer demands have combined to make package and airfreight re-supply economical. The evidence of this trend has already been discussed, but it is also interesting to note that air cargo experienced the highest rate of compound growth in tonnage in the 1990s of any freight mode of transport (22% annual compound growth as compared to the average for all modes of 4%). Air cargo has also grown to account for 30% by value of the small package market. With the recession in 2001, and especially since 9/11, the growth in air cargo has slowed. There is a maturation of the express shipping market occurring whereby integrated carriers are still selling speed and reliability, while shifting the physical transportation to truck whenever service standards and expectations can be met without use of airplanes. This trend will continue though it will run up against limitations where longer distance and (non-NAFTA) international express shipments will still require air service.

The trend towards customer-direct delivery, bypassing conventional warehouse and distribution facilities, is not a trend that began with e-commerce. The growing popularity of specialty catalog shopping and mail order companies has led to a growing amount of shipment directly from manufacturers with an increase in the use of air freight carriers and package delivery services. This shipping sector is now further optimizing their use of express shipping from the integrated high-service carriers, using lower cost truck shipments and time-definite delivery service options when possible. A looming challenge from this trend is taming the "last mile" delivery costs and dealing with the impacts that local transportation system congestion and unreliability has on the entire supply chain.

The trend towards the use of 3rd and 4th party logistics service providers has also been highly evident in recent years. Outsourcing logistics services is a common practice as these logistics specialists are able to bundle services across modes to meet high performance needs of customers.

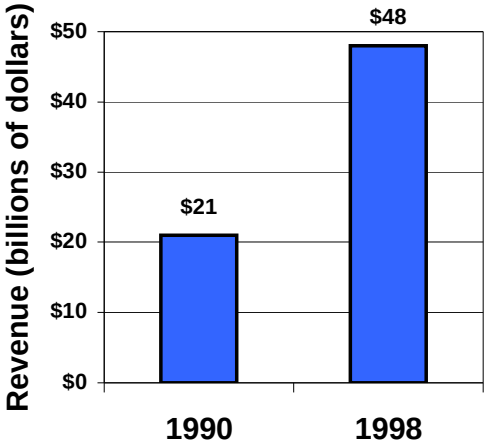
Coordinated Logistics and Mode-Neutral Services

Historically, the services of carriers have been narrowly defined along modal lines. The growth of intermodalism over the past 20 years has helped to break down modal barriers. The future of logistics suggests even greater modal coordination in the future. The notion of "coordinated logistics" involves the integration of disparate logistics activities. It is a direct response to the heightening of shippers' service expectations, market pressures on freight rates, and the desire to improve shipment visibility, especially across modes. As carriers have faced these new market realities, they have been pushed to the limits of their modal performance and have been forced to look across modes for better overall performance in their product offerings. At the same time, shippers are looking for seamless integration of services across modes.

Coordinated logistics, or mode-neutral services, have been greatly facilitated by information technology in three major areas: 1) shipment and asset tracking, 2) routing and dispatch optimization models, and 3) commercial transaction management software. These technologies have increased shipment visibility, improved hand-offs across modes and carriers, and reduced risk across modes. But as noted previously, the technology investments are very expensive for all but the largest companies.

Across the transportation industries, carriers have found returns squeezed to the point where they do not cover costs of capital to make the types of investments that are needed. In addition, carriers report that large financial institutions and investors have no interest in dealing with small carriers given the high capital requirements of the industry. This has led to concentration and consolidation to attract investment and expansion of service offerings beyond the traditional services as a means to reduce asset base relative to sources of revenue. The trend towards consolidation is illustrated in the case of trucking in the following figure.

Figure 5-4 Truck Line Revenue Concentration
(Revenue from Carriers with over $100 Million in Revenue)



Source: ATA's Transport Topics

The move by shippers to core carrier programs as a means to give shippers leverage and drive down costs, was a leading factor in encouraging carrier consolidation. Carriers responded to equalize the leverage and to achieve economies of scale. By 1998, the amount of business in the hands of motor carriers with more than $100 million in annual sales was two and a half times what it was in 1990. The number of trucks and drivers controlled by the largest trucking companies have also increased substantially over the decade. Domestic air freight is dominated by a half dozen integrated carriers. U.S. flag steamship companies have merged with foreign lines. Class I railroads have reduced in number to the point that there are six major systems in North America with another round of mergers possible in the future.

So far the productivity gains that have been achieved through coordinated logistics look impressive. But the long term implications of this trend for the modal mix of freight and the availability of services in all markets are not clear. A big question for the future is who will make the information technology investments that will be needed, shippers or carriers. Each side feels the other has the most to gain and neither wants to bear the lion's share of the costs. This has tended to be a tempering influence on the rush to greater cross-modal integration.

TRANSPORTATION INVESTMENT TRENDS

Over the past 150 years, in a series of major national efforts including the construction of the intercontinental railroad network, the inland waterway system, the system of international and domestic airports, and the interstate highway system, the United States has built the leading freight transportation network in the world. With the completion of the interstate highway system, there has been a growing sense that the era of adding capacity to this system is over and

that attention will now shift to maintenance, rehabilitation, and system optimization. This shift in the nature of transportation investment has significant implications for the future performance of the freight transportation network and the nature of funding that may be available from the federal government and the private freight industry. This new investment climate has led to the emergence of a number of problems, many of which will be apparent in Portland:

- Portions of the freight system require substantial rehabilitation (e.g., inland waterway system, highway and railway bridges).
- The costs of congestion associated with bottlenecks are growing and threatening industrial productivity.
- Rising costs for land, fuel, and labor are beginning to reverse trends in transportation system productivity growth.
- Increasing difficulties obtaining land and investment capital are making it hard to expand facilities and add necessary new capacity to meet growing freight transportation demand.

Over the next 20 to 30 years, there will be a tremendous need to maintain and rehabilitate the existing transportation network and less opportunity to expand the network. This trend could be at odds with the tremendous need for new capacity to alleviate congestion at freight hubs, especially at international gateways. Congestion in the vicinity of cargo hubs has become a particular problem because many of these facilities are located in older, built out areas where land is scarce and real estate costs are high. In ***NHS Intermodal Freight Connectors, Report to Congress***, the U.S. Department of Transportation found that the condition of intermodal freight connectors and the level investment in their repair was well below that of the rest of the National Highway System.

Rail and intermodal capacity is also a major issue nationally. During the last round of major railroad mergers, ton-miles of rail traffic increased substantially while track mileage actually declined. In addition, rail carriers have moved to heavy haul cars to increase efficiency, requiring significant investment in track upgrades. Intermodal terminal capacity is also an issue. These terminals require a great deal of land, they attract a steady stream of highway traffic, and they operate around the clock. This combination of attributes makes it very difficult to find suitable sites for new terminals or expansion. Railroads have tended to locate new terminal capacity where land is inexpensive, well outside metropolitan demand centers, leaving long-drayage moves along the most congested highways. Likewise, ocean carriers will tend to concentrate their business at fewer ports, with longer inland movements by truck or rail.

The land "crunch" for freight-related facilities is spawning some interesting new proposals for industrial development. In Northern New Jersey, the Metropolitan Planning Organization is looking at "brownfields" development for port-related uses. Some planners are beginning to propose "freight-oriented development," like "transit-oriented development," as an element of downtown revitalization strategies and to stem industrial sprawl into outlying areas. But thus far, these innovative solutions are few and far between.

The high cost of capacity enhancements for the freight system and the potential that there will be few new federal funding sources for freight in the next round of surface transportation

reauthorization means that competition for funding of major freight facilities will be hard fought. The need to demonstrate national benefits and the use of innovative financing approaches, particularly those that are revenue-based, will be important in the future.

The move to emphasize system optimization in future freight transportation system planning is another important trend that is likely to be in evidence in the future. Examples of system optimization activities include:

- Selected capacity enhancements aimed at bottlenecks
- Adoption of advance vehicle and facility technologies to improve operating efficiency
- Improved network utilization through the adoption of information technologies
- Improved operations and service planning by carriers.

All of these have been elements of recent efforts to improve freight system productivity. But there is growing concern that productivity gains may be on the wane just at the time when resources for new capacity are drying up. In addition, the drive towards greater efficiency in the freight transportation network has eliminated much of the system redundancy that could be useful in protecting tightly strung logistics networks from service interruptions.

TRENDS AND ISSUES FOR FREIGHT TRANSPORTATION PLANNING

Most of the issues that have been described in this chapter will provide the context for freight transportation planning and the national policy debate for federal surface transportation legislation reauthorization . It is important for those with responsibility for freight transportation in the Portland metropolitan area to understand the directions in which these issues may develop.

As noted already, a major national issue will be how to finance capacity investments in nationally significant freight facilities. There is likely to be growing interest in user-fee solutions and there is unlikely to be any major new sources of dedicated grant aid funding for freight. Attempts to obtain more flexibility in the use of existing funding resources, especially across modes, and new approaches to public-private partnerships that still preserve the efficiency gains from the last 30 years of economic deregulation are also likely topics in the national discussion of freight transportation finance policy.

Over the last several years, there has been the beginning of an evolution towards more multi-state planning for freight transportation, particularly in trade corridors. The Portland-Vancouver area has been a participant in this process for the I-5 corridor. Efforts to further institutionalize these emerging multi-state planning processes is another area of federal policy that is likely to be a part of the reauthorization debate.

There is a growing recognition of a mismatch in the planning timeframes of the public and private sectors that impedes cooperation on freight planning. Public sector planning tends to look at long time horizons while the private sector has a more near-term focus. Processes that

allow the two to come closer together to address near term needs may also be considered in reauthorization.

Lastly, there is a growing recognition that states and Metropolitan Planning Organizations lack basic freight data and analysis tools for evaluating project alternatives or understanding the implications of future freight industry trends. There are few metropolitan areas that have been as successful as Portland/Vancouver in marshaling the resources for conducting freight flow studies or developing freight forecasting models. There are hopes that in the next round of reauthorization, new programs can be devised to fill this gap.

6. CONCLUSIONS

The Commodity Flow Forecast Update and Lower Columbia River Cargo Forecast has produced two related long-term 2030 forecasts with reconciled assumptions, baseline data, and forecasts of all commodities moving to, from, in and through the Portland/ Vancouver metropolitan area by all major modes of transport. Overall, demand for commodity shipments, in tons, will double by 2030, growing at a compound average annual growth rate of about two percent.

The forecasts of commodity flows are influenced by trends occurring globally and locally which will affect the demands by producers and consumers for particular commodities and how and where they will be transported. Among these trends are the continuing globalization of production and markets, the continuing shift of employment from manufacturing sectors to services, the slowing of the growth in population and the workforce, the drive to further optimization of supply chains and the continuation of the Portland/Vancouver region's advantage as an export-dominated trade region within the United States. Continued rapid growth in China and other Asian trade partners will lead to the sustained growth of U.S. trade that passes to, from and through Portland/Vancouver between now and 2030.

Growth in commodity traffic will vary by transportation mode and commodity category, with the fastest growth coming in air cargo and truck freight. The largest tonnage of freight today moves by truck and this will increasingly be the case in the future, as only air cargo grows faster and off of a much smaller base. This is due to the use of trucks to carry goods of higher value, on average, than on other surface transportation modes. An even greater percentage of the value of commodities is shipped by truck. The share of the total value of commodities shipped carried by truck and air cargo will increase as well. The commodities that will see demand grow most rapidly are higher value goods such as machinery, processed foods, and electronic equipment and components, many of which are moved primarily by truck. Demand for commodities moved by rail, water and pipeline will also increase over the period, though at slower rates. Commodities carried by rail, water and pipeline include energy and agricultural products that are fundamental to supporting the forecast economic and population growth of the region.

Pass through traffic in the region is significant now and will double by 2030 with total pass through tonnage increasing from 48 million tons to almost 98 million tons. Rail and truck traffic are forecast to grow fastest with barge and pipeline pass through tonnage increasing much more slowly. This pass through traffic requires capacity from the area's transportation network that is then not available for traffic originating or destined for the area. The area's ability to handle this traffic as part of national freight transportation corridors support the economies of other regions of the country. However, the existence of this pass through traffic provides support for both public and private investment in the area's transportation infrastructure beyond what would be warranted by the Portland/Vancouver region traffic alone.

There are questions that derive from the implications of these forecasts of increased demand for commodities and Portland/Vancouver transportation system throughput. Among the questions the decision makers in the area will need to address are:

- Does the region have adequate capacity to meet increasing demands efficiently?

- How are the region's industrial areas linked to the regional transportation facilities? How will these links function in the future?
- Through ongoing economic development efforts in the area, what new industries is the region trying to attract? What freight will they generate or depend upon? What transportation modes will they use?
- How will the transportation system and services be positioned to meet future economic requirements?
- How will the region handle new cargo attracted to the region or re-routing of existing cargo within the region due to new transportation services or improved frequencies of service?

These questions and others will have to addressed by subsequent planning and analysis on the part of the transportation decision makers in the Portland/Vancouver area. With sufficient attention to the forecast future commodity transportation demands, the area can be best prepared to maintain and improve the transportation system that provides the goods that provide the quality of life in the region.

APPENDICES

- 1 – Methodology for the Commodity Flow Base Year
- 2 – Methodology for the Commodity Flow Forecast Update

APPENDIX 1 – METHODOLOGY FOR THE BASE YEAR 1997 COMMODITY FLOW DATA

DEVELOPMENT OF BASE YEAR (1997) COMMODITY FLOWS FOR PORTLAND

The first step in the update to the commodity flow forecast was the development of the new base year commodity flow database. The base year was set to 1997 and the SCTG commodity classification system was selected for use in organizing the data in order to be consistent with the 1997 U.S. Bureau of Transportation Statistics' Commodity Flow Survey. The development of the base year commodity flow database was led by Cambridge Systematics and consisted of five steps:

- 1 – First Approximation Base Year Commodity Flows
- 2 – Validation of First Approximation Flows with Mode/Commodity Specific Data Sets
- 3 – Validation of Revised Commodity Flow Database with Establishment Data and Reload Facility Data
- 4 – Development of Vehicle Load Factors and Validation with Truck Traffic Counts
- 5 – Development of Directional Flows

Each of these steps is described below.

First Approximation Base Year Commodity Flows

Several regional commodity flow and economic data sets were used to construct control totals for inbound, outbound, and through commodity flows at both the metropolitan area and county level of geographic detail. Control totals were established in terms of both dollar volumes and tonnage and are reported at the 2-digit Standard Classification of Transported Goods (SCTG) level of commodity detail. The control totals were adjusted in subsequent steps using progressively more detailed local data where available. By using various data sets for the first approximation control totals, it was possible to identify those commodities and economic sectors for which there is the greatest variation across sources and for which there would be more intensive validation with local data sources in subsequent tasks.

Construction of the first approximation base year commodity flows used the following data sources: (1) The 1994 DRI 2040 regional commodity flow forecast; (2) the 1997 ICF Kaiser commodity forecast; (3) the 1997 US Economic Census; (4) the 1997 Commodity Flow Survey; and (5) the Reebie Associates 1997 TRANSEARCH commodity flow data.

The appropriate starting point for the development of regional control totals was the prior commodity flow forecasts developed for the region in 1994 by DRI and in 1997 by ICF Kaiser. The approach took the base year databases in each case and "forecast" them to a 1997 baseline. These "forecasts" used data provided by DRI-WEFA on the historical growth rate in value of shipments by sector. In the case of outbound shipments, it was assumed that each commodity

was produced by a single industry sector and that historical growth rates in the output of each industry sector could be applied to the corresponding commodities to adjust the base year outbound flows.

In the case of inbound shipments, the approach was a bit more complex. Inbound shipments are primarily driven by the demand for goods. Demand is composed of both intermediate and final demand. Intermediate demand for goods results from productive activity of local businesses, as they demand goods and services to produce their product. For example, a vehicle manufacturer requires intermediate goods such as steel, aluminum, glass, plastics, etc. Final demand is composed of consumer, investment, and government spending on goods and services, with consumer demand as the largest component. Inbound shipments were estimated as the share of total demand by commodity that is fulfilled by imports from outside the region (domestic and international trade). Internal shipments result from the demand for goods that is met by local producers (sometimes referred to as self-supply). Input-output tables (available at the national level from the Bureau of Economic Analysis and available regionally from sources such as DRI-WEFA and the REMI models that were used in the I-5 Trade Corridor Study) were used to determine the share of inbound and internal movements that were allocated to final demand and to each industry for intermediate demand. Using DRI-WEFA historical data on growth in output by industry sector (for intermediate demand) and in consumer demand, the historical commodity flow totals were then "forecast" to the 1997 base year.

A similar approach was used to develop a set of commodity flow control totals from the 1997 Economic Census data. In this case the value of shipments data by economic sector for the metropolitan area and each of the counties in the metro area was used to develop estimates of inbound, outbound, and internal shipments (inbound and internal shipments were estimated using the input-output modeling approaches described above). Data from the 1997 U.S. Commodity Flow Survey (CFS), which provides data on value of shipments and tonnage by commodity, were used to develop value to weight ratios that were used to convert the value of shipments data to tonnage data.

The last two data sources that were used to establish the first approximation base year commodity flow data were the 1997 U.S. BTS Commodity Flow Survey (CFS) and the Reebie Associates 1997 TRANSEARCH database. Each of these databases is a commodity flow database, but each provides an incomplete picture of regional commodity movements. In 1997, the CFS provided data on commodity flows for the 50 largest metropolitan areas in the U.S. (including the Portland metropolitan area, though only for the Oregon side of the PMSA) and the commodity data are classified by SCTG categories (value of shipments and tonnage). However, the CFS only includes data on outbound shipments and is incomplete with respect to non-manufactured commodities. However, in cooperation with the U.S. BTS, Oak Ridge National Laboratories developed techniques to fill in the holes in the CFS data (using data sources such as the U.S. Customs Import/Export databases and the Census of Agriculture) that were used to supplement the CFS. Another advantage in use of the CFS is that it provided transportation mode split for each commodity flow.

The Reebie Associates TRANSEARCH database is perhaps the most extensive commodity flow database available, covering both inbound and outbound shipments with both value of shipments and tonnage. Reebie TRANSEARCH data is reasonably complete for all rail and waterborne

commodity flows for all commodities. However, it is incomplete with respect to non-manufacturing commodities and secondary movements (distribution traffic from warehouses). This left additional research to establish secondary shipment volumes and non-manufacturing commodity traffic in the region.

Validation of First Approximation Flows with Mode/Commodity Specific Data Sets

Through comparisons of each of the control totals developed above, in recognition of where each database was incomplete, it was possible to determine which commodities and which flows required more intensive investigation using other local data sources. This is the step in which the port specific data for the marine terminal and airport facilities were added in as well as new data from research on pipeline flows.

Validation of Revised Commodity Flows with Establishment Data and Reload Facility Data

Most commodity flow data include shipments as unlinked trips. A shipment between an origin in the Portland / Vancouver metropolitan area and the Midwest may involve multiple modes (truck to rail) or multiple movements within modes (truck to truck or rail to rail). This transfer of freight, from one shipment to another without consumption or processing of the goods, occurs at reload sites or intermodal terminals. It was not possible to directly calculate the linkages of these trips, but it was possible to infer the magnitude and location of these reload shipments by examining the commodity shipment data together with the economic forecasting variables.

From Input-Output tables, which relate industry sectors to the consumption and production of specific commodity groups and from the output of these commodities directly from economic models, and from productivity factors applied to employment in the associated industry sectors, control total tonnages were calculated for production and consumption of each commodity in the metropolitan area and for specific counties in the region. Shipments of the same commodity class to and from any area, in excess of the control totals established for economic activity, serve as indications of the amount of reload activity. These amounts in excess of the control totals were compared with the locations and activity levels of known reload facilities for both the base and forecast conditions. This process permitted the estimation of on-site consumption of products within the Portland / Vancouver metropolitan area.

Development of Vehicle Load Factors and Validation with Truck Traffic Counts

Factors to convert commodity tonnage to trucks were developed from the 1997 Vehicle Inventory and Use Survey (VIUS) database from the U.S. Bureau of Census. From the national database of 105,545 records, approximately 2,000 records were available with Oregon registration. Of these records more than 1,000 records were available that include average load information which were used to develop tonnage to truck conversion factors. VIUS contains expansion factors that made it possible to develop factors for the entire truck population.

From the five trip distance classes established in VIUS: local (less than 50 mile trip); short (50 to 100 mile trips); medium short (100 to 200 mile trips); medium long (200 to 500 mile trips), and; long (over 500 mile trips) payloads for each distance class were developed. The payloads were calculated by distance class because the average payload varies by distance, primarily because the truck size varies by distance class. Shorter distance trips tend to be dominated by single unit

trucks, which carry smaller average payloads. The longer distance trips are dominated by combination tractor-trailer trucks, which carry larger average payloads.

The VIUS survey data records include the percentage of the mileage that a truck is carrying certain products, equipment, materials, etc., which were adapted to the SCTG commodity classes used here. No Loads, where the vehicle is empty, is treated by VIUS as a product category. VIUS also includes buses and service trucks in the survey. Thus certain VIUS product categories have no correspondence in the SCTG commodity classes. Due to the differences between the VIUS product categories and the SCTG commodity classes, the necessary equivalency tables for the SCTG commodity groups were developed and used.

The weighted annual mileage for each VIUS product was calculated for each distance and record the VIUS database. The weighted annual mileage for each VIUS product, by distance class, was multiplied by the average payload to obtain the weighted annual pound miles by product. The weighted annual pound miles and the weighted annual miles was then summed to obtain Oregon average pound-miles and miles by distance class and product. The values obtained by product carried were summed based on the equivalencies of VIUS product to the SCTG commodity groups.

The payloads by commodity group were an important step in developing factors to convert tonnage to trucks. This payload does not include the percentage of mileage that a truck is empty but this percentage was able to be calculated from the VIUS database. Each VIUS record includes the percentage that a record carries no load. By proportioning that percentage to all other products carried within that record, the empty mileage attributable to each product class for each record was determined. The empty mileage by product class was summed over all records to determine the empty mileage by product class.

The combination of the loaded payload factors and the percentage empty factors were used to develop factors to convert commodity tonnage to trucks, both loaded and empty.

For all commodity groups and distance classes, the values obtained were based on small samples. The VIUS database sample was developed to national and statewide averages, not for disaggregation to the degree pursued in this analysis. Therefore it was appropriate to smooth all values within a commodity group to produce reasonable values by distance class.

Development of Directional Flows

The establishment of the amount of freight tonnage passing through the Portland metropolitan area without stopping was generally established from the Origin-Destination commodity flow tables and information on the paths connecting those Origin-Destination pairs that pass through a region or state. For the CFS and the Reebie TRANSEARCH data, these paths were established by the intermodal network developed by the Oak Ridge National Laboratory. While these paths serve the identification of paths at a national level, they do not always reflect local conditions. The Oregon Department of Transportation State Model was used to identify the likely paths between Origin-Destination pairs and external stations to identify the likely paths, and then those paths were used to determine the Origin-Destination pairs whose paths travel through the

metropolitan area. The commodity flows for these Origin-Destination pairs were then summed to estimate the commodity tonnage passing through the region.

The path information was then used to identify the general direction of commodity flows. Commodity flow information outside the metropolitan area was maintained at a geographic level of detail that made it possible to identify the likely paths to and from the region. The state and regional freight models identify the likely path used and establish the geographic orientation of the Portland / Vancouver area's commodity tonnage.

1997 METROPOLITAN AREA TO REST-OF-OREGON BASE YEAR COMMODITY FLOWS

The development of 1997 Portland metropolitan area to rest-of-Oregon base year commodity flows followed directly from the methodology used in the first baseline data tasks, except that the data produced has origin-destination detail assembled for all the state of Oregon at the other end of each Portland metropolitan area shipment. The Oregon Department of Transportation State model was used to determine the paths of commodity flows within the state and to and from the Portland metropolitan area and its component counties. Data produced are by commodity type and mode for volumes as of 1997. The same data sources, including the 1997 U.S. CFS and the Reebie Associates 1997 TRANSEARCH data was used whenever possible for consistency. For truck, rail and barge traffic, the tonnage between the counties in the metropolitan area and the rest-of-Oregon was estimated both inbound and outbound.

The resulting base year data was organized in a series of worksheets in an MS Excel workbook for input to the commodity flow forecasts and for analysis by the sponsor organizations.

APPENDIX 2 – METHODOLOGY FOR THE COMMODITY FLOW FORECAST UPDATE

This appendix provides detail on the methodology used to produce the commodity flow forecast update from the 1997 baseline commodity flow data.

OBJECTIVES

- Develop commodity flow forecasting models based on a 1997 baseline of Portland/ Vancouver freight flows and the national Reebie Associates 1997 TRANSEARCH database.
- Develop unique national freight forecast to provide the context for future national freight tonnage flows.
- Generate a base case forecast for Portland/Vancouver commodity flows for 2010, 2020, and 2030 by mode, origin and destination, and commodity.

DEVELOPMENT OF 2010, 2020, AND 2030 FORECAST COMMODITY FLOWS

The development of long-term commodity flow forecasts used the 1997 base year commodity flow data as their foundation. The commodity flow forecasts for the Portland/Vancouver were produced for 2010, 2020, and 2030 by origin, destination, and mode. The forecast was developed in the context of national models both driven by forecasts at the macroeconomic, regional, producing sector, purchasing sector levels.

The commodity flow forecast was developed using industry sector classified activity, which was then mapped to the study's SCTG commodity categories in the process of the forecast development. The general methodology involved taking benchmark values for 1997, and growing these values based on appropriate growth rates. The result represents either shipments or purchases for a commodity in a particular region of the country. The shipments growth rate was determined based on the growth rate in output in a particular region of the country and commodity group, from DRI·WEFA's Business Demographic Model (BDM). The purchases growth rate was determined based on DRI·WEFA's Business Transactions Matrix (BTM), which measures the purchases of a product made in one industry by industries in all other industry sectors, as well as the retail sector, in a particular region of the country. Finally, shipments were constrained to purchases by commodity group and region, and were required to be consistent with national estimated freight flow control totals by commodity group.

The forecasts cover the same commodity and modal dimensions as in the 1997 base year data for the years 2010, 2020 and 2030. After review and approval of the base year data by the sponsor organizations, the historical data was prepared for input to the commodity flow forecasts. This forecast required four major steps:

1. Preparation of underlying macroeconomic, regional, trade and industry and price forecasts for 2010, 2020, 2030
2. Forecast of national commodity group forecasts as a control

3. Forecast of modal Origin-Destination commodity flows at region-to-region and metropolitan area level
4. Forecast of modal commodity volumes by geography

Each of these steps is described below.

Preparation of underlying economic forecasts for 2010, 2020, 2030

As important inputs to the commodity forecasts, external forecast economic variables were produced for the required 2010, 2020 and 2030 periods. The DRI·WEFA national, regional, industry, and commodity price forecasts were extended from the latest existing standard forecast (either the year 2020 or 2025) to 2030. Industry sector and commodity classifications were mapped to SCTG classifications for purposes of the commodity forecast models. Similarly, the DRI·WEFA US international commodity trade forecasts were extended to 2030 and mapped to the SCTG commodity classification.

Underlying U.S. Economic Forecast

The national commodity forecasts depend explicitly on DRI·WEFA U.S. Macroeconomic forecasts. It should be noted that the study was undertaken during an economic downturn, in a post-9/11 environment. The cyclical response of the U.S. economy and the disruptive influences of terrorism globally are reflected in the short-run paths of key macroeconomic forecast variables, notably real GDP and employment.

Underlying U.S. Regional Economic Forecasts

The national and Portland Vancouver metro area forecasts also depend on DRI·WEFA U.S. state and metropolitan area forecasts, as they are used as inputs to the Business Demographics Model forecasts and the Business Transactions Matrix to estimate future production and consumption at a county level. The set of regional forecasts used included the results of 51 ‘state’ models (the 50 states plus the District of Columbia) and forecasts from 114 large metropolitan areas, of which the Portland Vancouver region is one. Each of these forecasts is linked to the geographic region containing it so that metropolitan area models are influenced by both the national forecast and the forecasts for the state(s) of which the metropolitan area is a part. For the commodity flow forecasts, regions external to the Portland Vancouver metropolitan area are important to the movement of commodities in, through and from the region. This is because the Portland Vancouver metropolitan area is a relatively small producing and consuming region and a relatively large trade and distribution center. Thus, what is happening elsewhere in the United States and around the world strongly influences the volume and type of commodities moving through the region.

Long Run U.S. Outlook and Assumptions Relevant to the Study

The longer-term trend effects of the macroeconomic and regional economies reflect steady-state levels and growth rates appropriate to the context of the supporting analysis. In particular, population and total U.S. employment serve as key drivers for overall growth as well as important components in aggregation. The DRI·WEFA forecast for U.S. employment was determined within the context of the macroeconomic forecast, which integrates influences from external factors and across industry sectors. The long-term growth rate in national employment depends directly on key labor market variables and influences from outside of the labor market, such as interest rate policy and corporate profits.

The Commodity Flow Forecast Update focused on commodity flows in the six-county Portland Vancouver metropolitan area that includes Clark County in Washington. The six component counties of the study area: Multnomah, Washington, Clackamas, Clark, Yamhill, and Columbia.

National Commodity Flow Control Forecasts

The methodology used to produce the national control commodity flow forecasts can generally be described as taking the base year data for 1997, and growing these flows based on appropriate growth rates. As a control on the Oregon and Portland / Vancouver area commodity flows, the national 1997 base year commodity database was assembled from the combination of the 1997 CFS and Reebie Associates 1997 TRANSEARCH data. The resulting flows represent either shipments or purchases for each commodity category in each county or region of the country. The underlying economic forecasts are at the county level for the Portland / Vancouver metropolitan area and for aggregations of counties into successively larger regions as one moves away from Oregon and Washington. This way the geographic detail needed was maintained where important but did not require extraordinary resources where less detail was acceptable. The geographic county/region detail definitions were determined at the start of the project in consultation with the study sponsor organizations.

Future shipment growth rates were determined based on the growth rate in output in county/regions of the country and commodity category, using DRI·WEFA's Business Demographic Model (BDM). The purchases growth rate was determined using DRI·WEFA's Business Transactions Matrix (BTM), which measures the purchases of a product made in one industry by industries in all other industry sectors, as well as the retail sector, in a each county in the country. Finally, shipments are constrained to purchases by commodity and region, and were forced to be consistent with national estimated freight flow control totals by commodity.

For the international freight flows, a similar methodology was applied for the portions of international freight movements within the US. The DRI·WEFA World Trade Service (WTS) forecast was used to estimate US imports and exports outside of the US. The international freight flows were constrained to the WTS forecast by commodity, and US port region, and then reconciled with the Lower Columbia River cargo forecasts.

To force consistency with total national potential production and consumption of commodities, we first created a national-level freight forecast. The national freight model by commodity served as a top-level constraint for the freight flows at the state, metropolitan area and county level. Equations were then estimated for the total freight flows and the commodity groups at a national level, using time series data from Reebie's TRANSEARCH national data as the dependent variables. The equation structure includes an index of industrial production as the primary independent variable. Trend variables and/or price variables were also included among the variables in cases where judged necessary.

Following the equation estimation, the raw forecast was created using forecasts from DRI·WEFA's U.S. Macroeconomic and U.S. Regional Services. The raw forecast results were adjusted based on external information about the relative ranking of the growth rates of freight flows in different commodity categories, as well as the resulting ranking of the growth rates of the different modes of transportation, creating an intermediate national freight forecast.

DOMESTIC FREIGHT FLOW FORECAST BY COMMODITY AND REGION

National freight flow data from the Reebie Associates TRANSEARCH data include both domestic freight flows, as well as some international freight flows involving particular modes of transportation. The domestic flows were split out from the international freight, by mode. The domestic share of the total national freight flow was determined for 1997, and the final domestic national freight forecast was calculated from the intermediate national freight forecast.

The base year 1997 freight flow data by commodity group and county/region is the basis for developing the domestic freight forecast by commodity and region. First, the domestic and international freight flow data was separated to create the 1997 base line data for the model. Second, the domestic base line value was grown by the DRI·WEFA Business Demographic Model (BDM) growth rate, by commodity and region, to create a forecast for domestic shipments, and by the DRI·WEFA Business Transactions Matrix (BTM) growth rate by commodity and county to create a forecast for domestic purchases. Purchases by commodity group and county/region are constrained to the national freight forecast by commodity, and shipments will be constrained to purchases, to result in a final domestic freight forecast by commodity and region.

INTERNATIONAL FREIGHT FORECAST BY COMMODITY AND WORLD REGION

The base year 1997 Portland / Vancouver commodity flow data, the Reebie Associates 1997 national TRANSEARCH freight flow data, U.S. Census foreign trade statistics, the United Nations world trade data, and the DRI·WEFA World Trade Service (WTS) forecast served as the basis for developing the international commodity flow forecast by commodity, trade partner region, US gateway, and domestic region. First, the international commodity flow base year data for 1997 was calculated. Second, the international freight flow movements inside the US were determined. To do this, the base year value was grown by the BDM growth rate by commodity and region to create a forecast for shipments of exports, and the benchmark value was grown by the BTM growth rate by commodity and region to create a forecast for purchases of imports.

Third, the international freight flow movements inside the US were constrained to the world total obtained from the DRI·WEFA World Trade Service by commodity, world region, and US gateway. The last step in finalization of the forecasts was the reconciliation with the Lower Columbia River cargo forecast growth rates.

See Attachment C for a diagram of both the domestic and international freight forecast methodology.

DATA INPUTS TO THE FORECAST

Commodity Flow Data

Cambridge Systematics produced the base year values for 1997 for freight flows by origin, destination, commodity, and mode based on the U.S. Commodity Flow Survey, Reebie Associate's TRANSEARCH database and other sources. The list of origin and destination regions in the base year data is shown in Attachment A. Attachment B contains a description of the Standard Transportation Commodity Classification (STCC) commodity categories and the mapping to SIC industry sector codes provided by Cambridge Systematics for the base year data. Attachment C contains the bridge table mapping the STCC commodity codes to the Standard Classification of Transported Goods (SCTG) categories used in the final analysis and data delivery.

Business Demographic and Transactions Data

DRI•WEFA's Business Demographic Model provided the forecasts of industry activity by four-digit SIC industry sector classification by county. This information was used as the basis for allocating changes in the supply of freight over time. DRI•WEFA's Business Transactions Matrix provides a forecast of purchases by four-digit buying and selling industry, as well as other sectors of the economy such as the government and retail sectors. This information was used to allocate changes in the demand for freight over time. These models, in turn, use inputs from U.S. macroeconomic, U.S. regional (state and metropolitan area) and U.S. industry forecasts to determine future employment, business formation, production and consumption by SIC industry sector. These forecast inputs were taken from the most recently updated DRI•WEFA forecast.

ATTACHMENT A: ORIGIN AND DESTINATION REGIONS

Region	Region Name
AK	Alaska
EC	East Coast
FE	Far East
N	North
NE	Near East
OR	Oregon
OE	Oregon East
OS	Oregon South
OW	Oregon West
OZ	Oregon Southeast
S	South
SE	Southeast

ATTACHMENT B: STCC COMMODITY DESCRIPTIONS AND SIC CODE MAPPING

STCC	SIC	DESCRIPTION
1	1	FARM PRODUCTS
1	2	AGRICULTURAL PRODUCTION-LIVESTOCK
8	8	FOREST PRODUCTS
9	9	FRESH FISH OR MARINE PRODUCTS
10	10	METALLIC ORES
11	11	COAL
11	12	BITUMINOUS & LIGNITE
13	13	CRUDE PETROLEUM OR NATURAL GAS
14	14	NONMETALLIC MINERALS
19		ORDNANCE OR ACCESSORIES
20	20	FOOD OR KINDRED PRODUCTS
21	21	TOBACCO PRODUCTS
22	22	TEXTILE MILL PRODUCTS
23	23	APPAREL OR RELATED PRODUCTS
24	24	LUMBER OR WOOD PRODUCTS
25	25	FURNITURE OR FIXTURES
26	26	PULP, PAPER OR ALLIED PRODUCTS
27	27	PRINTED MATTER
28	28	CHEMICALS OR ALLIED PRODUCTS
29	29	PETROLEUM OR COAL PRODUCTS
30	30	RUBBER OR MISC PLASTICS
31	31	LEATHER OR LEATHER PRODUCTS
32	32	CLAY, CONCRETE,GLASS OR STONE
33	33	PRIMARY METAL PRODUCTS
34	34	FABRICATED METAL PRODUCTS
35	35	MACHINERY
36	36	ELECTRICAL EQUIPMENT
37	37	TRANSPORTATION EQUIPMENT
38	38	INSTRUM, PHOTO EQUIP, OPTICAL EQ
39	39	MISC MANUFACTURING PRODUCTS
40		WASTE OR SCRAP MATERIALS
41		MISC FREIGHT SHIPMENTS
42		SHIPPING CONTAINERS
43		MAIL OR CONTRACT TRAFFIC
44		FREIGHT FORWARDER TRAFFIC
45		SHIPPER ASSOCIATION TRAFFIC
46		MISC MIXED SHIPMENTS
47		SMALL PACKAGED FREIGHT SHIPMENTS
50		SECONDARY TRAFFIC

Note: STCC codes higher than 41 are not included in international freight flow data.

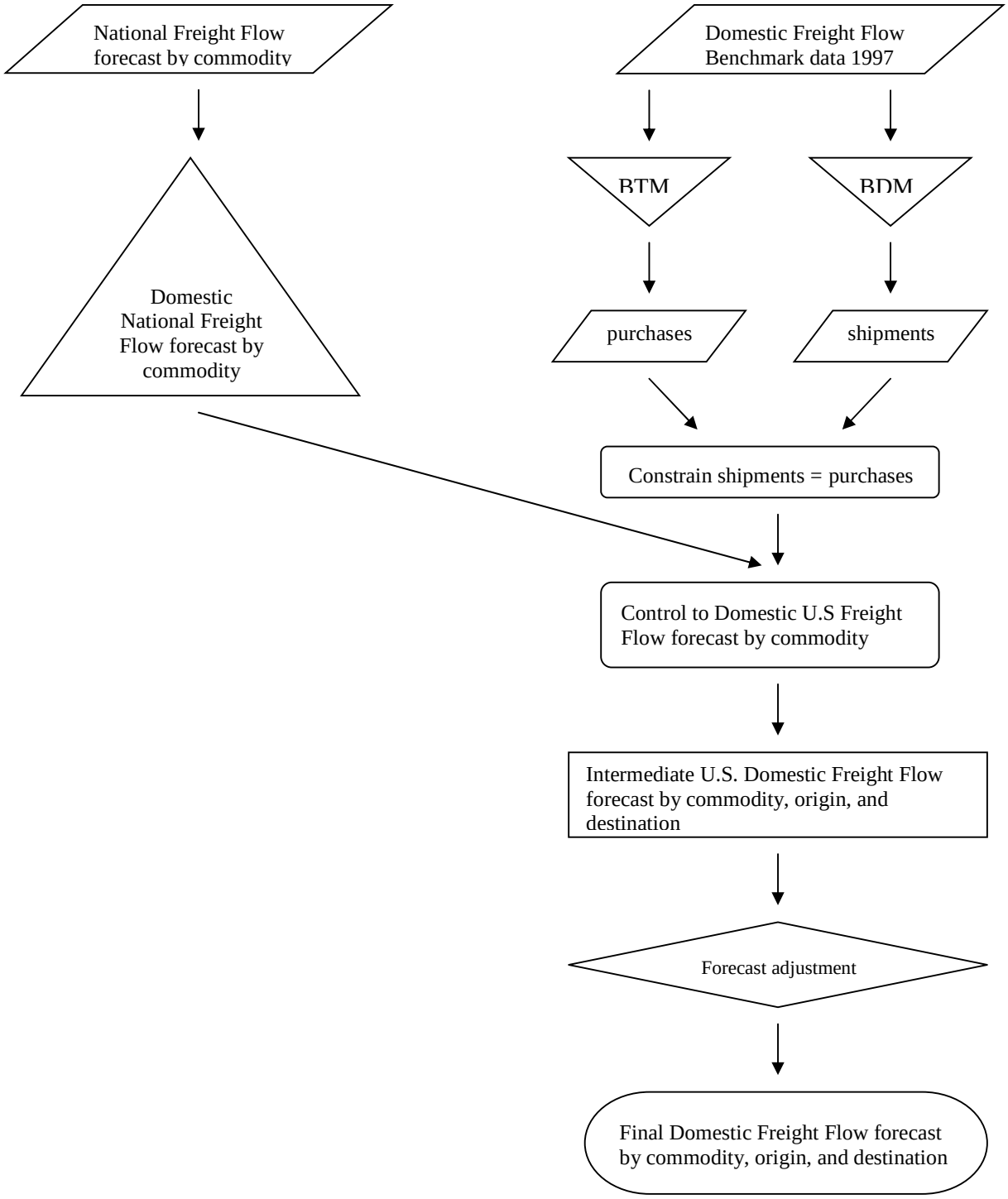
ATTACHMENT C: STCC COMMODITY TO SCTG COMMODITY CODE MAPPING

STCC	SCTG	Description
1	1	FARM PRODUCTS
1	2	FARM PRODUCTS
1	4	FARM PRODUCTS
8	3	FOREST PRODUCTS
9	5	FRESH FISH OR MARINE PRODUCTS
10	14	METALLIC ORES
11	15	COAL
13	16	CRUDE PETROL. OR NATURAL GAS
14	10	NONMETALLIC MINERALS
14	11	NONMETALLIC MINERALS
14	12	NONMETALLIC MINERALS
14	13	NONMETALLIC MINERALS
19	40	ORDNANCE OR ACCESSORIES
20	6	FOOD OR KINDRED PRODUCTS
20	7	FOOD OR KINDRED PRODUCTS
20	8	FOOD OR KINDRED PRODUCTS
21	9	TOBACCO PRODUCTS
22	30	TEXTILE MILL PRODUCTS
23	30	APPAREL OR RELATED PRODUCTS
24	25	PRIMARY FOREST MATERIALS
24	26	LUMBER OR WOOD PRODUCTS
25	39	FURNITURE OR FIXTURES
26	27	PULP,PAPER OR ALLIED PRODUCTS
26	28	CONVERTED PAPER OR PAPERBOARD PRODUCTS
27	29	PRINTED MATTER
28	20	CHEMICALS OR ALLIED PRODUCTS
28	21	CHEMICALS OR ALLIED PRODUCTS
28	22	CHEMICALS OR ALLIED PRODUCTS
28	23	CHEMICALS OR ALLIED PRODUCTS
29	19	PETROLEUM OR COAL PRODUCTS
30	24	RUBBER OR MISC PLASTICS
31	30	LEATHER OR LEATHER PRODUCTS
32	31	CLAY,CONCRETE,GLASS OR STONE
33	32	PRIMARY METAL PRODUCTS
34	33	FABRICATED METAL PRODUCTS
35	34	MACHINERY
36	35	ELECTRICAL EQUIPMENT
37	36	TRANSPORTATION EQUIPMENT
37	37	TRANSPORTATION EQUIPMENT
38	38	INSTRUM, PHOTO EQUIPMENT, OPTICAL EQUIPMENT
39	40	MISC MANUFACTURING PRODUCTS
40	41	WASTE OR SCRAP MATERIALS
41	43	MISC FREIGHT SHIPMENTS
42	-	SHIPPING CONTAINERS
43	44	MAIL OR CONTRACT TRAFFIC
44	44	FREIGHT FORWARDER TRAFFIC
45	44	SHIPPER ASSOCIATION TRAFFIC
46	43	MISC MIXED SHIPMENTS
47	43	SMALL PACKAGED FREIGHT SHIPMENTS
48	43	SMALL PACKAGED FREIGHT SHIPMENTS

Note: STCC codes higher than 41 are not included in international freight flow data.

ATTACHMENT D: COMMODITY FLOW FORECAST UPDATE METHODOLOGY FLOW CHARTS

Domestic Commodity Flow Forecasts



International Commodity Flow Forecasts