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Transportation Characteristics and Needs of the Washington Hay Industry: Producers and Processors

SFTA Research Report # 11

November 2004

Transportation Characteristics and Needs of the Washington Hay Industry: Producers and Processors

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by

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SFTA Research Reports:
Background and Purpose

The Strategic Freight Transportation Analysis (SFTA) is a six year, $1.8 million comprehensive research and implementation analysis that will provide information (data and direction) for local, state and national investments and decisions designed to achieve the goal of seamless transportation.

The overall SFTA scope includes the following goals and objectives:

- Improving knowledge about freight corridors.
- Assessing the operations of roadways, rail systems, ports and barges-freight choke points.
- Analyze modal cost structures and competitive mode shares.
- Assess potential economic development opportunities.
- Conduct case studies of public/private transportation costs.
- Evaluate the opportunity for public/private partnerships.

The five specific work tasks identified for SFTA are:

- Work Task 1 - Scoping of Full Project
- Work Task 2 - Statewide Origin and Destination Truck Survey
- Work Task 3 - Shortline Railroad Economic Analysis
- Work Task 4 - Strategic Resources Access Road Network (Critical State and Local Integrated Network)
- Work Task 5 - Adaptive Research Management

For additional information about this report or SFTA, please visit **http://www.sfta.wsu.edu/** or contact Eric Jessup or Ken Casavant at the following address:

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www.sfta.wsu.edu

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The contents of this report reflect the view of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Washington State Department of Transportation. This report does not constitute a standard, specification or regulation.

PREVIOUS SFTA REPORTS NOW AVAILABLE

1. Casavant, Kenneth L. and Eric L. Jessup. "SFTA Full Scope of Work." SFTA Research Report Number 1. December 2002.

2. Clark, Michael L., Eric L. Jessup and Kenneth L. Casavant. "Freight Truck Origin and Destination Study: Methods, Procedures and Data Dictionary." SFTA Research Report Number 2. December 2002.

3. Casavant, Kenneth L. and Eric L. Jessup. "Value of Modal Competition for Transportation of Washington Fresh Fruits and Vegetables." SFTA Research Report Number 3. December 2002.

4. Ripplinger, Toby, Kenneth L. Casavant and Eric L. Jessup. "Transportation Usage of the Washington Wine Industry." SFTA Research Report Number 4. May 2003.

5. Clark, Michael L., Eric L. Jessup and Kenneth L. Casavant. "Dynamics of Wheat and Barley Shipments on Haul Roads to and from Grain Warehouses in Washington State." SFTA Research Report Number 5. September 2003.

6. Casavant, Kenneth L., Eric L. Jessup and Joe Poire. "An Assessment of the Current Situation of the Palouse River and Coulee City Railroad and the Future Role of the Port of Whitman County." SFTA Research Report Number 6. October 2003.

7. Tolliver, Denver, Eric L. Jessup and Kenneth L. Casavant. "New Techniques for Estimating Impacts of Rail Line Abandonment on Highways in Washington." SFTA Research Report Number 7. September 2003.

8. Tolliver, Denver, Eric L. Jessup and Kenneth L. Casavant. "Implications of Rail-Line Abandonment on Shipper Costs in Eastern Washington." SFTA Research Report Number 8. September 2003.

9. Jessup, Eric L. and Kenneth L. Casavant. "Rail Line Investment Alternatives Resulting from Abandonment: A Case Study of Moses Lake, Washington." SFTA Research Report Number 9. July 2003.

10. Peterson, Steve, Eric L. Jessup and Kenneth L. Casavant. "Freight Movements on Washington State Highways: Results of the 2003-2004 Origin and Destination Study." SFTA Research Report Number 10, October 2004.

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SECTION 1: INTRODUCTION

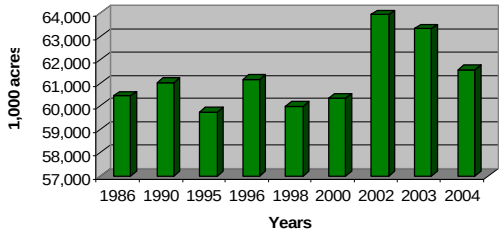
The local and regional hay industry has experienced considerable growth over the past few years generating multiple economic benefits and multiplier effects throughout Washington's economy. Growth in this industry and continued success depend upon access to markets and an efficient multimodal transportation system to bridge production supply sources with destination demand markets. The value of hay to regional producers and the state's economy is substantially diminished without an efficient transportation system. Therefore, this study investigates those transportation characteristics and requirements necessary for efficient movement of hay to domestic and international markets. This is accomplished through the evaluation and analysis of data collected and compiled from a variety of sources, including industry level surveys to hay producers, processors and brokers.

The information contained in this report detail specific attributes regarding when, where, and how hay is moved from production points and through processing facilities in Washington State to domestic and international destination markets. Additional information for this report was compiled using data provided by the United States Department of Agriculture, National Agricultural Statistics Service and personal interviews with industry experts.

SECTION 2: UNITED STATE'S HAY INDUSTRY

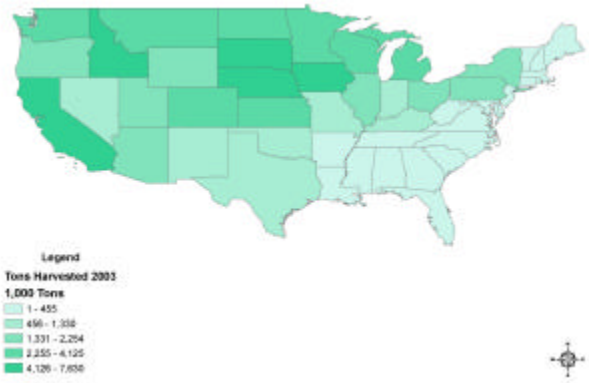
A total of 61.6 million acres throughout the United States was devoted to the production of hay in 2004 as reported by the USDA. There has been considerable fluctuation in the number of acres allocated to U.S. hay production between the years 1986 to 2003 with 2002 having the highest acreage at 63.7 million acres and 1995 experiencing the least acreage with 59.5 million acres (Figure 1). The primary concentration of hay production in the U.S. is in the Northern Plains and the Western states, as illustrated in Figure 2. South Dakota, Nebraska, California and Idaho each produce between 4.1 and 7.6 million tons of hay per year (2003). The Southeast and Northeast U.S. produce the least amount of hay with most states in these regions producing less than 455 thousand tons per year. Hay production in Washington is between 2.2 and 4.1 million tons per year.

Figure 1: United States Hay Acreage



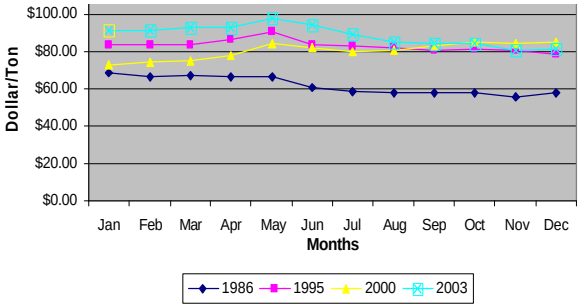
Source: National Agriculture Statistics Service, USDA, 2004, Agriculture Statistics Data Base

Figure 2: Harvested Hay (Alfalfa and Other) by State, 2003



The U.S. price of hay has increased significantly in value over the past 20 years. In 1986, the price of hay ranged from $56 per ton in November to $68.50 per ton in January (Figure 3). In 2003, the price of hay varied from a low of $80.70 per ton in November to a high of $94.60 per ton in May. Hay prices over the last 20 years have consistently peaked during the beginning of harvest, likely illustrating the uncertainty that exists in the market early in the production year and the desire of hay buyers/processors/livestock farms to secure necessary volume.

Figure 3: United States Monthly Hay Prices



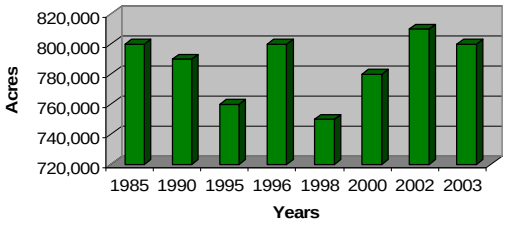
Source: National Agriculture Statistics Service, USDA, 2004, Agriculture Statistics Data Base

SECTION 3: WASHINGTON HAY INDUSTRY

The Washington hay market has had a steady increase in value over the past five years. The value of production for Hay currently ranks sixth in Washington among the Top 40 Agricultural commodities. When looking at Washington's rank in the Nation's agriculture, hay is ranked seventh among all the states. In 2003, the value of production for hay was about $414 million, an increase of 1.5% from 2002. Alfalfa hay totaled over half of Washington's value in hay at about $289 million.

The area of land allocated to hay production within the state of Washington has also followed a similar pattern as the U.S., fluctuating considerably over the past 20 years. For the specific years of 1985 and 2003, the number of acres allocated to hay production was the same at 800 thousand, with fluctuations from 10 to 40 thousand acres between these years. Alfalfa acreage remained the same in the state at 490 thousand acres, while all hay acreage decreased slightly from 810 thousands acres in 2002 to 800 thousand acres in 2003 (Figure 4). Similar to U.S. hay production, 1995 marked the year with the lowest hay acreage and 2002 the year with the largest hay acreage.

Figure 4: Washington Hay Acreage

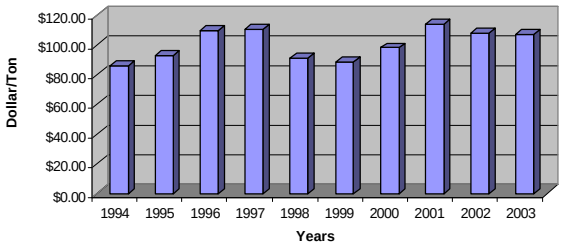


Source: National Agriculture Statistics Service, USDA, 2004, Agriculture Statistics Data Base

Washington hay prices generally peak during the months of May, June, and July. The typical trend for hay prices is to be strong and constant through June and then level off for the remainder of the year. This trend has been consistent from 1996 through 1998 but may not continue into 2004 due to the sharp drop in prices towards the end of the 2003 year. This drop in prices may prompt a change quantity supplied as area producers alter production plans, switching to more profitable crops.

Eighty percent of Washington hay is distributed domestically, whereas the remaining 20 percent is exported. With a large percentage being distributed locally, the need for rail has diminished, whereas, trucking services offer shipments to final destination more quickly and efficiently.

Figure 5: Washington Alfalfa Average Prices



Source: 2004 Hay Market and Export Report, William T. W. Woodward

Washington hay is grown in several different counties, but the heavy concentration of production is predominantly in two central counties. Grant and Franklin counties together total 43 percent of the total tons produced in Washington (Table 3.1). The information in Table 3.1, also shown in Figure 7, represents the total amount of tonnage per county that was produced in Washington in 2003. The collected data clearly illustrates the dominance that Franklin and Grant County has in hay production.

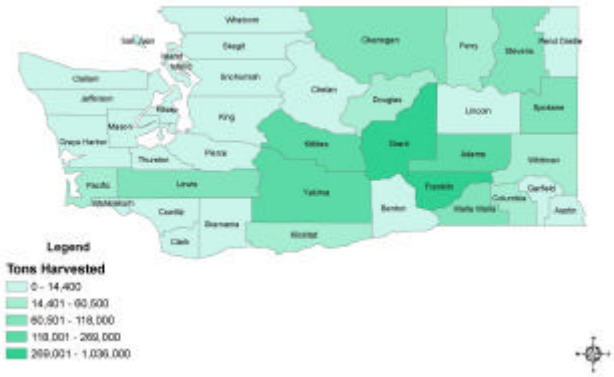
Table 3.1: 2003 Total Annual Hay Tonnages by County

County	Tons
Grant	1,036,000
Franklin	678,000
Adams	269,000
Kittitas	244,000
Yakima	213,000
Walla Walla	118,000
Spokane	115,000
Stevens	100,000
Okanogan	93,000
Lincoln	82,200
Klickitat	60,500
Whitman	38,000
Pend Oreille	26,200
Ferry	21,800
Douglas	18,800
Columbia	17,000
Asotin	14,400
Clallam	13,600
Garfield	6,600
Other counties	437,900
Total	**3,603,000**

Source: National Agricultural Statistic Services, USDA, 2004, Agriculture Statistics Data Base

Figure 6: Acres Allocated to Hay Production, by County, 2003

Figure 7: Total Tons Hay Production, by County, 2003



SECTION 4: INFORMATION SOURCES

In order to obtain more specific and detailed information on Washington Hay movements and transportation characteristics, a statewide survey of all producers and processors was conducted. The Washington State Hay Growers Association provided a list of producers throughout the state. Processing facilities were obtained similarly, based on interviews with area producers and industry experts. Surveys were sent to producers and processors in 18 Washington counties gathering transportation and shipment characteristic information for the statewide hay industry. The questionnaire asked producers and processors for the volume of inbound and outbound shipments, seasonality of shipments, local and state roads being used, vehicle type, and destination of shipments.

As is shown in Table 4.1, the response rate within each of the 18 Washington counties ranged from 0% to 100.0% of the total producers and processor in each county.

Table 4.1: Response Rates by County

	County Totals		
County	**Number Mailed**	**Number of Responses**	**Response Rate**
Okanogan	1	1	100.0%
Pend Oreille	1	1	100.0%
Douglas	1	1	100.0%
Benton	3	3	100.0%
Grays Harbor	1	1	100.0%
Stevens	11	8	72.7%
Spokane	10	7	70.0%
Whatcom	3	2	66.7%
Klickitat	7	4	57.1%
Walla Walla	12	6	50.0%
Franklin	35	17	48.6%
Kittitas	7	3	42.9%
Yakima	14	6	42.9%
Grant	64	26	40.6%
Adams	8	1	12.5%
Lincoln	1	0	0.0%
Whitman	1	0	0.0%
King	1	0	0.0%
Total	**181**	**87**	**48.1%**

The overall response rate of 48.1% provided excellent information regarding hay shipments, including which roads were predominately utilized, volume of shipments on those roads and highways, and primary destinations for hay shipments. King, Lincoln and Whitman counties were the only three counties where no responses were received. However, these counties represent a small fraction of statewide hay production and in those areas where hay production is heavily concentrated the response rate was above 40.0%.

SECTION 5: TRANSPORTATION OF HAY BY PRODUCERS

Seasonality of Hay Shipments

Hay is harvested throughout the summer with the first cutting beginning in May. On average, 31.03% of hay is delivered from producers to various destinations during October-December time period (Table 5.1). This time period coincides with the period prior to the harsh winter months and immediately following the last harvest. Thus, livestock operations are securing anticipated feed requirements and hay producers are less constrained by harvest to ship during this time period. Percentages of hay delivered are lowest during April-June at 19.30%. The low percentage of hay distribution reflects the abundance of lush pasture grass that is used for grazing in the later spring months. The largest variation from the seasonal transportation pattern is the July-September time period. This time period has an average of 10.28% more hay delivered then the April-June time period. The increase of hay distribution from spring to summer months is due to the increase in consumption from cattle. July-September is an important time period for producers to fatten their cattle for slaughter. The cattle are gaining weight by consuming more roughage which increases the distribution during this time period.

The percentage of alfalfa, grass and other hay shipped varies slightly throughout the year. There is a pattern with alfalfa, grass, and other hay having a greater percentage of transportation in the July-September and October-December time period, reflecting the abundance of hay being supplied after the summer's cuttings. The January-March and April-June time periods low percentages reflect the amount of hay availability prior to harvest. Alfalfa shipments show less overall variation during the year then grass and other hay, for all shipment combinations (Table 5.1). Shipments vary between 18.87% in April-June to 29.87% in July-September.

Table 5.1: Annual Hay Distributed by Time Period

	Percent of Hay Distributed			
Time Period	**Alfalfa**	**Grass**	**Other**	**All**
January-March	22.47%	20.53%	17.29%	20.10%
April-June	18.87%	19.87%	19.16%	19.30%
July-September	29.78%	32.33%	26.64%	29.58%
October-December	28.88%	27.28%	36.92%	31.03%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**

There is considerable variation among counties as to when hay is shipped. On average, 15 counties ship the majority of hay in the October-December time period. Franklin and Grant counties have a fairly steady flow of alfalfa hay shipments throughout the year. As for grass and other hay, there are extreme variations throughout the year in these two counties (Table 5.2). Adams, Benton, Douglas and Okanogan counties did not report any shipments of grass or other hay. These counties only reported alfalfa shipments, which show large variation throughout the four seasons. Grant, Kittitas, and Whatcom are the only counties to have reported shipment in all time periods with alfalfa, grass and other hay.

Table 5.2: Seasonality of Hay Shipments from Producers by County

	Percent of Hay Shipped											
	Alfalfa				Grass				Other			
County	Jan-March	April-June	July-Sept	Oct-Dec	Jan-March	April-June	July-Sept	Oct-Dec	Jan-March	April-June	July-Sept	Oct-Dec
Adams	22.00%	11.00%	16.00%	51.00%	-	-	-	-	-	-	-	-
Benton	14.86%	17.14%	49.14%	18.86%	-	-	-	-	-	-	-	-
Douglas	-	20.00%	30.00%	50.00%	-	-	-	-	-	-	-	-
Franklin	28.32%	18.65%	24.23%	28.80%	16.50%	0.50%	66.50%	16.50%	40.00%	-	-	60.00%
Grant	27.19%	22.45%	23.51%	26.86%	25.53%	21.33%	22.60%	30.53%	53.00%	13.00%	19.00%	15.00%
Grays Harbor	-	-	-	-	20.00%	20.00%	50.00%	10.00%	-	-	-	-
Kittitas	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	27.50%	37.50%	12.50%	22.50%
Klickitat	8.75%	11.25%	52.50%	27.50%	30.00%	10.00%	10.00%	50.00%	-	-	-	-
Okanogan	20.00%	-	20.00%	60.00%	-	-	-	-	-	-	-	-
Pend Oreille	-	-	-	-	10.00%	60.00%	20.00%	10.00%	-	-	-	-
Spokane	5.74%	11.57%	58.20%	20.49%	10.53%	27.63%	43.42%	18.42%	-	9.00%	36.00%	55.00%
Stevens	55.67%	10.64%	18.44%	15.25%	12.86%	20.71%	32.14%	34.29%	-	15.00%	50.00%	35.00%
Walla Walla	15.83%	15.00%	27.50%	41.67%	10.00%	12.50%	65.00%	12.50%	-	-	-	-
Whatcom	27.50%	27.50%	22.50%	22.50%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Yakima	31.54%	16.57%	25.95%	25.95%	33.33%	5.00%	33.33%	28.33%	-	-	-	-

Producer Destination for Hay Shipments

Hay is transported from locations throughout the state of Washington to various destinations regionally and internationally, but predominantly shipped to livestock farms within the state. The secondary location of hay shipments is to one of two destinations; to the coast (Port of Seattle and Port of Tacoma) or the Port of Pasco. When reaching these locations, hay is loaded into containers that are then placed on barges or ships for further destinations. These locations are destined for export markets in Asia, predominately Japan. Of the hay shipped from Washington producers, 67.22% stays in Washington and is transported to various livestock operations, 3.74% goes to Oregon, 25.51% is shipped to Foreign Markets, and 3.53% to other locations (Table 5.3).

Table 5.3: Annual Hay Shipments to Destinations from Producers

	Percentage of Each Destination
Destination	**Percent**
Washington	67.22%
Oregon	3.74%
California	-
Foreign Markets	25.51%
Other	3.53%
Total	**100.00%**

The average percentage of hay shipped to various destinations from the 12 Washington counties is reported in Table 5.4. Seven of the 12 counties ship at least 80% of their hay within Washington. The remaining counties still ship a significant amount (40% or higher) within Washington. Douglas, Klickitat, and Okanogan are the only reported counties that do not ship to foreign markets. Oregon had only 3 of the 12 counties shipping hay to them, whereas, California had no reported shipments of hay being transported for a final destination.

Table 5.4: Destination of Hay Shipments by County

	Percent of Hay Shipped				
County	**Washington**	**Oregon**	**California**	**Foreign Markets**	**Other**
Benton	73.33%	-	-	26.67%	-
Douglas	100.00%	-	-	-	-
Franklin	46.00%	7.08%	-	46.92%	-
Grant	60.00%		-	34.93%	5.07%
Klickitat	85.00%	15.00%	-	-	-
Okanogan	100.00%	-	-	-	-
Pend Oreille	40.00%	-	-	60.00%	-
Spokane	86.67%	-	-	6.67%	6.67%
Stevens	95.00%	-	-	2.50%	2.50%
Walla Walla	55.74%	24.59%	-	9.84%	9.84%
Whatcom	85.00%	-	-	7.50%	7.50%
Yakima	80.00%	-	-	20.00%	-
Total	**67.22%**	**3.74%**	**-**	**25.51%**	**3.53%**

Producer's Modal Choice for Hay Shipments

Hay is shipped from farms to market destinations via truck and truck-barge. Hay producers and processors were asked to identify the percentage of their hay shipped by each mode currently available from their farm/facility. The percentage of each hay type that is shipped via transportation mode to various destinations is presented in Tables 5.6 and 5.7.

Truck to Livestock Farms has a large percentage, representing over 60% for alfalfa and grass hay being shipped (Table 5.6). The lower percentages of 4.73% and 5.27% for Truck to River Barge were for hay being shipped to the Port of Pasco. The hay that is transported to the Port of Pasco is most commonly shipped to processing facilities and then loaded onto river barges to be further processed and shipped to markets abroad. The percentage of river barge usage has dropped significantly due to the increase in rail usage. This survey was conducted before September 2004, when containers were shipped almost exclusively via barge on the Columbia River to the Port of Portland. Subsequent to this date there has been an enormous increase in usage of rail. A relatively large percentage of "other" hay is shipped via the "other" transportation mode, representing 40.36% (Table 5.6). This high percentage represents other variety hay being transported via truck to processing facilities. Major Hay processing facilities locations are in the central region of the state. The location of these facilities increases accessibility to producers all over the state, create short haul shipment opportunities within the state and therefore reduce transportation costs.

Table 5.6: Annual Hay Shipments via Transportation Mode from Producers

	Percentage Shipped Via Transportation Mode			
Transportation Modes	**Alfalfa**	**Grass**	**Other**	**All**
Truck to Livestock Farms	65.87%	61.04%	32.74%	53.22%
Truck to River Barge	4.73%	5.27%	-	3.33%
Truck to Ocean Port	12.23%	18.55%	26.91%	19.23%
Rail to River Barge	-	-	-	-
Rail to Ocean Port	-	-	-	-
Other	17.16%	15.14%	40.36%	24.22%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**

There is some variation in modal choice among counties (Table 5.7). All counties primarily ship alfalfa using Truck to Livestock Farms except Benton County. This could be because Benton County borders the Columbia River, where access to river barge is more feasible. Trucks are more likely to be used for alfalfa shipments than for grass and other because alfalfa is more often shipped directly to a final market. In 11 counties, shipping by truck to the Livestock Farms is the predominant mode of shipment with a range of 0% to 100% shipment by this mode. Okanogan and Walla Walla counties strictly ship their hay 100% via Truck to Livestock Farms, not utilizing river barge or ocean ports. The least used mode was Truck to River Barge for all counties and all hay types. Rail to river barge and rail to ocean port were not reported by any of the survey respondents.

Table 5.7: Hay Shipments via Transportation Mode by County

	Percent of Hay Shipped																	
	Alfalfa						Grass						Other					
County	Truck to livestock farms	Truck to river barge	Truck to ocean port	Rail to river barge	Rail to ocean port	Other	Truck to livestock farms	Truck to river barge	Truck to ocean port	Rail to river barge	Rail to ocean port	Other	Truck to livestock farms	Truck to river barge	Truck to ocean port	Rail to river barge	Rail to ocean port	Other
Adams	80.00%	-	-	-	-	20.00%	-	-	-	-	-	-	-	-	-	-	-	-
Benton	-	40.00%	10.00%	-	-	50.00%	-	-	-	-	-	-	-	-	-	-	-	-
Douglas	30.00%	-	-	-	-	70.00%	-	-	-	-	-	-	-	-	-	-	-	-
Franklin	47.86%	20.32%	18.18%	-	-	13.64%	1.00%	49.00%	50.00%	-	-	-	-	-	100.00%	-	-	-
Grant	54.00%	-	21.20%	-	-	24.80%	47.48%	6.47%	35.97%	-	-	10.07%	-	-	100.00%	-	-	-
Klickitat	100.00%	-	-	-	-	-	60.00%	-	-	-	-	40.00%	-	-	-	-	-	-
Okanogan	100.00%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spokane	92.86%	-	-	-	-	7.14%	80.00%	-	-	-	-	20.00%	-	-	-	-	-	100.00%
Stevens	68.33%	-	1.11%	-	-	30.56%	59.29%	1.43%	-	-	-	39.29%	-	-	-	-	-	100.00%
Walla Walla	100.00%	-	-	-	-	-	100.00%	-	-	-	-	-	-	-	-	-	-	-
Whatcom	100.00%	-	-	-	-	-	100.00%	-	-	-	-	-	10.00%	-	-	-	-	90.00%
Yakima	84.62%	-	-	-	-	15.38%	100.00%	-	-	-	-	-	70.00%	-	-	-	-	30.00%

SECTION 6: TRANSPORTATION OF HAY BY PROCESSORS

Truck Type for Inbound and Outbound Hay Movements

There are many different vehicle types used to transport hay to its various locations either domestically or for export. Semi-Flatbed had the highest percent of usage for both inbound at 49.22% and 59.73% for outbound movements. The category for other type of transportation totaled at somewhat high percentage of inbound movement at 22.43%. The most commonly used other type of transportation to move hay was a pickup truck. The secondary mode of transportation to the Semi-Flatbed is the Single Axle Flatbed. Semi-Container and Semi-Van were not used for inbound hay movement.

Table 6.1: Truck Type for Inbound and Outbound Hay Movements

	Percentage of Movement	
Type of Transportation	**Inbound**	**Outbound**
Single Axle Flatbed	22.35%	15.73%
Semi-Flatbed	49.22%	59.73%
Semi-Container	-	6.39%
Semi-Van	-	6.92%
Goose-neck Flatbed Trailer	6.01%	1.35%
Other	22.43%	9.88%
Total	**100.00%**	**100.00%**

Hay is transported in several different product forms, including five main forms from the farm to final destination. These five forms consist of small square bales, large 3-string bales, 1 ton bales, round bales, and 3'x4'x8' bales. There are three main destination points, in which hay is shipped from producers including; processing facilities, livestock farms and ocean ports (export).

Hay which is shipped into processing facilities may remain in the form in which it was received or may be further processed to be shipped for export or destinations within Washington State. The processing facilities are equipped with technology to ensure consistent quality control. When the hay arrives to the facility, it is tagged with information that includes the name of the producer, location of which field the hay came from, cutting and test measurements. This information is entered, and maintained in a database system to preserve the identity of the producer and optimize processing and shipping to destination markets.

Once hay reaches processing facilities it is processed into three main forms; compressed, double compressed, and cubed hay. Single compressed bales (both 2 and 3 string) are compressed once and sorted according to quality before loading. Double compressed bales are used most commonly for over-sea shipments to conserve space. Double compressed bales can either be compressed and shipped whole or cut in half for easier handling. As the field bales are passing through the compaction machine, they are subject to rigorous quality screening. A finished whole double

compressed bale weighs between 95 to 135lbs. Cubed hay is a process of coarsely chopping alfalfa hay that has been partially or completely field dried and then formed into a cube at 35 lbs per cubic foot. Cubes are also screened heavily before going into containers to assure clean product for delivery to the customer. There are several advantages to feeding cubed hay at livestock operations, including less waste, higher quality and greater feed intake as compared to loose hay.

Table 6.2: Annual Hay Percentage of Forms and Average Weight

	Percentage of Hay	
Form	**Percent**	**Weight (lbs)**
Cubed	0.95%	35lbs per cubic ft.
Compressed	5.75%	130
Double Compressed	1.25%	130
Small Bales	46.86%	90
Large (3 string bales)	18.34%	130
1 ton Bales	20.90%	1715
Round Bales	1.31%	775
Other	4.64%	1395
Total	**100.00%**	

The majority of hay is shipped from processors as small square bales (46.86%), followed by 1 ton bales (20.9%) (Table 6.2). Compressed and double compressed hay collectively only accounts for 7% of outbound shipments and cubed hay represent less than 1%. Generally, the end use and final destination of hay determines product form and the heavy proportion of square bales illustrates the demand for hay at regional livestock operations.

Seasonality of Hay Shipments by Processors

Hay processors have a comparatively consistent percentage of hay that is received and distributed throughout the year. One of the most evident patterns for other hay transportation is the even distribution of shipments at 25.00% received and distributed throughout the year (Table 6.3 and 6.4). Shipments of alfalfa and grass hay vary in the four seasons on the receiving end, but then remain even once distributed. The percentage of alfalfa and grass hay distributed during January-March is consistent at 20.53%, but then increases to 33.87% in the July-September time period (Table 6.4). Overall, there is more variation during the time when processors receive the hay rather then distribute it, which is indicative of the natural seasonal influences of hay production.

Table 6.3: Annual Hay Received by Time-Period

	Percent of Hay Received			
Time Period	**Alfalfa**	**Grass**	**Other**	**All**
January-March	15.00%	17.50%	25.00%	19.17%
April-June	21.67%	22.50%	25.00%	23.06%
July-September	41.67%	37.50%	25.00%	34.72%
October-December	21.67%	22.50%	25.00%	23.06%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**

On average, hay which is received at processors is the lowest during the January-March time period at 19.17%, while the high was 34.72% in the July-September time period (Table 6.3). The distribution of all hay had a high of 30.91% in the July-September time period, with all other seasons remaining fairly consistent (Table 6.4). Processing facilities operate on a yearly base, not seasonal. The percentage of hay that is received at a processing facility experiences more of a variation than the processed hay that is distributed from these facilities. Hay shipment receipts coincide with harvest, whereas the hay that is distributed reflects the stable demand that is requested throughout the year.

Table 6.4: Annual Hay Shipments from Processors by Time-Period

	Percent of Hay Distributed			
Time Period	**Alfalfa**	**Grass**	**Other**	**All**
January-March	20.53%	20.53%	25.00%	22.02%
April-June	21.67%	21.67%	25.00%	22.78%
July-September	33.87%	33.87%	25.00%	30.91%
October-December	23.87%	23.87%	25.00%	24.25%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Processor Destinations for Hay Shipments

Hay exports are an important market to Washington hay and forage producers. Alfalfa hay and cubes, timothy, orchard grass, oat hay, ryegrass and fescue straw are all forage products exported from Washington to the Pacific Rim. The demand from Japan and Asia for forage products is increasing in West Coast markets, especially in Washington. Alfalfa cubes and bales are highly demanded by markets in the Pacific Rim. Forage products are shipped to Japan and the Pacific Rim from Washington in 40 foot cargo containers. Depending on the product shipped, each container will hold approximately 20-28 metric tons. The savings in transportation costs have helped Washington increase its market share of cube exports to Japan and Korea. About 90% of the alfalfa cubes shipped to Japan is for dairy cows and 10% for beef cows. Dairy cows also take about 60% of baled hays, and the balance would be split evenly between beef cows and horses. A recent trend has been the shipment of bagged cubes to Japan in containers. Smaller bags are generally about 30-40 Kg and larger bags are 400-550 kg. The smaller bags are stacked on a pallet and wrapped with plastic.

The marketability of the hay, especially in the foreign markets, depends on the quality of the hay. The quality of the forage is dependent on several factors including: management of the soil, nutrient composition, seeding rates, the timing of cutting, raking and baling, and the storage of the product. One of the most important factors affecting quality is the state of maturity at the time of cutting. Young, vegetative forage is higher in protein and energy than older flowering material. Management experience is required to find the optimal harvesting time, to maximize both quality and quantity of forage stands.

Foreign Markets are Washington processor's largest market destination. Foreign markets absorb 91.33% of the market for processors (Table 6.5) Washington has the remaining 8.67% of hay shipped to domestic destinations. Processors ship to either ocean port facilities or Columbia River terminals that are accessible to ocean ports for further shipments. Processors either ship processed hay by truck, rail or barge to further market destinations.

Table 6.5: Annual Hay Shipments to Destinations from Processors

	Percentage of Each Destination
Destination	**Percent**
Washington	8.67%
Oregon	-
California	-
Foreign Markets	91.33%
Other	-
Total	**100.00%**

Processor's Modal Choice for Hay Shipments

After the hay has been transported to a processing facility a large percentage is shipped for outbound movement by truck. After it has been processed hay is predominately destined for foreign markets via Truck to Ocean Ports. Other hay is the only hay that is shipped 100% Truck to Ocean Ports. Alfalfa and grass both come in close with a high over 60% (Table 6.6). Table 6.6 clearly represents that minimal hay is shipped by rail. It is not a feasible alternative for hay producers and processors.

Table 6.6: Annual Hay Shipments Via Transportation Mode from Processors

	Percent of Hay Shipped			
Destination	**Alfalfa**	**Grass**	**Other**	**All**
Truck to Livestock Farms	12.05%	15.87%	-	9.31%
Truck to River Barge	24.10%	3.17%	-	9.09%
Truck to Ocean Port	62.65%	80.95%	100.00%	81.20%
Rail to River Barge	-	-	-	-
Rail to Ocean Port	1.20%	-	-	0.40%
Other	-	-	-	-
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**

SECTION 7: PRIMARY STATE HIGHWAYS FOR HAY TRANSPORTATION

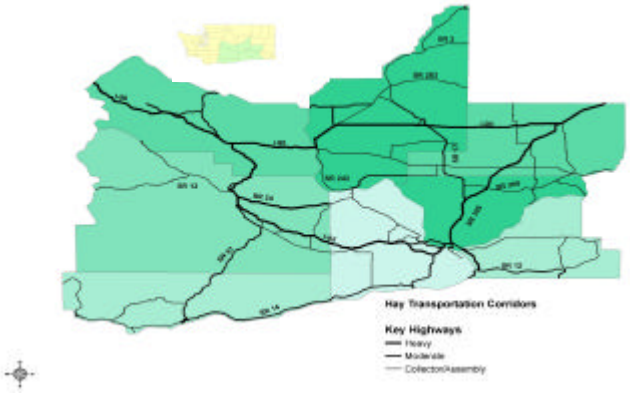
Producer to Processor

When examining the transportation of hay there are three separate, identifiable segments that should be examined. There is the raw product to processor, raw product to livestock farm and finished product from processors to final markets. It is beneficial for hay producers that want to sell their hay internationally to first process the hay for more efficient packaging (either compressed or cubed hay), typically performed at separate processing facilities owned by hay marketing firms or hay brokers. This is primarily due to the high costs of owning and operating a processing unit. Also, the processing facility will then find international buyers for the hay.

Hay harvest starts in late spring and runs through the end of the summer. During this time of year the hay industry related traffic peaks for processors, while producer's shipments remain fairly steady throughout the year. The harvest period involves several tons of hay being transported via truck across the state to processor or final markets.

There are three major routes that are used for movements of hay in the industry; I-90, I-82 and SR 395 (Figure 8). These three major routes run through the two largest hay producing counties (Franklin and Grant) and provide both north-south and east-west access to markets within and beyond the state. A number of major hay processing facilities are located in these two counties making these routes critical to the hay industry.

Figure 8: Key Highways Supporting Hay Producer to Processor Shipments



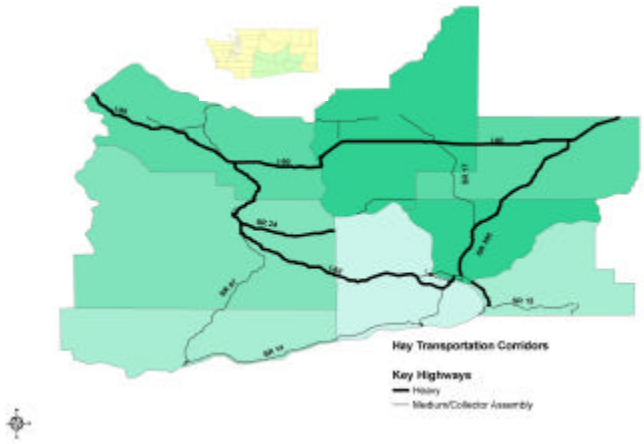
SR-12, SR-14, SR-24 and SR-97 also generate significant truck traffic that intersects with I-90, I-82 and SR 395 for further shipment. These state roads are located in the central southern part of Washington which houses the largest hay production in the state as illustrated in Figure 8.

Processor to Final Destination

Key highways that support hay shipments from major hay processing facilities to final markets include; I-90, I-82, SR 24 and SR 395 (Figure 9). These highways support hay movements from hay processors to final destinations. I-90 and SR 395 are surrounded by the two leading hay producing counties in the state. 43 percent of the total tons of hay produced in Washington are supplied by Franklin and Grant County and travel on these highways.

After the hay has been processed, it is transported by truck to the Port of Seattle or the Port of Tacoma for further shipment. I-90 is a major corridor to large markets domestically and also internationally. Processed hay can also be barged from the Port of Pasco down the Columbia River for further shipments.

Figure 9: Key Highways Supporting Hay Shipments from Processor to Final Market



SECTION 8: IMPLICATIONS FOR PUBLIC POLICY

The hay industry contributes $414 million to Washington's economy and ranks in the top six agriculture commodities by value for the state. However, without an efficient and accessible transportation system for producers/processors, the economic success of this industry is lessened. Evaluation of the transportation characteristics of the hay industry is additionally enlightening given likely policy changes that may impact freight movements and recent changes at the Port of Portland regarding ocean container services.

Each year a significant amount of state and county highways throughout the state are closed due to freeze/thaw conditions that limit the structural integrity of the highway infrastructure. As a result, shippers are forced to find alternative routes that may increase shipping costs or limit market accessibility. One persistent highway closure is the I-90 Snoqualmie Pass that is the main east-west corridor for the state and is often closed for long periods during the winter months due to snow. The data and analysis provide in this study will help identify the extent to which shipments of hay are impacted.

Another recent issue impacting hay shipments involves the reduction in container services at the Port of Portland. As a result, the Port of Seattle and Tacoma have experienced a considerable increase in hay shipments received by rail since September of 2004. Prior to this date, containers filled with hay were shipped almost exclusively via barge on the Columbia River to the Port of Portland. After reaching Portland, the containers were then loaded onto one of three steamship lines: Hyundai, K-Line, or Hanjin. After September 2004, Hanjin is the only carrier that calls on the Port of Portland. K-Line and Hyundai now required producers to haul their containers to the Port of Tacoma and Seattle by either truck or rail. As a result, barge shipments of containers out of the Port of Pasco decreased 75%, while rail shipments to the Port of Tacoma and Seattle grew from 40 containers per month to 600 containers per month. The Port of Pasco's rail facilities are sufficient for lighter volumes which they formerly experienced, but not for the heavier volumes now needed.

Information provided identifying the modes of transportation utilized within the hay industry and routes most commonly used to distribute shipments provides significant insight into the type of infrastructure development required to handle freight traffic within Washington State. Data related to the volume of hay shipments, seasonality of shipments, movements from producer/processor to destinations can help the state plan for current and future transportation infrastructure needs.

Adequate rail accessibility and efficiency is essential to support the increase in container shipments that are destined to various markets within the state of Washington. The Port of Pasco has an Inter-Modal Hub Development project in the works at the Big Pasco Industrial Center. The Inter-Modal Hub Development (IHD) is a project that will develop rail and road facilities at the Port of Pasco into an inter-modal hub for the movement of agricultural products to their Asian Markets. The IHD project planning began in October 2004 and is planned to be completed by the summer of

2006. The project will provide important economic benefits to the local area and statewide region:

- Reduce the volume of trucks on state highways.
- Fosters competitive freight prices for agricultural producers shipping to international markets
- Encourages container delivery to northwest seaports by providing backhaul for empty containers
- Maintains and improves existing access to Class I railroad for regional freight.
- Investment is directed to existing inter-modal site already served by BNSF and barge lines.

Further analysis needs to be done to determine the different types of expenditure that are associated with transportation costs. Recommendations to investigate the type of problems the hay industry encounter will help to effectively evaluate the transportation characteristics and requirements necessary for efficient movement to domestic and international markets.

SECTION 9: SUMMARY

The hay industry in Washington relies heavily on truck movements, significantly in the central southern part of the state. Truck transportation is the dominant mode of transportation utilized by processors to receive raw product from fields as well as to ship products to final markets. Maintaining an efficient highway freight transportation system is essential to the economic success of Washington's hay industry.

Hay movements in Washington consist of three destination points; processing facilities, livestock farms and ocean ports. Eighty percent of Washington hay is destributed domestically. The largest amount of transported hay within the state is shipped via truck to livestock farms. The remaining twenty percent of hay is exported to forgein markets, specifically the Pacific Rim. Efficient truck connections to western Washington ocean ports, as well as, Tri Cities' ports are key to international market success for the hay industry.

There is year-round demand for hay, which requires an efficient and multimodal transportation infrastructure supporting hay movements. These hay movements include the five forms in which hay is shipped: small square bales, large 3-string bales, 1 ton bales, round bales, and 3'x4'x8'. The Semi-Flatbed is the dominate vehicle type for hay shipments throughout the state.

The seasonlity of hay shipments into processing facilities is more varied and less differentiated than shipments from processing faclities, illustrating the natural climatic factors influcing hay production and the product transformation occuring at processing facilities to satisfy export demand markets.

Those highways supporting hay movements from the producer tend to be more local and county highways whereas shipments from hay processors are primarily state and interstate highways.

APPENDIX

WASHINGTON STATE UNIVERSITY
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Marketing and Transportation of Washington Hay

Thank you for your participation in this study. If at any time should you require assistance completing this form, or have any other questions or concerns about this project feel free to contact Stephanie Meenach Graduate Research Assistant at (509) 335-8189. Thank you once again for your assistance.

Please list your name, the name of your business and the address of your farm(s).

Name _____

Company _____

Address _____

Transportation of Hay ***FROM*** this Facility (farm):

1) For a typical year, please estimate the annual volume of hay shipped **from** this facility (farm). _____Tons per year.

2) Do you have rail service at this location: ____Yes ____No

If you **do not** have local rail, please give the **NAME** of the nearest rail facility that you use (or would use if you used local rail) and the general route to travel between your facility and that rail facility:
NAME: _____

GENERAL ROUTE USED (indicate state and county roads used in %):

	Road Name	Percent
a)		_____%
b)		_____%
c)		_____%
d)		_____%
e)		_____%
	Total	**100 %**

3) Please indicate the **NAME** of the RIVER PORT FACILITY that you use (or would use if you go to the river):
NAME: _____

4) Please identify the destination and percent of shipments leaving this facility.

Check the following that apply: Percent

_____% Washington
_____% Oregon
_____% California
_____% Foreign markets
_____% Other (please specify)
100 %Total

Transportation of Hay ***FROM*** this Facility (farm):

5) What are the different forms and an estimate of the weight in each form that is shipped **from** your facility?

	Form	Weight
a) Cubed	_____%	_____lbs
b) Compressed	_____%	_____lbs
c) Small bales	_____%	_____lbs
d) Large (3 string bales)	_____%	_____lbs
e) 1 ton bales	_____%	_____lbs
f) Round bales	_____%	_____lbs
g) Other (please specify)	_____%	_____ lbs

6) Please estimate the typical percentage of hay shipped **from** this facility for each month in a typical year.

	Alfalfa	**Grass**	**Other**
a) January – March	_____%	_____%	_____%
b) April - June	_____%	_____%	_____%
c) July - September	_____%	_____%	_____%
d) October - December	_____%	_____%	_____%
Total	**100 %**	**100 %**	**100 %**

7) Please provide the truck type for inbound and outbound hay movements.

	Inbound	Outbound
a) Single Axle Flatbed	_____%	_____%
b) Semi-Flatbed	_____%	_____%
c) Semi-Container	_____%	_____%
d) Goose-neck Flat bed Trailer	_____%	_____%
e) Other (please specify)	_____%	_____%
Total	**100 %**	**100 %**

Transportation of Hay ***FROM*** this Facility (farm):

8) Please estimate the approximate percentage (average over 3 years) of Washington HAY shipped **from** this location via each one of the following transportation modes.

	Alfalfa Average Percent Shipped	**Grass** Average Percent Shipped	**Other** Average Percent Shipped
Truck to livestock farms	_____%	_____%	_____%
Truck to River Barge	_____%	_____%	_____%
Truck to Ocean Port	_____%	_____%	_____%
Rail to River Barge	_____%	_____%	_____%
Rail to Ocean Port	_____%	_____%	_____%
Other (please specify)	_____%	_____%	_____%
TOTAL	**100 %**	**100 %**	**100 %**

9) Please estimate the percentages of Washington local and state roads that are utilized most frequently to transport hay products **from** this facility (e.g. I-82, US395, and Wheeler Road).

	Road Name	Percent
a)		_____%
b)		_____%
c)		_____%
d)		_____%
e)		_____%
Total		**100 %**

Transportation of Hay ***FROM*** this Facility (farm):

10) Most shippers of Washington hay seem to prefer shipping by truck rather than rail. In your opinion, what improvements to rail transportation must be made in order to make it a viable alternative?

_____
_____
_____

11) Please list the location of any Processing (cubing, compressing, etc.) operations that you utilize that have not been included in this survey.

Plant 1_____
_____
Plant 2_____
_____
Plant 3_____

12) A new technology is Round-up Ready hay (GMO); Do you currently produce or handle this type of hay? Yes____ No____

Comments:

_____
_____
_____
_____

Transportation of Hay ***FROM*** this Facility (farm):

13) How well do you believe Round-up Ready hay will be received in the international markets?

_____
_____
_____
_____

14) Would you like a copy of the results of this survey? Yes___ No___

THANK YOU for taking the time to complete this survey!

All information will be kept completely confidential.