OREGON COMMODITY FLOW FORECAST

FINAL REPORT

For:

OREGON DEPARTMENT OF TRANSPORTATION

Transportation & Land Use Model Integration Project, Phase 3I

PB Consult Number 70429B

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Oregon Commodity Flow Forecast

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EXECUTIVE SUMMARY

The report documents freight flow forecasts to 2030 for Oregon by transportation mode, area and commodity group. Although comprised of commodities growing at different rates, this study forecasts that the total of all commodity tonnage in the state will increase 81 percent 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 state are destined for or are originating in other parts of the country, or even overseas, the future of freight transportation demand in Oregon is influenced by economic conditions outside the state. Most importantly is the condition of the national economy, which is in the later stages of recovery from the recession of 2001. There are now several long-term trends that are shaping the future path of demand for commodity shipments. From a national level, the projections of these trends 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 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 Oregon. These include:

- Globalization, which will continue to increase via trade links, increasing the importance of longer distance freight transportation.
- 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. Use of more efficient equipment (heavier rail cars, larger truck configurations, larger containerships) is but one 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 from 1997 levels, with the international share of total tonnage slightly increasing.

The demand for commodity transportation in Oregon will be influenced as well by several factors affecting regions within the state. These include:

- The position of the state's largest metropolitan area, Portland, on the West Coast, where its position as an export dominated sea port will continue to shape the outlook for international cargo in the region. Channel limitations and the limited local market (compared with Los Angeles) have meant that although ocean carriers can fill otherwise-empty containers back to Asia across the Pacific serving exporters shipping through Portland, international-trade related growth will continue to be shipped by truck and rail to other ports as well.
- A greater share of domestic production will be sold for domestic consumption which will reduce the available capacity for exports.
- The state’s traditional strong ties to North Asia, especially Japan, have reduced potential trade growth as those economies have lost out to China and Southeast Asia in share of trans-Pacific trade with the U.S.

The Oregon 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 state economy has been lagging the country as a whole in employment growth, though is now seeing signs of recovery. Unfortunately, the recovery in jobs is not uniform as some sectors such as information systems and technology manufacturing remain weak. The forecast for the area economy to 2030 includes the following characteristics:

- The state’s population growth will slow from the recent 1.2 percent growth to one percent from 2010-2020 and 0.9% from 2020-2030. This will contribute to slow civilian labor force growth.
- After slow recovery from the recession, overall Oregon employment growth has resumed and it is forecast to average 1.4% annually during the period 2004–2010. Employment growth is expected to slow to an average of 1.2% growth over the period 2010-2030. This is consistent with the growth in population and net migration for the state.
- Real output in the state is expected to average 2.8% annually between now and 2010 and then average 2.1% over the 2010-2030 period.

The resulting forecast of an 81 percent increase in commodity tonnage is made up of projections that have different outlooks among commodity groups and across the transportation modes. Trucking will have the greatest absolute increase in tonnage over the forecast followed by rail tonnage. Air cargo tonnage will grow the fastest, averaging 2.6 percent per year, though the tonnage remains very small. The waterborne and pipeline tonnage will grow much more slowly averaging less than one percent over the forecast.

From a commodity perspective, the top ten tonnage categories together comprise 87 percent of all tonnage volume in the state in 1997 and will be 82 percent by 2030. These commodities include lumber and wood products, farm products, petroleum products and natural gas, nonmetallic minerals, food products, chemicals, stone and concrete, pulp and paper.

Of these large tonnage volume categories, only the petroleum products are among the ten fastest growing commodity categories over the forecast period. The fastest growing commodity category over the forecast is the electrical equipment category, averaging 4.9 percent annual growth through 2030. The higher value manufactured goods categories are generally those that are forecast to grow more rapidly. These categories include transportation equipment, as well as miscellaneous manufacturing products, and primary metal products.

A significant volume of traffic using the transportation networks in Oregon is traffic not originating or destined for the region. This is “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 Oregon. This traffic is projected to increase at a compound average annual growth rate of 2.3 percent between 1997 and 2030 with total Oregon through tonnage increasing from 57 million tons to 122 million tons. Truck through traffic is forecast to grow fastest with rail through tonnage increasing more slowly.

The implications of the forecasts of increased demand for commodities and the consequential demands on the Oregon transportation system are significant. Decision makers in the region will need to address several questions that derive from these forecasts and the TLUMIP model will provide the mechanism for addressing them quantitatively. These questions include:

- Does the state have adequate capacity to meet increasing demands efficiently?
- All modes rely on roadways as the glue linking them together. How are the state’s industrial areas linked to the transportation facilities? How will these links function in the future?
- Economic development efforts in the state will have implications for freight transportation. What new industries is the state 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 Oregon handle new cargo attracted to the state or re-routing of existing cargo within the state due to new transportation services or improved frequencies of service?

Please note this is still a preliminary forecast report and will be revised after review, comment and discussion with the Oregon Department of Transportation.

1. INTRODUCTION

Overview of the Report and Forecast

This report describes the long-term commodity flow forecasts developed for the Oregon Transportation & Land Use Model Integration Project. These forecasts extend to the year 2030 and were developed from baseline 1997 commodity flow estimates prepared and reported separately. The forecasts used this 1997 baseline year for comparability with other recent work completed for the Portland metropolitan area (reference in Appendix A). The basic forecast methodology outlined here was also used for the earlier Portland metropolitan area commodity flow forecast. For the statewide forecasts, this methodology was adapted to take into account the additional commodity flows captured in the statewide baseline database. The commodity flow data developed for this forecast uses the Standard Transportation Commodity Classification (STCC) codes, while the previous Portland study developed data in both STCC and Standard Classification of Transported Goods (SCTG) classifications. This report covers the Commodity Flow Forecast.

Overview of the Commodity Flow Forecast

The purpose of the Commodity Flow Forecast was to use the 1997 commodity baseline to project future modal commodity flows for use in the Oregon Department of Transportation's Transportation & Land Use Model Integration Project (TLUMIP). This forecast has been produced by Global Insight, Inc. as part of the PB Consult TLUMIP team. The preparation of the 1997 baseline data has been led by Cambridge Systematics, Inc. who are also part of the PB Consult team. ODOT staff have contributed data and review comments for the structure and content of the baseline estimated flows, which have carried through to the forecasts. The commodity flow forecasting methodology applies macroeconomic, industry and consumer sector economic forecasts to produce the modal commodity flows with geographic detail.

As with the baseline data, the forecasts were produced at several levels of geography within Oregon: the Area Commissions on Transportation (ACT) areas; six metropolitan areas (Bend, Corvallis, Eugene-Springfield, Medford-Ashland, Portland and Salem); and four counties (Hood River, Columbia, Washington, Yamhill.) The commodity flow forecasts were produced for Hood River County, because it is part of neither an ACT nor a metro area, and for three counties in the Portland Metropolitan area (Columbia, Washington, Yamhill) that overlap multiple ACT areas. The definition of the North West Oregon ACT includes the western portion of Washington County. Because the population of this county is concentrated in the eastern half, closer to Portland, Washington County was not included in the estimates for the North West ACT.

2. Forecast Of Commodity Flows To 2030

The commodity flow forecast is derived from 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 and data dimensions 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 Forecast Commodity Flows to 2030

The commodity flow forecasts project freight flows out to the year 2030 for Oregon freight flows moving inbound, outbound, internally and through Oregon by mode and commodity category. The forecast was developed using industry sector classified activity, which were then mapped to the study's STCC 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 geographic 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 Global Insight's Business Demographic Model (BDM). The purchases growth rate was determined based on Global Insight'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 flow forecast methodology is provided in appendix A-2.

The forecast was produced in several steps. The first was preparation of underlying macroeconomic, regional, 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 state's shipments. And finally, the commodity flow forecast for Oregon 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 out to 2030

As important inputs to the commodity flow forecasts, separate forecasts of economic variables were produced the period 1998 - 2030. The Global Insight national, regional, industry, and commodity forecasts were the source for these external forecasts, extended when necessary from 2025 or 2029 to the year 2030. Industry sector and Global Insight commodity classifications were mapped to the study's commodity classifications for purposes of the commodity forecast models. Similarly, the Global Insight U.S. international commodity trade forecasts were extended to 2030 and mapped from the commodity classification used for international trade to the same study commodity classification.

Overview of the U.S. Economy and Forecast Assumptions

Because the detailed commodity flow forecasts depend on the Global Insight 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 forecast was produced during the recovery in the economy following the economic downturn in 2001. Recovery from the recession's adverse affects on freight transportation is still underway. The cyclical response of the U.S. economy and the disruptive influences of the war on terrorism are reflected in the short-run paths of key macroeconomic variables, notably real GDP, industry output and employment. The recession itself was short but the recovery in 2002 and 2003 was muted by the lingering effect of the war on terror on consumer and business confidence.

The recession of 2001 was one of collapsing investment and inventory liquidation even before 9/11. This was a business-led recession where 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 economy. The rebound started earlier in the U.S. than in our trading partners' economies, so imports rose in advance of the recovery in exports. Only in 2003 with a declining dollar and an uneven recovery overseas, was there a significant upturn in exports.

Between falling investment and sluggish consumer spending, manufacturing activity fell significantly due to the recession. The protracted decline in factory output was the steepest since the 1982 recession. Inventories shrunk and inventory rebuilding was sluggish until 2003.

The federal government gave the recovery a significant boost through increased spending and tax cuts. Although the ramp-up in spending took some time, the fiscal 2002 and 2003 budgets contained a huge amount of fiscal stimulus. However, the impact of this stimulus on the long-term forecast is slight. The measures adopted supported spending in the short term, but did not do much to accelerate the long-term recovery. The real stimulus was in the form of the tax cuts and the increased spending on education, security, defense, and intelligence.

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 Global Insight 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 Global Insight 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 project 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%.

There has recently been more attention paid to energy prices and their impact on the economy due to the run up in energy commodity prices since 2001. In this forecast it is projected that the average acquisition price of crude oil will remain above $30 per barrel through 2030. With worldwide demand steadily increasing, the OPEC cartel will maintain some pricing power. Although it is impossible to predict the precise timing of oil price changes, the projection assumes that oil prices will drop from current high levels of near $50 a barrel and hover around $30–35 per barrel through the end of 2014. Thereafter, the forecast shows (current dollar) oil prices climbing steadily back to around $51 per barrel by 2030. In the long run, petroleum resource scarcity tends to bid energy prices up, while new technologies tend to hold them down. The dynamics of the world economy and the oil industry are such that the forecast is for scarcity to dominate, with the real price of crude oil rising from about $21 per barrel in 2001 to $27 by 2030.

Background and Overview to the Oregon Economy and Forecast Assumptions

More closely influencing the Oregon commodity flow forecast are the economic forecasts for the state. A summary of the outlook for the state 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 the recession of 2001, Oregon had the largest percent decline in employment in the United States. Total employment contracted in 2001 and year-over-year growth lagged the rest of the country until 2004, dragged down by the 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 and did not rebuild back employment until adding 700 workers as demand grew in 2004. The services, trade, and construction sectors fell victim to lower consumer spending. The finance, insurance, and real estate sector was one of the few sectors that avoided an employment contraction. Consequently, the unemployment rate leapt from 4.7 percent in early 2001 to 7.4 percent in 2004, the highest in the continental United States.

The future holds only tepid growth for Oregon. The state’s economic performance hit bottom in 2002, as job growth declined further, from –0.8% in 2001 to -1.5% in 2002. In addition to the national slowdown, Oregon’s economy suffered from the decline in high-tech, especially semiconductors, as investment in high-tech equipment declined and companies consolidated operations. Employment in the manufacturing sector retracted throughout 2002, as production leveled off because employers were slow to hire until they were sure of the recovery, instead adding overtime to existing workers before hiring new workers. Overall manufacturing employment is now in recovery, seeing gains of 3.2 percent over the past year. The lumber, wood products, and paper industries have stagnated but the transportation equipment sector began to rebound in 2003, and showed strong growth in 2004.

Overall job growth recovered in 2003 and 2004, as export-related markets regained some ground, and consumer spending rebounded, boosting the construction and services sectors.

Although employment growth will accelerate over the next five years, Oregon will not ramp up to stronger gains until the end of the decade; the unemployment rate will remain near seven percent through 2010. After 2004, trend growth in employment through the rest of the forecast period is expected to range between 1.1% and 1.6%.

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 had the fourth-largest concentration of semiconductor chip companies in the nation, which made it vulnerable to the severe downturn in this industry in the last few years. 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 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.

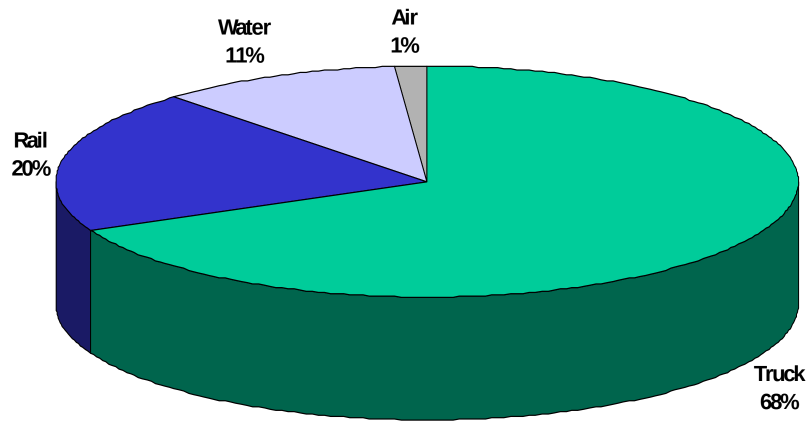
Business costs in Oregon are roughly on a par with the rest of the nation, and slightly lower in some areas. Oregon, like the rest of the region, benefits from relatively moderate energy costs. Moreover, the state has the lowest tax burden in the Pacific Northwest region, with state and local taxes amounting 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 however, especially in the Portland area.

The long-term view for the Oregon economy sees real Gross State Product in the range of 1.8 percent and 3.5 percent through the 2030 study horizon. Growth will be near the top end of this range through 2010 and then slow to near the bottom end of this range by 2015 after which growth will increase towards 2.4 percent per year by 2030. Consistent with this view is total employment growth in the range of 0.9 percent to 1.3 percent per year, although greater employment growth is expected in service industries, such as healthcare and business services.

National Commodity Flow Control Forecasts

To assure consistency with total national potential production and consumption of commodities, a national-level freight forecast was prepared to be able to estimate Oregon commodity flows in the context of national freight activity. This approach is important for the forecast as many of the commodity flows in the state originate or are destined for a location outside the state. This means that economic conditions in areas outside Oregon will have a significant impact on both the supply and demand for goods that will be shipped in, to, from, or through the state. By producing a national freight flow forecast by commodity, it was possible to have a top-level control over the forecasts of freight flows at the state, ACT area, metropolitan area and county level.

Figure 2-1 U.S. Commodity Transportation Forecast by Mode
Percentage Share of Growth in Tonnage 1997 - 2030



The table below shows the U.S. national forecast results by commodity category for the baseline historical data 1997, and the forecasts to 2010, from 2010 to 2020, and from 2020 to 2030 as compound annual growth rates of the forecast tonnage.

Table 1 – U.S. National Commodity Forecast, All Modes
(Compound Annual Growth Rates of Tonnage)

Commodity Category Description	1997-2010	2010-2020	2020-2030
Farm products	-0.3	0.7	1.3
Forest products	-6.7	5.3	7.6
Fresh fish or other marine products	-5.8	-5.8	-8.4
Metallic ores	-2	-1.1	-1.6
Coal	1.5	1.6	2.5
Crude petroleum, natural gas or gasoline	-2.8	2.7	4.3
Nonmetallic minerals	0.3	1.3	2
Ordnance or accessories	-5.7	-0.6	-0.7
Food and kindred products	2.7	5.4	8.3
Tobacco products, excluding insecticides	-1.1	-2.2	-3.2
Textile mill products	0.9	1.5	2.3
Apparel or other finished textile products	5.5	3.4	5.1
Lumber or wood products, excluding furniture	2.7	3.6	5.5
Furniture or fixtures	3.8	3.1	4.6
Pulp, paper or allied products	2	3.1	4.8
Printed matter	2.2	4.9	7.5
Chemicals or allied products	3.2	2.6	4
Petroleum or coal products	1.5	2	3.2
Rubber or miscellaneous plastic products	3.4	3.8	5.8
Leather or leather products	5.9	2.2	3.1

Commodity Category Description	1997-2010	2010-2020	2020-2030
Clay, concrete, glass or stone products	3.2	4	6.2
Primary metal products	2.9	2.4	3.7
Fabricated metal products	2.8	3.2	5
Machinery, excl. electrical	5	4.9	7.6
Electrical machinery, equipment or supplies	6.1	4.5	6.9
Transportation equipment	3.1	2.6	3.9
Instruments, photo and optical goods, timepieces	4.8	4.9	7.6
Miscellaneous products of manufacturing	4.9	3.8	5.8
Waste or scrap materials	0.9	3.3	5
Miscellaneous freight shipments	-2.3	2.7	3.4
Containers, shipping carriers, returned empty	2.4	3.2	5.1
Mail, express, other contract	2.5	11.2	15.9
Freight forwarder traffic	4.7	3.4	5.1
Shipper Association Traffic	-4.9	-8.8	-12.9
Misc. Mixed Shipments	2.5	3.6	5.7
Small package shipments	6	3.6	5.4
Total	**2.2**	**3.4**	**5.3**

Total domestic freight flows are expected to increase at an average annual rate of 2.2 percent from 1997-2010, and 3.4 percent from 2010-2020. Thirteen of these commodity categories are expected to grow faster than average for 2010-2020 and 2020-2030. The fastest growing sectors in the first half of the forecast are electrical machinery, equipment and supplies and small package shipments, and leather and apparel. This supports the anecdotal evidence that high value goods will comprise a larger share of total freight in the future. Forest products, shipper association traffic and fresh fish or marine products show the sharpest decline in the first half of the forecast. These sectors have seen a decline since 1985. Mail or contract traffic continues to be the fastest growing sector in the second half of the forecast.

Forecast of Modal Origin-Destination Commodity Flows at the Region-to-Region Level

With national commodity flow forecasts completed, commodity-specific region-to-region growth rates were applied to the 1997 baseline modal commodity data established earlier. The commodity group and direction-specific base line data was matched against the forecast growth rates for origin-destination pairs. Necessary aggregation of the out-of-state regions was performed to align with the direction information in the Oregon baseline 1997 commodity flows. The resulting ACT area, metro 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 state, ACT, county and metropolitan area commodity forecasts. One example of constrained infrastructure was for petroleum product pipelines where no new pipeline construction is assumed.

COMMODITY FLOW FORECAST RESULTS

The commodity flow forecast for Oregon is for sustained growth over the long term to 2030. The volume of commodity flows for Oregon is forecast to increase from 434 million tons to 788 million tons between 1997 and 2030. This total tonnage volume growth will be at a compound average annual rate of 1.8 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 are presented next by mode and commodity.

Commodity Forecast Results by Transport Mode

The largest volume of commodities shipped in, to, from and through Oregon moves by truck. Truck tonnage is forecast to grow from 330 million tons to over 631 million tons by 2030, at a compound average annual growth rate of 1.98 percent. Total Oregon rail commodity tonnage is forecast to increase from 55 million tons to 100 million tons by 2030, at a compound average annual growth rate of 1.83 percent. Off of a very small tonnage base, air cargo is forecast to increase the fastest at a compound average annual rate of 2.6 percent, to 0.7 million tons by 2030. Waterborne cargo is expected to see average annual growth of just 0.5 percent increasing from 38 million tons in 1997 to 45 million tons by 2030. Pipeline transport is expected to see no growth due to the lack of additional construction or capacity. The following table summarizes the forecast commodity tonnage by mode over the 1997 to 2030 period for Oregon.

Table 2 – Oregon Commodity Flow Tonnage Forecast by Mode

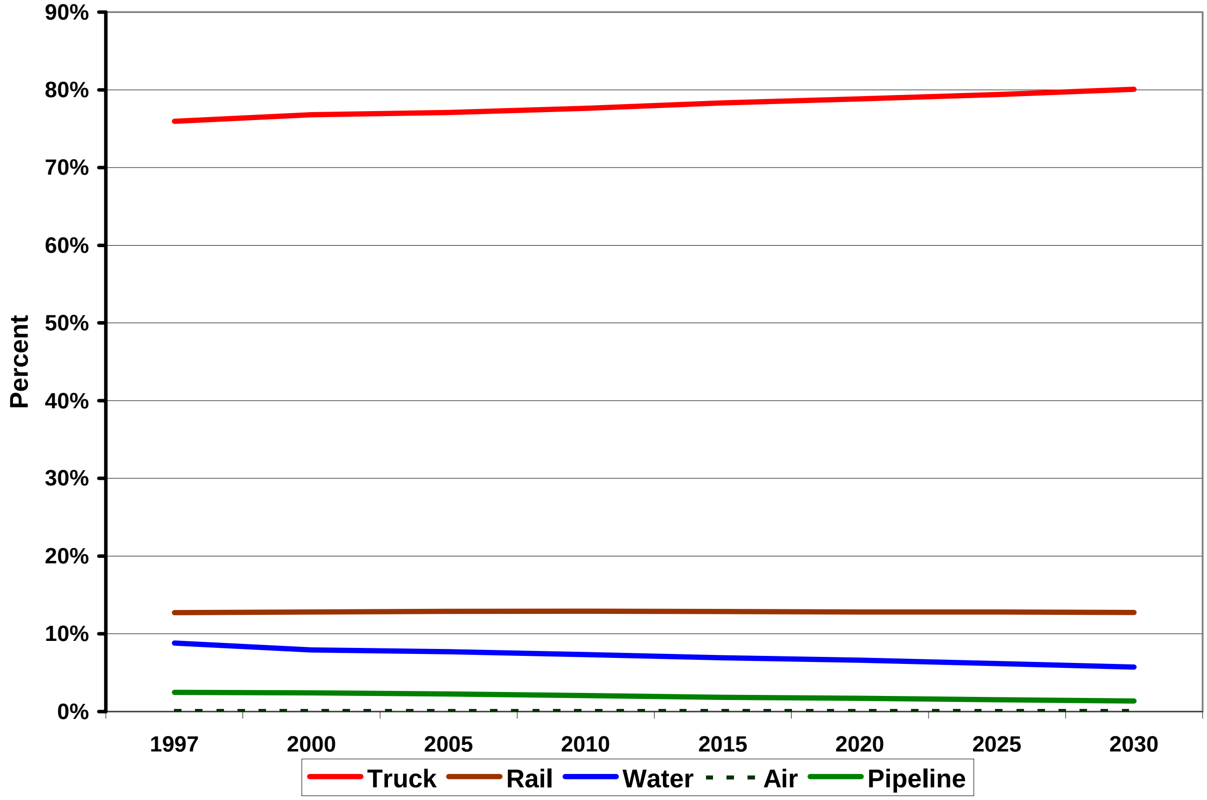
(Thousands of Tons and Compound Annual Growth Rate)

Mode	1997	2000	2010	2020	2030	CAGR 1997-2030
Truck	330,027	341,778	402,995	503,060	631,172	1.98%
Rail	55,225	56,971	67,081	81,800	100,606	1.83%
Water	38,266	35,238	38,099	42,098	45,092	0.50%
Air	318	329	386	495	747	2.62%
Pipeline	10,713	10,713	10,713	10,713	10,713	0.00%
Total	434,549	445,029	519,273	638,166	788,331	1.82%

Oregon will see a significant further increase in truck tonnage volumes on the highways as the truck share of tonnage increases from 76 percent to 80 percent of total tons by 2030. Rail's total share of tonnage will increase slightly from 12.7 percent in 1997 to 12.8 percent in 2030. Water and pipeline lose share to truck and rail over this same time period.

The modal shares of the tonnage forecast for Oregon can be seen in the figure below.

Figure 2-2 Mode Share of Tonnage in 1997 - 2030 (Percent of Tons)



When measured in value terms, the growth in commodity movements in Oregon over the forecast period is greater than the rate of increase in tonnage. The total real (constant) dollar value of Oregon commodities is forecast to increase at a compound annual growth rate of 2.9 percent between 1997 and 2030, compared with the growth of 1.8 percent when measured in tons. This difference is due to the faster growth projected for the higher unit value commodities. From a modal perspective, in real value terms truck carries the highest value of commodities of all modes, with rail and water modes carrying the next most in value, now and through 2030. Reflecting the different mix of commodities carried by each mode, the growth in airborne commodity value will be highest over the forecast period at a compound annual growth rate of 3.7 percent. The value of trucked commodities will increase at a compound annual growth rate of 3.2 percent and rail is forecast to see an increase of 2.1 percent through 2030. The value of waterborne and pipeline commodities will grow at compound annual rates of less than one percent over the forecast period.

The summary Oregon commodity flow forecasts are summarized in the following table for selected years through 2030.

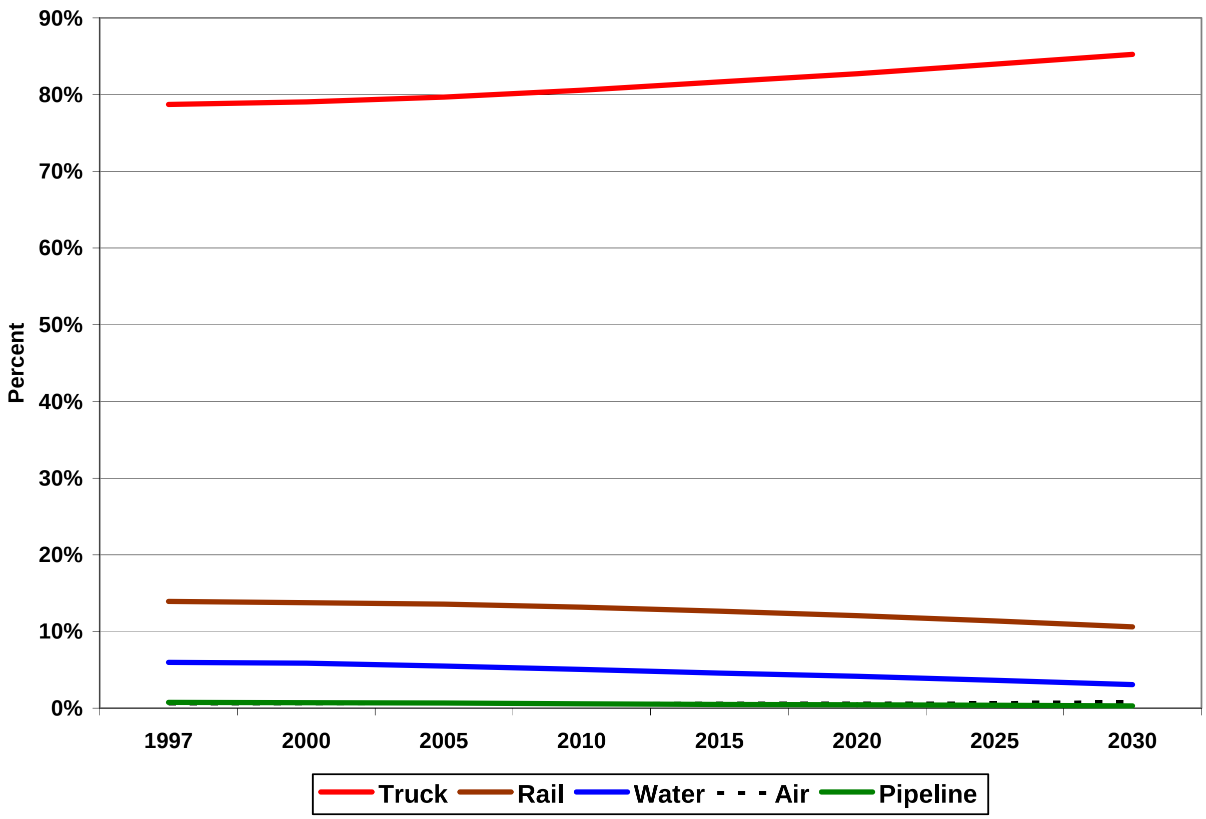
Table 3 – Oregon Commodity Flow Value Forecast by Mode

(Millions of Dollars and Compound Annual Growth Rate)

Mode	1997	2000	2010	2020	2030	CAGR 1997-2030
Truck	399,272	419,364	533,997	738,927	1,114,936	3.16%
Rail	70,583	72,889	87,313	107,768	138,403	2.06%
Water	30,233	31,091	33,538	37,058	40,023	0.85%
Air	3,232	3,316	4,054	5,720	10,536	3.65%
Pipeline	3,816	3,816	3,816	3,816	3,816	0.00%
Total	507,136	530,477	662,718	893,290	1,307,715	2.91%

Trucks increase their importance to the economy of Oregon with respect to the other modes of transportation with their share of the value commodities growing from 79 percent to 85 percent of total commodity value by 2030. Air increases its small share from 0.6 percent to 0.8 percent by 2030. Rail's total share of commodity value is forecast to decrease slightly from 14 percent in 1997 to 11 percent by 2030. Water and pipeline also lose share to truck and rail over this same time period, as shown in the following figure.

Figure 2-3 Mode Share of Value in 1997 - 2030 (Percent of Value)



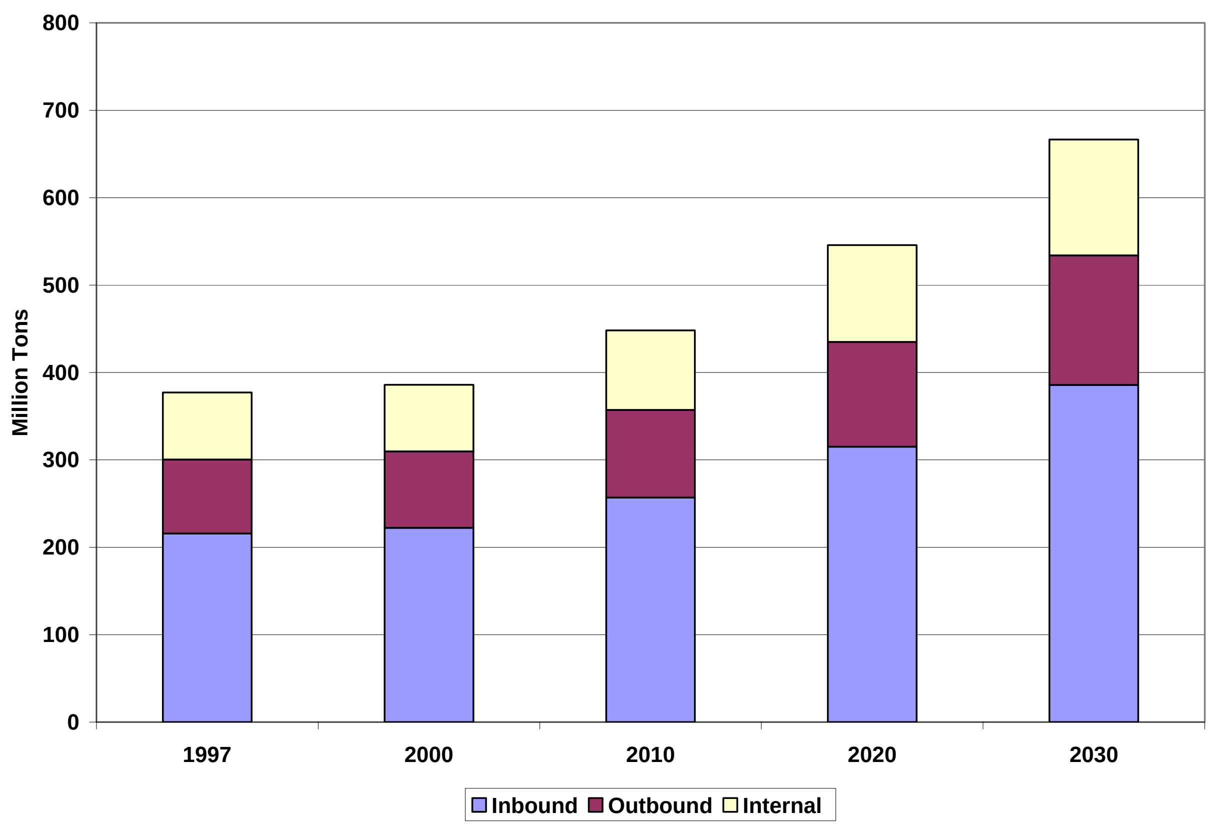
Commodity Forecast Results by Direction

The commodity flow forecast for Oregon predicts that internal traffic will grow more slowly 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 1.68 percent growing from 77 million tons in 1997 to 133 million tons by 2030. Outbound tonnage is forecast to increase at a compound average annual growth rate of 1.72 percent, increasing from 85 million tons in 1997 to 148 million tons by 2030. Inbound tonnage is forecast to increase at a compound average annual rate of 1.77 percent over the period, growing from 216 million tons to 386 million tons by 2030. The directional split of forecast commodity flows for the area are displayed in the following table and figure.

Table 4 – Oregon Commodity Flow Forecast by Direction

	1997	2000	2010	2020	2030	CAGR 1997-2030
Inbound	215,862	222,301	256,872	315,159	385,644	1.77 %
Outbound	84,673	87,457	100,163	119,991	148,483	1.72 %
Internal	76,622	76,242	91,022	110,795	132,563	1.68 %
Total	377,157	386,000	448,057	545,944	666,690	1.74 %

Figure 2-4 Direction Share of Tonnage in 2030 (Million Tons)



Commodity Forecast Results by Commodity Group

Forecast growth of commodity flows for Oregon varies by commodity group. The Oregon commodity tonnage forecast, as the total of modes and directions is summarized in the table below by 2-digit STCC commodity classification to 2030. Also included is the compound average annual growth rate from 1997 to 2030.

Table 5 – Forecast of Oregon Commodity Group Tonnage (1000 tons)

STCC	Description	1997	2000	2010	2020	2030	CAGR 1997-2030
1	Farm Products	48,038	51,429	62,100	70,703	79,408	1.53
8	Forest Products	54	57	71	92	114	2.31
9	Fresh Fish Or Marine Products	188	211	241	288	343	1.85
10	Metallic Ores	1,268	1,424	2,021	2,851	3,449	3.08
11	Coal	1,016	1,014	1,259	1,590	2,033	2.12
13	Petroleum Prod, Natural Gas	26,425	27,273	31,663	36,254	41,783	1.40
14	Nonmetallic Minerals	55,415	56,449	60,685	68,790	81,396	1.17
19	Ordnance or Accessories	0	0	1	1	2	4.80
20	Food or Kindred Products	43,177	45,255	54,727	70,950	91,767	2.31
21	Tobacco Products	706	630	526	469	407	-1.66
22	Textile Mill Products	6,232	6,149	6,995	8,416	14,292	2.55
23	Apparel or Related Products	440	408	374	399	414	-0.18
24	Logs, Lumber, Wood Prod.	116,647	116,444	136,268	168,137	189,377	1.48
25	Furniture or Fixtures	1,117	1,153	1,328	1,637	2,050	1.86
26	Pulp, Paper or Allied Products	14,273	14,089	15,615	20,111	25,717	1.80
27	Printed Matter	1,670	1,592	1,572	1,726	1,923	0.43
28	Chemicals or Allied Products	21,845	22,736	26,101	30,865	39,454	1.81
29	Petroleum or Coal Products	10,008	11,066	13,868	18,859	25,675	2.90
30	Rubber or Misc. Plastics	2,369	2,429	2,982	4,246	6,522	3.12
31	Leather or Leather Products	80	72	59	59	61	-0.83
32	Clay, Concrete, Glass or Stone	28,453	27,681	29,222	34,798	43,500	1.29
33	Primary Metal Products	6,868	7,024	8,484	11,375	15,437	2.48
34	Fabricated Metal Products	4,043	4,106	4,816	6,355	8,849	2.40
35	Machinery	2,860	2,761	3,059	4,516	7,143	2.81
36	Electrical Equipment	2,923	3,127	4,577	7,331	14,179	4.90
37	Transportation Equipment	7,108	8,217	11,946	16,850	23,763	3.72
38	Instrum, Photo Equip, Optical Eq.	444	449	511	637	844	1.96
39	Misc. Manufacturing Products	1,483	1,564	1,944	2,522	3,382	2.53
40	Waste or Scrap Materials	8,661	8,927	10,459	13,648	18,946	2.40
41	Misc. Freight Shipments	82	82	94	107	127	1.33
42	Shipping Containers	1,565	1,413	1,594	1,941	2,436	1.35
43	Mail or Contract Traffic	104	109	127	148	180	1.69
44	Freight Forwarder Traffic	810	824	950	1,190	1,601	2.09
45	Shipper Association Traffic	27	28	32	41	55	2.15
46	Misc. Mixed Shipments	13,967	14,347	16,888	21,456	29,050	2.24
47	Small Package Freight Shipments	665	669	745	895	1,140	1.64
48	Waste	70	78	98	111	122	1.69
49	Toxic Waste	0	0	1	1	1	2.71

The fastest growing commodity tonnage category for Oregon is electrical equipment while the slowest growing commodities are some of the goods whose manufacture and distribution is moving out of Oregon or where consumption is falling, namely apparel, leather products and tobacco. Of those commodities forecast to have above-average tonnage growth, electrical equipment and transportation equipment will grow fastest, followed by mail and electronics.

Pipeline Traffic

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

The forecasts for petroleum products assume that the market for refined products in the state grows at a compound annual growth rate of 3.2% per year for the period 2000 to 2010, then slows to a compound annual growth rate of about 1.8% per year for the next two decades. This forecast includes a projection that alternative technologies and conservation (through higher CAFÉ standards and other factors) will increasingly affect demand growth over time.

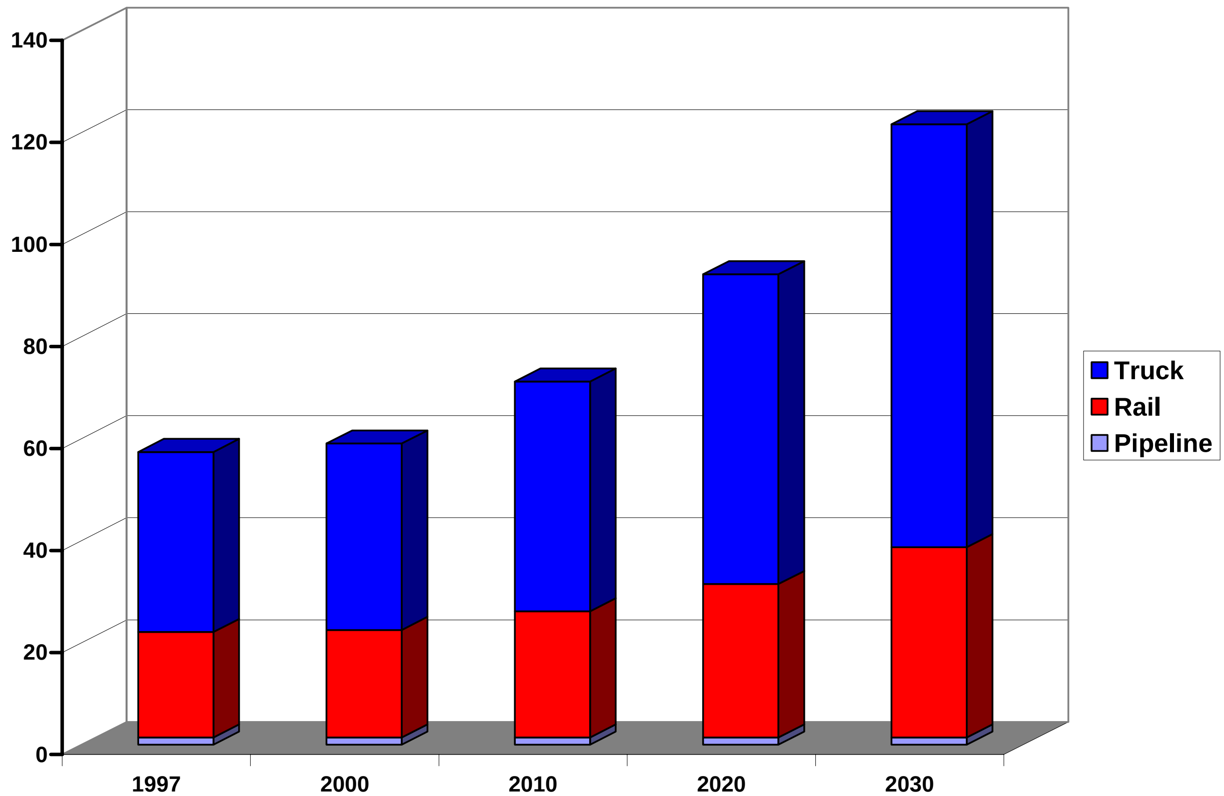
There was a shutdown of the Olympic pipeline during 1999 and into 2000 that disrupted historical patterns of refined product supply to Oregon. When this happened, Puget Sound refined products were shipped to Portland by tanker vessels on the Columbia River. After repair of the pipeline and its return to operation, Puget Sound-originating petroleum product shipments returned to using the pipeline. For the forecast, it is assumed that the Olympic pipeline operates at capacity. The volume of petroleum products handled by the Linn county Albany station of the Kinder-Morgan pipeline has been transferred to Eugene after 1997 following that station's closure. Statewide, future demand not met by pipeline capacity will be met by waterborne and truck shipments which will be equal to the residual of the total market growth less the volumes carried by the pipeline. Under these assumptions, growth in pipeline tonnage is expected to be flat through the period to 2030. To supplement pipeline capacity, petroleum products will continue to be carried by tanker vessels on the Columbia River from external sources and by truck within the state. Of the waterborne petroleum product volumes forecast, imports are expected to grow slightly more rapidly than domestic shipments by water from outside the region.

Through Traffic

A significant volume of commodities today are moving through Oregon that are not destined for nor originating in the state. This cargo is just passing through the area between external regions. This traffic still relies on the state’s transportation network capacity to carry it. The forecast for through traffic is for1997-2030 growth rates to average 1.8 percent annually for rail, 2.6 percent for truck and less than one percent for pipeline. Overall through traffic tonnage growth is forecast to grow by a compound annual growth rate of 2.3 percent over the entire period.

As seen in the Figure below, the significance of trucking to through tonnage increases over the period to 2030.

Figure 2-5 Oregon Through Traffic Forecast (Million Tons by Mode)



Commodity Forecast Results by Region

The commodity flow forecast for Oregon shows significant variation in the forecast growth rates for each of the regions around the state. Such variation is expected and reflects the different mix of industries and consumers in different parts of Oregon. The ACT area with the most rapid forecast growth, at a compound annual rate of growth of 2.2 percent from 1997 to 2030, is the Rogue Valley ACT, with significant growth in tonnage of construction-activity related commodity groups. In contrast, the North West Oregon ACT is forecast to see a compound annual growth rate of only 0.9 percent from 1997 to 2030 due to the slower growth of its key farm products commodity tonnage category.

Of the commodity forecasts for the six metro areas, Medford-Ashland is forecast to have the greatest increase in total tonnage at a compound average annual growth rate of 2.3 percent growing from 33 million tons in 1997 to 68 million tons by 2030. Corvallis, on the other hand, is projected to have increases in tonnage at a compound average annual growth rate of 0.9 percent, increasing from 8.6 million tons in 1997 to 11 million tons by 2030 reflecting weakness in logs, lumber, wood products shipments in the area.

The total tonnage forecasts for each of the ACT areas, the six metro areas and the four selected counties is presented in the following table, with the compound average annual growth rate calculated for the period from 1997 to 2030. Tonnage data are in millions.

Table 6 – Forecast of Oregon Region Total Commodity Tonnage (million tons)

Region	1997	2000	2010	2020	2030	CAGR 1997-2030
Cascades West ACT	81.0	84.0	99.9	124.3	148.3	1.85
Central Oregon ACT	26.2	26.8	30.3	35.9	42.4	1.47
Lower John Day ACT	78.8	78.3	89.5	108.1	129.4	1.51
Mid-Willamette ACT	79.4	81.8	96.3	120.6	147.5	1.90
North East Oregon ACT	85.7	86.0	98.7	120.3	148.6	1.68
North West Oregon ACT	47.7	38.3	43.5	53.6	63.7	0.88
Rogue Valley ACT	34.0	35.4	42.8	55.1	69.7	2.20
South Central Oregon ACT	19.4	19.9	22.9	27.6	32.3	1.56
South East Oregon ACT	53.9	55.7	65.3	80.8	101.6	1.94
South West Oregon ACT	50.0	49.6	59.0	74.4	90.1	1.80
Bend Metro	21.0	21.5	24.0	27.8	31.7	1.25
Corvallis Metro	8.6	8.7	9.4	10.5	11.4	0.86
Eugene-Springfield Metro	68.9	71.5	85.0	106.7	128.2	1.90
Medford-Ashland Metro	32.8	34.2	41.5	53.8	68.3	2.25
Portland Metro	216.3	219.9	256.0	314.3	388.5	1.79
Salem Metro	79.7	82.6	97.9	121.8	146.9	1.87
Columbia County	44.9	35.6	40.7	50.7	60.4	0.90
Hood River County	53.2	53.9	62.3	75.2	90.3	1.61
Washington County	83.9	86.7	103.1	129.3	158.5	1.95
Yamhill County	7.6	7.7	8.8	11.1	14.6	2.00

3. IDENTIFICATION OF FACTORS, TRENDS AND LIMITATIONS

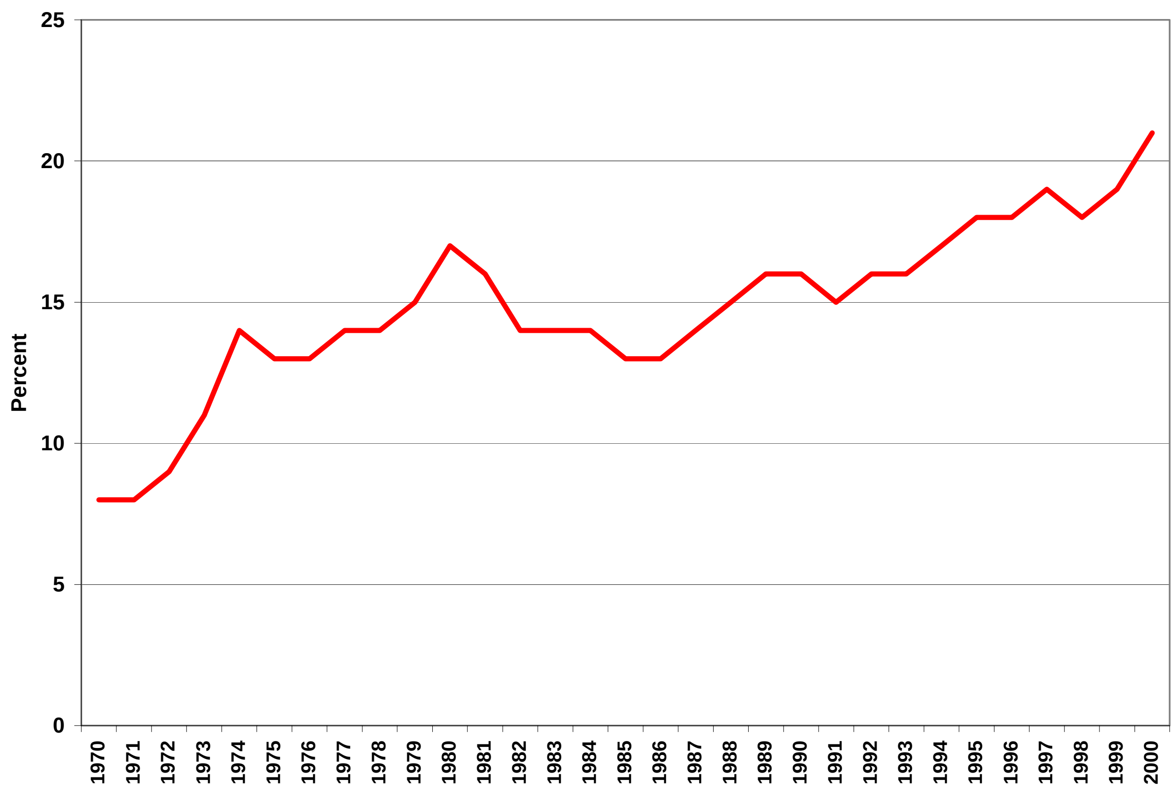
This section describes major factors, trends and limitations that are likely to impact the future of commodity movement in Oregon.[1] Long-term commodity growth is affected by factors other than the primary underlying demand for consumption of the goods. The geographic distribution of production, the business processes and practices, and government policy all affect the characteristics of future modal commodity transportation activity. These issues are discussed here to put the quantitative commodity flow forecasts in context and explain some of the reasons behind the changes in patterns observed over the long run.

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 2000, U.S. merchandise trade as a share of gross domestic product (GDP) grew from 8 percent to 21 percent (in current dollars). This trend, including the spike up three percent in share just in the three years from 1998 to 2000 is illustrated below.

Figure 3-1 U.S. Merchandise Trade as Share of U.S. GDP



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

[1] Some of the information contained in this section 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 China as a leading trade partner has already had significant impacts on Oregon and the U.S. West Coast. 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.

While high levels of growth in Pacific Rim container trade is expected to continue, especially with China, North-South trade associated with the North American Free Trade Agreement (NAFTA) will continue to be important for Oregon. The Western states are major trading partners with Western Canada and the impacts on traffic into, out of, and through Oregon is projected 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 trade development of free trade agreements between the U.S. and Canada and the political climate in British Columbia in recent years. 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 the pro-business climate in the British Columbian provincial government, Western Canadian exporters continue to seek 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 Canadian sea ports and Canadian primary manufacturing firms in the North American marketplace.

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) and the nodes connecting them to the statewide transportation network. Many of these facilities have already experienced congestion problems and landside access to these facilities is likewise threatened by continuing growth. Despite the recent loss of container vessel service at the Port of Portland, the three largest West Coast ports, Los Angeles, Long Beach, and Seattle are all facing congestion problems on both the wharf side and the land side. The San Pedro Bay ports (Los Angeles and Long Beach) have gained market share and continued to grow with the growth in U.S. – Asian trade, 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 larger post-Panamax vessels to serve these markets, with attendant needs for deep-water ports, have contributed to the further concentration of cargo at the deepest draft container ports. The increased trade volume has led to further congestion of freight transportation in already congested landside corridors. Although the San Pedro Bay and Puget Sound ports have made major investments in new terminal capacity, 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. The available capacity and national transportation network connections at the Port of Portland are expected to attract new container vessel service to Oregon, regardless of the status of the Lower Columbia River deepening project.

Port communities are also facing significant land use problems. Expansion of facilities in existing locations at some ports 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. 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.

Are these trends an opportunity or a problem for Oregon? The answer to this question is ambiguous. On the one hand, the trend towards concentration of U.S. trade with China carried on much larger container vessels may continue to impact Oregon's trade patterns. However, the congestion problems at other West Coast ports can provide an opportunity if the right types of land use policies are in place. In many ways Oregon is well positioned to capitalize on the trends. Many of the state's freight transportation facilities have room for expansion, such as Port of Portland's important Terminal 6. The state can benefit from the fact that maritime port and airport facilities around the state remain uncongested, especially when compared to the major port facilities on the West Coast. Oregon's transportation system has benefited from investments to develop facilities to facilitate freight movement. The key Port of Portland is served by on-dock rail and both the BNSF and Union Pacific railroads have invested in their main rail lines that pass through the Columbia Gorge to provide dual tracks and double stack container handling capability. This significant investment is already in place and able to handle increased freight activity. Finally, while available industrial land for development in the Portland area is limited, work is underway in the region to create more industrially zoned sites. The State of Oregon has established a program to pre-certify sites that are available for immediate development and elsewhere in the state, land costs can be an advantage especially in the Willamette Valley and along the Interstate 84 corridor in eastern Oregon.

Nevertheless, a remaining concern for Oregon is what types of additional financial resources may be available at the federal and metropolitan level and among private shippers and carriers to address the future capacity needs around gateway facilities. The cost of addressing these needs is still likely to be substantial and all indications are that new funding resources in the new 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 state of Oregon related to 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, Oregon may see additional change in truck flow patterns. Reductions in empty backhauls and new demands for regulatory enforcement of hours of service and size and weight limits are examples of the types of changes that may yet be in store.

DOMESTIC ECONOMIC TRENDS AND IMPACTS ON FREIGHT TRANSPORTATION

Over the past 25 years, there has been a major shift in the U.S. economy away from a manufacturing orientation to a 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 transportation lanes. Growth in manufacturing is expected to occur through continuing growth in productivity. In the last ten years, lower real freight rates and reliance on dependable transportation as a substitute for inventory holding were 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, with an even greater application of information and communications technology to achieve further transportation productivity growth.

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 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 merchandise delivery services, web-based or catalog shopping, pizza restaurants, 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 is pushing 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 long term trend has impacts for all freight modes. There has been 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.
- Employees expect better working conditions – With the shift away from traditional lower skill 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 transportation carriers and warehouses that are pressured to provide 24 hour/7 day a week operations as a way to increase operational capacity without major new infrastructure investment. This is also a problem for trucking companies trying to recruit more long haul truck drivers to handle the increased freight volumes.
- 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 Internet bubble focus on e-commerce-related shipments and the shift to a service orientation for the economy, the market for bulk commodities continues to be a 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 Oregon. 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) return to 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 three to four years, but most analysts now believe the growth in the retail side of e-commerce has been and will continue to be relatively slow. On the supply side (business-to-business), 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 Oregon’s experience with the impacts of carrier consolidation efforts may be a harbinger of what lies ahead.

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 has experienced the highest rate of compound growth in tonnage over the last decade 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 and this trend is expected to continue.

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 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. 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

Historically, the services of carriers have been narrowly defined along modal lines. The growth of intermodalism over the past 25 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, competition has remained strong with carriers continuing to find returns squeezed to the point where they do not cover costs of capital. This has made them reluctant to make the types of investments that are needed to provide significantly expanded capacity. In addition, carriers report that large financial institutions and investors have little 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 in freight transportation has continued over the last several years and has prompted more efforts on the part of carriers to obtain government financial support for intermodal and common use transport infrastructure. While 2004 has seen capacity constraints in portions of the rail, trucking and port industries, carriers have not rushed to increase capital spending to add capacity.

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. Domestic air freight is dominated by less than half a dozen integrated carriers. U.S. flag steamship companies have merged with foreign lines. Class I railroads have reduced to the point that there are six major systems in North America with another round of mergers still possible in the future.

The productivity gains achieved through coordinated logistics over the last fifteen years are 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 additional information technology and communications 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, though some very large shippers such as Wal-Mart are forcing technology change on their suppliers.

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 Oregon:

- 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 will be at odds with the significant 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 an increasingly important issue. The intermodal rail 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 have tended to concentrate their business at fewer ports, with longer inland movements by truck or rail.

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 would 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 report provide the context for freight transportation planning and the regional, state and federal surface transportation policy debates. It is important for those with responsibility for freight transportation in Oregon 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 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 25 years of economic deregulation are also 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. For example, Oregon has been a participant in this process for the I-5 corridor. Further institutionalization of these multi-state planning processes is another area of federal policy that has been part of the federal reauthorization debate. It is expected that some Federal programs in support of this direction will be included in the final reauthorization legislation and it will be important for Oregon to continue to participate to assure the state benefits from the measures available.

The mismatch in the planning timeframes of the public and private sectors continues to be a problem 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. With the projected growth in freight volumes, processes that allow the two to come closer together to address near term needs should continue to be encouraged within Oregon.

Lastly, most states and Metropolitan Planning Organizations still lack basic freight data and analysis tools for evaluating project alternatives or understanding the implications of future freight industry trends. There are few states that have been as successful as Oregon in marshaling the resources for conducting freight flow studies or developing freight forecasting models. There are hopes that in the next round of federal reauthorization, new programs will build on the innovative work as in Oregon and help states coordinate with their neighbors on multi-state planning.

4. Conclusions

The Commodity Flow Forecast has produced a new comprehensive long-term 2030 forecast from the 1997 baseline data, with forecasts of all commodities moving to, from, in and through the Oregon and its regions by all major modes of transport. Overall, tonnage will increase 81 percent by 2030, growing at a compound average annual growth rate of about 1.8 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 Oregon's population and the workforce, the drive to further optimization supply chains and the continuation of Oregon's position as an export-dominated state within the United States.

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. The commodities that will see demand grow most rapidly are higher value goods such as electrical equipment and transportation equipment, 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.

Through traffic in Oregon is significant now and will increase at a compound average rate of 2.3 percent by 2030 with total through tonnage increasing from 57 million tons to almost 122 million tons. Through truck traffic is forecast to grow fastest while rail through tonnage increases at a compound rate of 1.8 percent by 2030. This through traffic requires capacity from the state's transportation network that is then not available for traffic originating or destined for the state. The state'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 through traffic provides support for the investment in the state's transportation infrastructure beyond what would be warranted by Oregon's traffic alone.

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

- Does Oregon have adequate capacity to meet increasing demands efficiently?
- How are the state's industrial areas linked to the regional transportation facilities? How will these links function in the future?

- Through ongoing economic development efforts in the state, what new industries is the state 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 Oregon handle new cargo attracted to the state or re-routing of existing cargo within the state due to new transportation services or improved frequencies of service?

These questions and others will have to be addressed by subsequent planning and analysis on the part of the transportation decision makers in Oregon, including through the application of the TLUMIP models. With sufficient attention to the forecast future commodity transportation demands, Oregon can be best prepared to maintain and improve the transportation system that provides the goods that provide the high quality of life throughout the state.

APPENDICES

- A.1 – References
- A.2 – Methodology for the Commodity Flow Forecast
- A.3 – Commodity Flow Forecast Data Files, 1997 - 2030

APPENDIX A.1 – REFERENCES

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APPENDIX A.2 – METHODOLOGY FOR THE COMMODITY FLOW FORECAST

This appendix provides detail on the methodology used to produce the commodity flow forecast from the 1997 baseline Oregon commodity flow data. The baseline data is critical to the structure of the data dimensions which make up the forecasts as the geographic regions, commodity and modal classifications had to be the same in the forecasts as in the baseline data. Complete documentation of the 1997 baseline commodity flow data is available in a separate report prepared by another Parsons Brinckerhoff subcontractor, Cambridge Systematics, Inc. and referenced in Appendix A.1.

The following were the objectives of the commodity flow forecasting tasks:

- Develop commodity flow forecasting models based on a 1997 baseline of Oregon commodity flows and the national commodity flows from Reebie Associates 1997 TRANSEARCH database for the rest of the country.
- Develop unique national freight forecasting models to provide aggregate controls for future national freight tonnage flows.
- Generate the forecast datasets of commodity flows out to 2030 by mode, geographic region, direction and commodity, measured in tonnage and value.

DEVELOPMENT OF LONG-TERM 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 Oregon were produced for 2000, 2005, 2010, 2015, 2020, 2025 and 2030 by direction and mode. The forecast was developed in the context of national models driven by forecasts at the macroeconomic, regional, producing sector, and purchasing sector levels.

Implicit in this commodity forecasting approach is the assumption that the commodity flows are commodity-demand driven. Consequently, modal distributions over time are endogenous and are jointly determined by the differential growth in commodities and changes in the patterns of origins and destinations. This supply/demand approach allows emerging origin and destination patterns to evolve over the forecast period as the industry structure and performance of different regions varies over the forecast period. This methodology has modal share as a function of existing patterns of commodity market share on an individual origin – destination pair basis, using the historical market share for that commodity group.

The commodity flow forecast was developed using industry sector-classified economic activity, mapped to the study’s STCC commodity categories in the process of the forecast development. The general methodology involved can be summarized as taking the baseline commodity flow data for 1997, and growing (or shrinking) these flows based on appropriate growth rates. The result represents either shipments or purchases for a commodity in a particular geographic region. The shipments growth rate was determined based on the growth rate in output in a particular region and commodity group, from Global Insight's commercial Business Demographic Model (BDM). The purchases growth rate was determined based on Global Insight'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 geographic region of the country. Finally, shipments were constrained to purchases by commodity group and region, and were reconciled to be consistent with national estimated freight flow control totals by commodity group.

The forecasts cover the same geography, commodity and modal dimensions as in the 1997 base year data for the years 2000, 2005, 2010, 2015, 2020, 2025 and 2030. After repeated review, revision and approval of the 1997 base year data by ODOT, 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 forecasts for the period 1998 - 2030.
2. Forecast of national commodity group forecasts as a control.
3. Forecast of modal Origin-Destination commodity flows for region-to-region and external levels.
4. Forecast of modal commodity volumes by geographic region and direction.

Each of these steps is described below.

Preparation of underlying economic forecasts from 1998 - 2030

As important inputs to the commodity forecasts, external forecast economic variables were produced for the required 1998 – 2030 forecast period. The Global Insight national, regional, industry, and commodity price forecasts were extended from the latest existing standard forecast (either the year 2025 or 2029) to 2030. Industry sector and commodity classifications were mapped to STCC classifications for purposes of the commodity forecast models. Similarly, the Global Insight U.S. international commodity trade forecasts were extended to 2030 and mapped to the STCC commodity classification.

Underlying U.S. Economic Forecast

The national commodity forecasts depend explicitly on Global Insight U.S. Macroeconomic and U.S. Regional forecasts. It should be noted that the study was undertaken during the economic recovery following the 2001 U.S. and global recession. The cyclical response of the U.S. and Oregon economy and the disruptive influences of the war on terrorism globally are reflected in the short-run paths of key macroeconomic forecast variables, notably real GDP and employment.

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 Global Insight 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 employment depends directly on key labor market variables and influences from outside of the labor market, such as interest rate policy and corporate profits.

This forecast was for Oregon, the ACT areas, six metropolitan areas and Columbia, Hood River, Yamhill and Washington counties. This is not directly comparable to the geography of the previous Portland/Vancouver Commodity Flow Forecast because the study area for that forecast focused on commodity flows in the six-county Portland Vancouver metropolitan area that included Clark County in Washington, which is excluded here.

National Commodity Flow Control Forecasts

The methodology used to produce the national control commodity flow forecasts can be summarized as taking base year flow data for 1997, and growing these levels based on appropriate growth rates. As a control on the Oregon and regional commodity flows, the national 1997 base year commodity database used was from Reebie Associates' 1997 TRANSEARCH data, including the 1997 Commodity Flow Survey. 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 Oregon and for aggregations of counties into successively larger regions as one moves away from Oregon. 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 lead contractor PB Consult and ODOT.

Future shipment growth rates were determined based on the growth rate in output in county/regions of the country and commodity category, using Global Insight’s Business Demographic Model (BDM). The purchases growth rate was determined using Global Insight’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 international freight flows, a similar methodology was applied for the portions of international freight movements within the U.S. The Global Insight World Trade Service (WTS) forecast was used to estimate U.S. import and export growth outside of the U.S. The international freight flows were constrained to the WTS forecast by commodity, and U.S. port region, and direction of trade.

To force consistency with total national potential production and consumption of commodities, a national-level freight forecast was generated. The national freight model by commodity served as a top-level constraint for the freight flows forecast for Oregon, ACT 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 Global Insight’s U.S. Macroeconomic and U.S. Regional Services. The raw forecast results were adjusted based on external information about the relative growth rates of freight flows across different commodity categories, as well as the resulting growth rates of the different modes of transportation, creating an adjusted 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 Global Insight Business Demographic Model (BDM) growth rate, by commodity and region, to create a forecast for domestic shipments, and by the Global Insight 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 were constrained to purchases, to result in the final domestic freight forecast by commodity and region. Where commodity group definitions were not defined by a direct mapping to an industry sector (e.g. freight forwarder traffic), appropriate composite growth rates were estimated from combinations of the other commodity group forecasts.

INTERNATIONAL FREIGHT FORECAST BY COMMODITY AND WORLD REGION

The base year 1997 Oregon 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 Global Insight World Trade Service (WTS) forecast served as the basis for developing the international commodity flow forecast by commodity, trade partner region, U.S. gateway, and domestic region. First, the international commodity flow base year data for 1997 was calculated. Second, the international freight flow movements inside the U.S. were determined. To do carry this out, 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 U.S. were constrained to the world total obtained from the Global Insight World Trade Service by commodity, world trade partner region, and U.S. border gateway zone.

Attachment B provided diagrams for both the domestic and international freight forecast methodology.

COMMODITY FLOW AND INDUSTRY SECTOR DATA

Freight Flow Data

Cambridge Systematics produced the baseline 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. Attachment A contains a description of the Standard Transported Commodity Classification (STCC) commodity categories and the mapping to SIC industry sector codes.

Business Demographic and Transactions Data

Global Insight's Business Demographic Model provides forecasts of employment, establishments, and output 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. Global Insight'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. Attachment A contains a description of the Standard Transported Commodity Classification (STCC) commodity categories and the mapping to SIC industry sector codes.

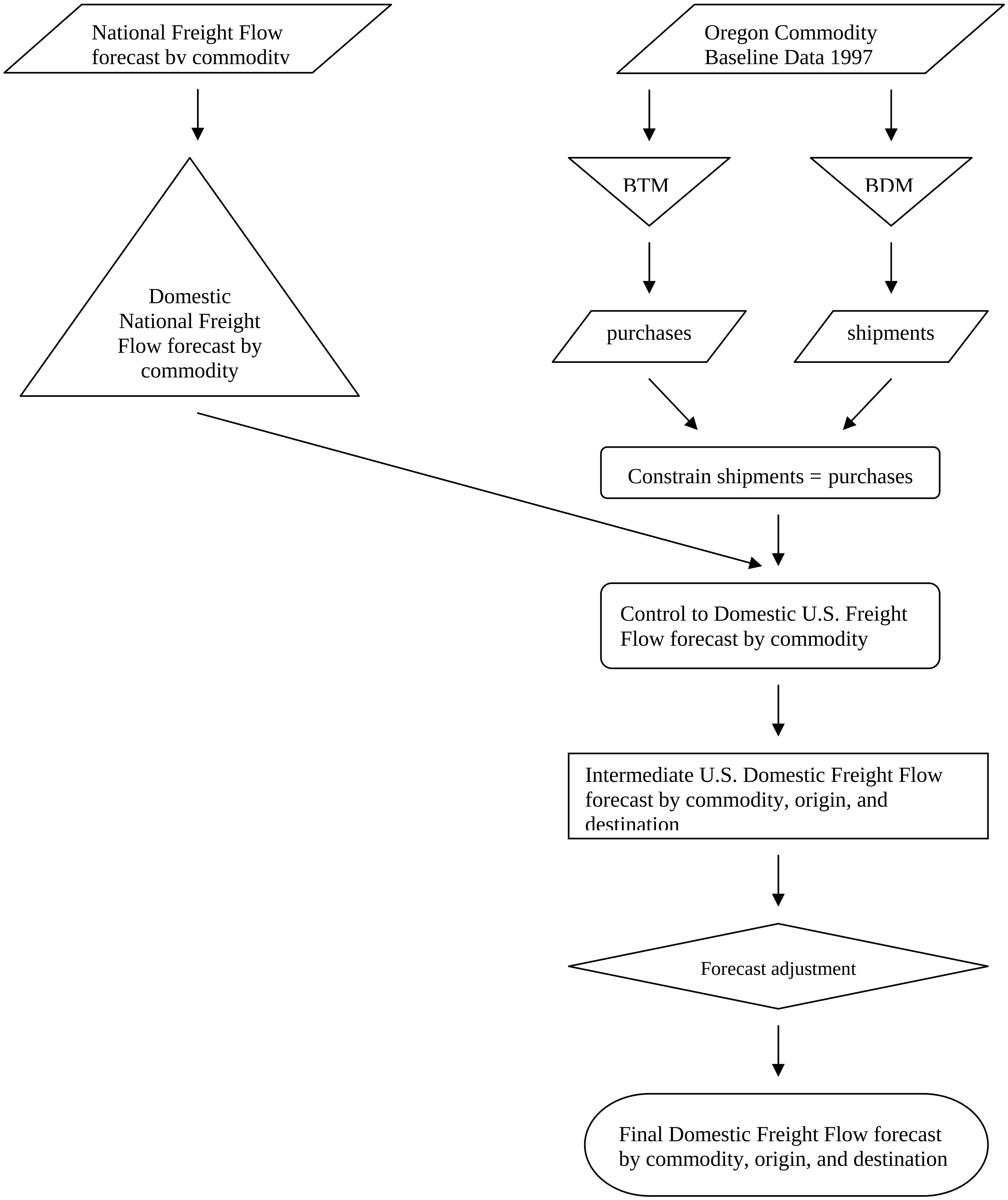
ATTACHMENT A: STCC COMMODITY DESCRIPTIONS AND SIC CODE MAPPING

STCC	SIC	CATEGORY 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	INSTRUMENTS, 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 PACKAGE FREIGHT SHIPMENTS
48		WASTE
49		HAZARDOUS WASTE

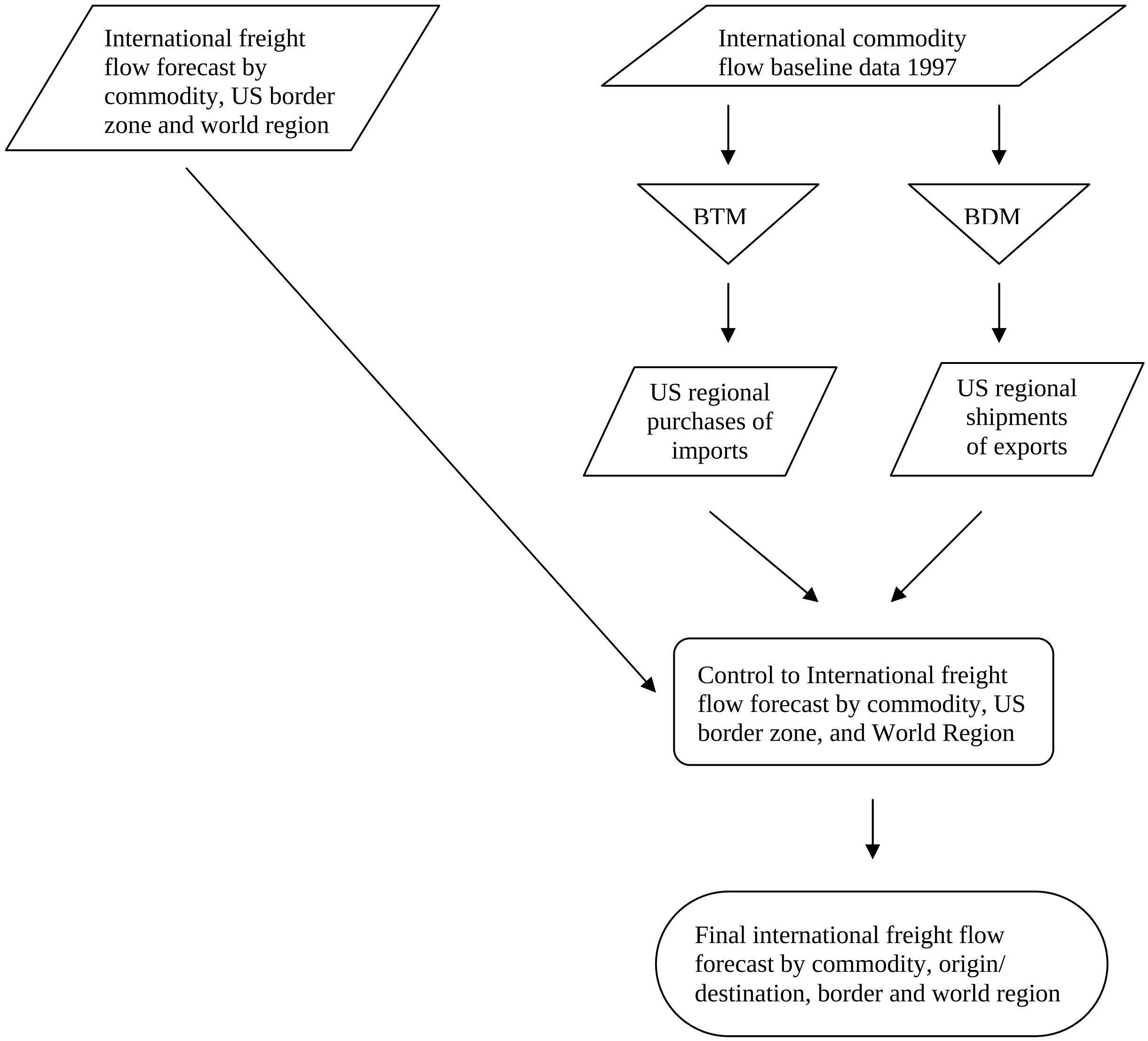
Note: STCC codes higher than 41 are not included in international freight flow data.

ATTACHMENT B: COMMODITY FLOW FORECAST UPDATE METHODOLOGY FLOW CHARTS

Domestic Commodity Flow Forecasts



International Commodity Flow Forecasts



APPENDIX A.3 – COMMODITY FLOW FORECAST DATA FILES, 1997 – 2030

With the dimensions of the forecast data, tables with the commodity, mode, direction, geographic and time detail of the forecasts would fill over 1,000 pages, therefore we are not reproducing here all the detailed forecast data from the files produced to accompany this report. These files have been delivered separately to the Oregon Department of Transportation for use with the Transportation & Land Use Model Integration Project models. In addition to an Microsoft Access database, the forecast data have been formatted as Microsoft Excel spreadsheet tables, one worksheet per geographic region in the forecast. Each worksheet contains the tonnage and value forecasts for each mode and direction combination for one geographic region. Therefore there are 21 files, one each for:

Oregon
Cascades West ACT
Central Oregon ACT
Lower John Day ACT
Mid-Willamette ACT
North East Oregon ACT
North West Oregon ACT
Rogue Valley ACT
South Central Oregon ACT
South East Oregon ACT
South West Oregon ACT
Bend Metro
Corvallis Metro
Eugene-Springfield Metro
Medford-Ashland Metro
Portland Metro
Salem Metro
Columbia County
Hood River County
Washington County
Yamhill County