

# Strategic Freight Transportation Analysis

## Transportation and Marketing Needs for the Washington State Livestock Industry

SFTA Research Report # 12

November 2004

# **Transportation and Marketing Needs for the Washington State Livestock Industry**

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## **SFTA Research Report #12**

November 2004

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## **SFTA Research Reports: Background and Purpose**

The Strategic Freight Transportation Analysis (SFTA) is a six year 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/](http://www.sfta.wsu.edu) or contact Eric Jessup or Ken Casavant at the following address:

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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.
11. Meenach, Stephanie, Eric L. Jessup and Kenneth L. Casavant. Transportation Characteristics and Needs of the Washington Hay Industry: Producers and Processors. SFTA Research Report Number 11, December 2004.

## TABLE OF CONTENTS

I. INTRODUCTION .....	1
II. DATA AND INFORMATION.....	1
III. WASHINGTON'S LIVESTOCK INDUSTRY .....	2
IV. TRANSPORTATION OF LIVESTOCK - PRODUCERS .....	5
Seasonality of Livestock Shipments .....	7
Destination of Livestock Shipments.....	9
V. TRANSPORTATION OF LIVESTOCK - PROCESSORS.....	9
Seasonality of Livestock Shipments .....	10
Destination of Packaged Meat.....	10
Primary Washington Highways Supporting Livestock Shipments .....	11
VI. SUMMARY / CONCLUSIONS .....	12
APPENDIX.....	14
REFERENCES .....	16

## TABLE OF TABLES

Table 1.1: Survey Response Rates, by County .....	2
Table 1.2: Destination of Outbound Livestock Shipments from Producers.....	6
Table 1.3: Distance of Inbound Livestock Shipments to Producers.....	6
Table 2.1: Percent of Inbound Livestock Shipments to Producers, by Time Period .....	7
Table 2.2: Inbound Livestock Shipments to Producers, by Time Period and County .....	7
Table 2.3: Percent of Outbound Livestock Shipments from Producers, by Time Period. ....	8
Table 2.4: Outbound Livestock Shipments from Producers, by Time-Period and County.....	8
Table 2.5: Destination of Livestock Shipments from Producers. ....	9
Table 3.1: Percent of Inbound Livestock Shipments to Processors, by Time-Period. ....	10
Table 3.2: Percent of Outbound Livestock Shipments from Processors, by Time-Period. ....	10
Table 3.3: Destination of Packaged Meat from Washington Processors.....	11

## TABLE OF FIGURES

Figure 1.1: Washington State Cattle Production, by County (2003). ....	3
Figure 1.2: Number of Cattle Slaughtered Per Month, 1999-2003. ....	4
Figure 1.3: Washington State Cattle Production, by County (2003) and Location of Regional Cattle Markets.....	5
Figure 1.4: Key Washington State Highways Supporting Livestock Shipments. ....	12
Figure A.1: Possum belly trailer with punched sides. ....	14
Figure A.2: Typical configurations for possum belly trailers.....	14
Figure A.3: Straight livestock trailer with slatted sides.....	14
Figure A.4: Gooseneck trailer with slatted sides.....	15
Figure A.5: Pup trailers hooded in tandem (double). ....	15
Figure A.6: Straight truck with slatted sides.....	15

## **I. INTRODUCTION**

Growth in the livestock industry depends on access to markets and an efficient multimodal transportation system. Therefore, this study investigates those transportation characteristics and requirements necessary for the efficient movement of livestock to domestic markets. This is accomplished through the evaluation and analysis of data collected and compiled from a variety of sources, including industry level surveys to licensed livestock producers, processors and brokers. The information provided in this report details when, where and how livestock are moved from production to destination markets and the transportation infrastructure supporting these shipments.

## **II. DATA AND INFORMATION**

In order to obtain more specific and detailed information on Washington livestock movements and transportation characteristics, a statewide survey was conducted of all producers, processors and brokers. The Washington State Department of Agriculture Licensed Livestock Dealers provided a list of producers and brokers throughout the state (WSDA). Processing facilities were obtained similarly, based on interviews with area producers and industry experts. Surveys were sent to producers, processors and brokers in 20 Washington counties gathering transportation and shipment characteristic information for the statewide livestock industry. The questionnaire asked producers, processors and brokers 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 1.1, the response rate within each of the 20 Washington counties ranged from 0% to 100% of the total producers and processor in each county. The overall response rate of 42.4% provided great information regarding livestock shipments, including which roads were predominately utilized, volume of shipments on those roads and highways, and primary destinations for livestock shipments. Cowlitz, King and Walla Walla counties were the only three counties where no responses were received. Grant and Yakima counties are the leading counties in livestock production and they both received over a 50% response rate. The two leading processing facilities in Washington had a 100.0% response rate. Their responses to the survey provided an excellent source of information of when, where and how much processed meat is transported in Washington.

**Table 1.1: Survey Response Rates, by County.**

County	County Totals		
	Number Mailed	Number of Responses	Response Rate
Adams	1	1	100.0%
Asotin	1	1	100.0%
Clallam	1	1	100.0%
Klickitat	1	1	100.0%
Snohomish	1	1	100.0%
Whitman	1	1	100.0%
Kittitas	3	2	66.7%
Franklin	2	1	50.0%
Grant	4	2	50.0%
Pierce	2	1	50.0%
Thurston	2	1	50.0%
Spokane	5	2	40.0%
Whatcom	10	4	40.0%
Yakima	8	3	37.5%
Skagit	3	1	33.3%
Lewis	4	1	25.0%
Okanogan	4	1	25.0%
Cowlitz	2	0	0.0%
King	1	0	0.0%
Walla Walla	3	0	0.0%
<b>Total</b>	<b>59</b>	<b>25</b>	<b>42.4%</b>

### III. WASHINGTON'S LIVESTOCK INDUSTRY

The transportation of livestock is an important component of Washington's livestock industry and an integral requirement for future growth and prosperity. The cattle industry comprises a significant proportion of the livestock being produced, processed and transported throughout Washington. Cattle production currently ranks fifth among the Top 40 Agricultural Commodities of Washington in 2002. Cattle and calf operations total 13.6 percent of the market value for Agricultural sales in Washington, behind Fruits, Nuts, and Berries (WASS). Given the economic significance of this industry to the state's agriculture industry, this study focuses on those transportation and shipment characteristics for both *producers* and *processors*.

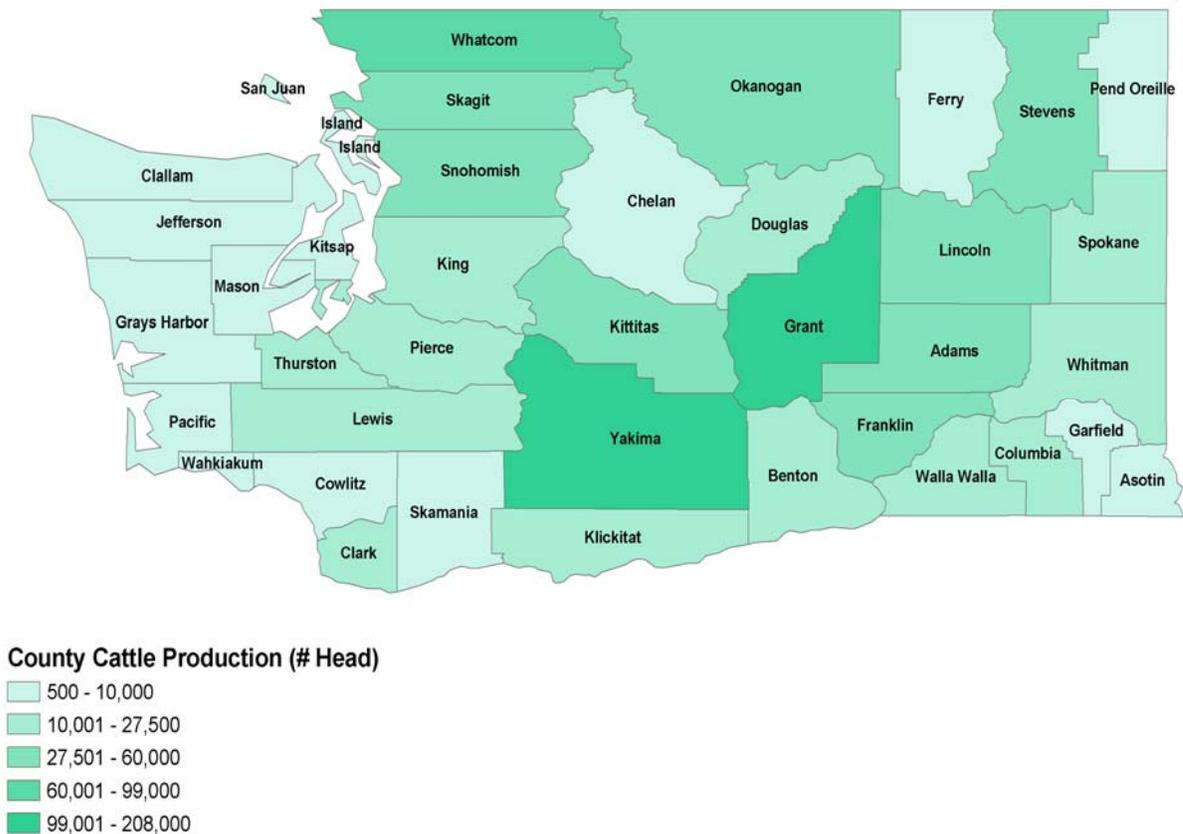
In the state of Washington there are currently 15,000 cattle operations. Cattle and calves are brought to market from all regions of the state to be slaughtered or raised for slaughter; though the majority of the cattle originate from large operations that are centrally located. Washington State has seen a slight decrease in total cattle production since 2000, though the number of cattle operations has stayed the same.

The Columbia Basin region represents the heaviest concentration of cattle production in Washington State. There are many factors contributing to the heavy concentration in this geographic area. The climate plays a key role with maintaining and raising premium

cattle. The Columbia Basin has the mildest weather in comparison to the rest of the state. It receives the least amount of rain, thereby reducing the amount of disease and sickness; hence the low production in the coastal counties. The accessibility to feed is a major contributing factor in the Columbia Basin due to the fact it is also the leading area in hay production. The leading county in the state for cattle production is Yakima County with a total production in 2003 of 208,000 head of cattle (Figure 1.1). The neighboring county, Grant, was the second largest producing county with 167,000 head in 2003 (WASS).

The second leading area for cattle production in Washington is in the Northwestern part of the state. Whatcom County's production is comprised of dairy cattle. The dairy cattle that are taken to feed lots and processed are the culls. Cull dairy cattle would be one that is picked out from others, especially one that is rejected because of an inferior quality. The lowest concentration of cattle production is in the furthest western counties along the coast and also the eastern counties of Washington.

**Figure 1.1: Washington State Cattle Production, by County (2003).**

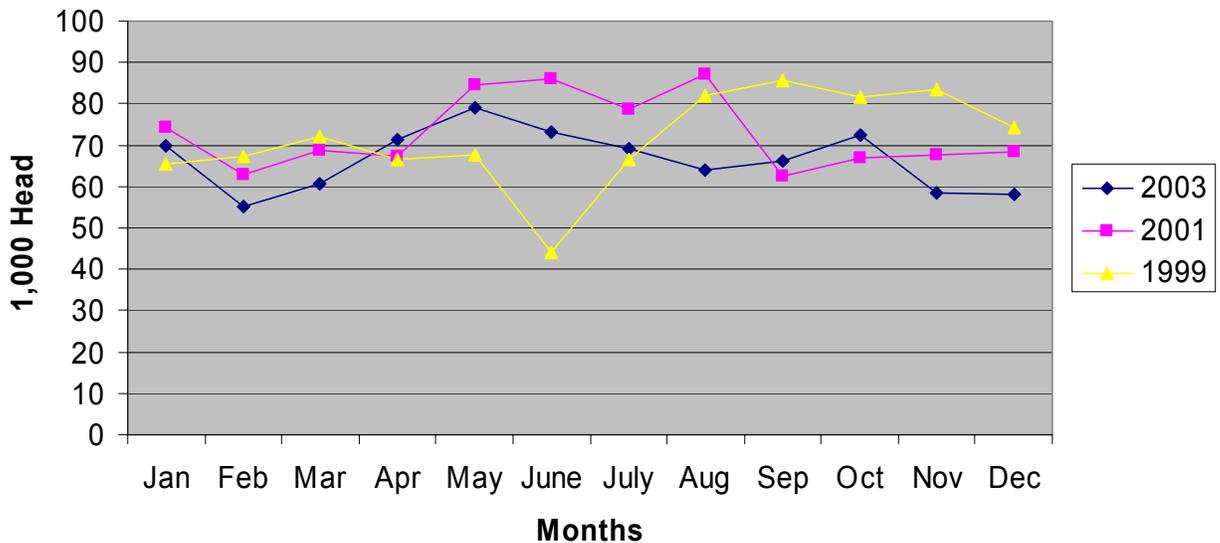


The average live-weight of cattle at the time of slaughter is 1,231 pounds, down 20 pounds from a year ago. The total cumulative live-weight of cattle slaughtered in Washington State for 2003 was slightly less than 978 million pounds (WASS). In 2003,

there was 797,300 head of cattle slaughtered, a 7 percent decrease from the previous year. This number includes slaughter in federally inspected and in other slaughter plants, but excludes animals slaughtered on farms.

Since 1999 the number of cattle slaughtered each month in Washington State has experienced slight seasonal fluctuations, as illustrated in Figure 1.2. The number of animals slaughtered each month for years 2001 and 2003 exhibit very similar patterns with February being the lowest volume month and the period between May and August representing the largest volume periods. However, the seasonal pattern for 1999 does not follow the prior patterns established in 2001 and 2003. The month of June represented the yearly low for 1999, nearly 20,000 fewer animals slaughtered during this month as compared to other periods through the year. Overall, the winter months tend to experience the lowest slaughter number with higher volume during the months of May through August.

**Figure 1.2: Number of Cattle Slaughtered Per Month, 1999-2003.**

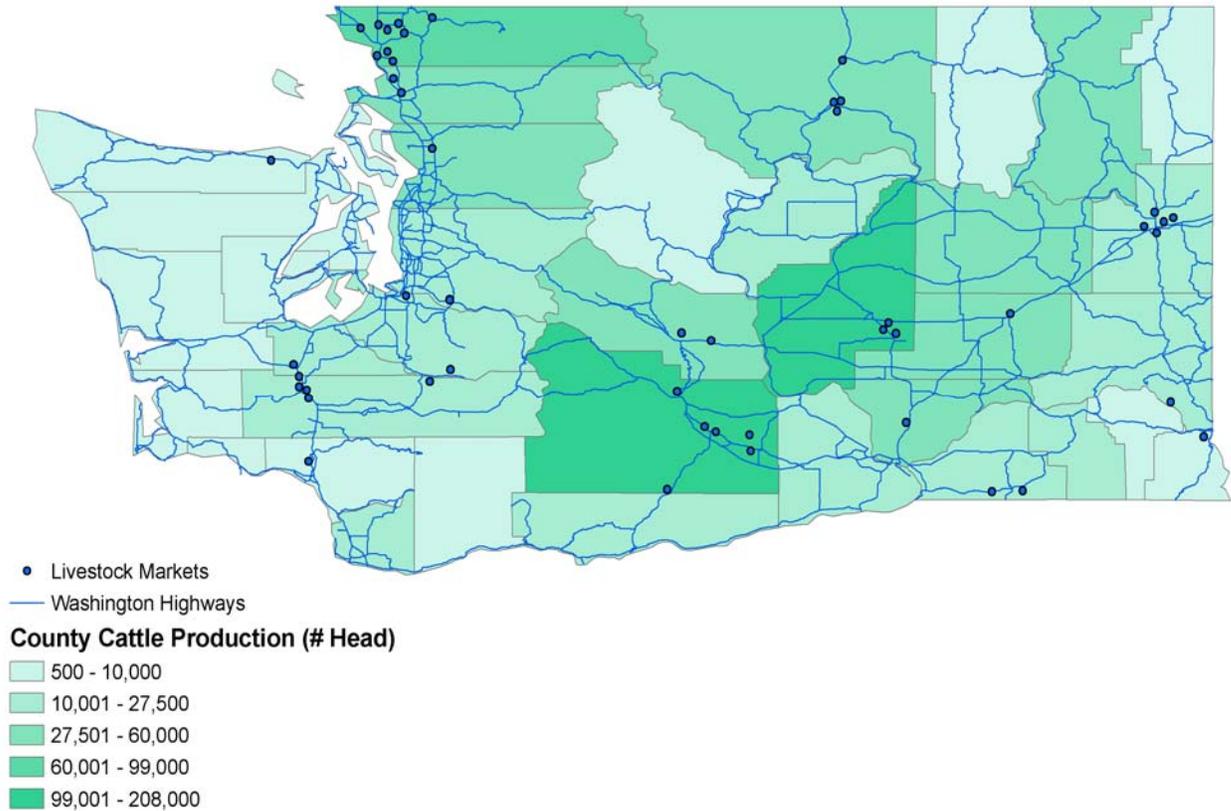


Washington Agricultural Statistics Service, 2004, USDA

Washington cattle production is highly concentrated in two areas; Yakima and Grant County. These two counties are responsible for a large majority of the state's production. As mentioned previously, these areas are also the leaders in hay production. The abundance of feed makes it more accessible and less expensive. The weather is also a prominent factor with the heavy concentration of livestock production.

The Bellingham area or Whatcom County produces a significant amount of cattle, specifically for the dairy industry. The area also encompasses several livestock markets. There are numerous livestock markets spread throughout the state with some concentration in certain areas. These areas include; Centralia, Spokane and Toppenish. The locations of Washington's livestock markets are shown in Figure 1.3.

**Figure 1.3: Washington State Cattle Production, by County (2003) and Location of Regional Cattle Markets.**



#### **IV. TRANSPORTATION OF LIVESTOCK - PRODUCERS**

The advancement and evolution of livestock transportation systems in the U.S. has significantly contributed to the current structure of the livestock industry. In the beginning, river transport was the main means of accessing destination markets. Transportation technology then evolved to rail and over time to the service advantages of truck. During the 1950's with the development of the Interstate road system livestock producers and processors began to have more flexibility marketing their products and significant structural changes throughout the industry began to occur. Before the development of the interstate road system animals were shipped into major cities to be processed, leading to large, regional, centralized livestock markets that relied predominantly on rail for outbound movements. Now boxed meats can be shipped anywhere in the country via trucks and in the case of specialized products can go via plane to various locations in the world.

Livestock are shipped in many different vehicle types (see Figures A.1 thru A.6 in Appendix A). Trucks ranging from the possum belly trailer, straight trailer, gooseneck trailer, pup trailer, or straight truck are a small collection of common utilized vehicles and

are depicted in Appendix A. Additionally, farmers and producers have bumper hitch and “gooseneck” trailers of varying sizes that may be used to haul live animals.

The most popular vehicle of the commercial livestock industry is the semi or “Pot” trailer. Pot trailers are 40 feet long by 8.5 feet wide. The multiple decks make it possible to legally haul up to 45,000 pounds of livestock. These trailers can haul 37, 1200 pound slaughter steers or 90, 500 pound feeder calves (Cobb).

Livestock are shipped to three main locations in Washington once leaving producer operations; feed lots, other farms, and slaughter facilities (Table 1.2). A feedlot primarily engages in the fattening of beef cattle in a confined area for a period of at least 30 days, for their own account, contract or fee basis. Feedlot operations are an integral part of the breeding, raising, or grazing of beef cattle. Establishments which feed beef cattle for periods of less than 30 days are generally in connection with their transport. After the cattle are fattened they are then transported from the feedlot either back to the farm or to a slaughter facility.

**Table 1.2: Destination of Outbound Livestock Shipments from Producers.**

<b>Location</b>	<b>Percentage at Each Location</b>	
	<b>Percent</b>	
Feed Lots	25.50%	
Other Farms	30.62%	
Slaughter	25.44%	
Other	18.44%	
<b>Total</b>	<b>100.00%</b>	

Livestock arriving at feedlot and producer operations are transported from all over the state of Washington. A significant volume of the livestock are received from locations more than 50 miles from the destination location (61%) (Table 1.3). Over 23% of animals are transported over 100 miles to reach the production location, thus capturing locations within Washington, Idaho, Montana and Oregon. However, the majority of live cattle are transported less the 75 miles to reach production and feedlot operations (68%).

**Table 1.3: distance of Inbound Livestock Shipments to Producers.**

<b>Area</b>	<b>Percentage in Miles Radius</b>	
	<b>Percent</b>	
Less than 25 mile radius	24.05%	
25 to 50 mile radius	15.00%	
50 to 75 mile radius	29.11%	
75 to 100 mile radius	8.29%	
Greater than 100 miles	23.54%	
<b>Total</b>	<b>100.00%</b>	

## Seasonality of Livestock Shipments

There is relatively little variation in the seasonality of livestock shipments arriving at producer and feedlot operations throughout the state. The heaviest period for inbound shipments occurs during October-December (29%), followed by the April-June period (26%), as illustrated in Table 2.1. These two peak periods of inbound shipments to producer operations likely follows the biological pattern of spring and fall calving, as calves born in one period become large enough to move into back-grounding and feedlot operations during the next season. The July-September time period represents the season with the fewest inbound shipments at 22%.

**Table 2.1: Percent of Inbound Livestock Shipments to Producers, by Time Period.**

Time Period	Livestock Received	
	Percent	
January-March	23.07%	
April-June	26.29%	
July-September	21.64%	
October-December	29.00%	
<b>Total</b>	<b>100.00%</b>	

Drilling down further into the seasonality of shipments, the proportion of inbound livestock shipments into producer operations varies by county and time period. For the January-March time period, as few as 5% of shipments from Asotin County are transported whereas 50% of livestock from Kittitas are shipped during this period (Table 2.2). The opposite holds during the April-June season as only 10% of inbound producer shipments for Kittitas occur while 40% occurs for Asotin. Many of the differences in shipment percentages which occur between counties are due to the type of operations receiving inbound shipments within each county. Those counties which have a high concentration of feedlots relative to cow-calf operations have different seasonal inbound shipment patterns.

**Table 2.2: Inbound Livestock Shipments to Producers, by Time Period and County.**

County	Percent of Livestock Shipped			
	January-March	April-June	July-September	October-December
<b>Asotin</b>	5.00%	40.00%	5.00%	50.00%
<b>Grant</b>	30.00%	20.00%	10.00%	40.00%
<b>Kittitas</b>	50.00%	10.00%	10.00%	30.00%
<b>Klickitat</b>	30.00%	30.00%	30.00%	10.00%
<b>Lewis</b>	20.00%	25.00%	30.00%	25.00%
<b>Pierce</b>	25.00%	25.00%	25.00%	25.00%
<b>Snohomish</b>	20.00%	30.00%	30.00%	20.00%
<b>Spokane</b>	19.67%	23.00%	25.67%	31.67%
<b>Whatcom</b>	20.00%	21.67%	26.67%	31.67%
<b>Yakima</b>	24.50%	39.50%	15.50%	20.50%

The outbound shipments from producer operations display a slightly different pattern as compared to inbound livestock shipments, as displayed in Table 2.3. The October-December season still represents the period with the largest proportion of shipments (similar to inbound shipments), but by a large magnitude (34%). Unlike inbound shipments where two distinct seasons dominated the volume of shipments, outbound shipments are concentrated in one period (October-December), with the remaining periods receiving approximately equal proportion of shipments (21% or 22%). This difference is probably indicative of the seasonal fluctuations in feed availability and the repositioning of animals heading into the winter months.

**Table 2.3: Percent of Outbound Livestock Shipments from Producers, by Time Period.**

<b>Time Period</b>	<b>Livestock Distributed</b>
	<b>Percent</b>
January-March	22.20%
April-June	21.07%
July-September	22.40%
October-December	34.33%
<b>Total</b>	<b>100.00%</b>

When comparing the distribution of outbound shipments from each county by season, there appears to be little variation in the magnitude of shipments (Table 2.4). On average, the October-December time period possesses the largest proportion of livestock shipments in Washington. The widest fluctuations occur in Asotin County, ranging from 5% in January-March all the way to 50% during October-December. Pierce County was the only county to have a consistent flow of 25% of livestock shipped in each time period. The other 9 counties showed some moderate variation throughout the year.

**Table 2.4: Outbound Livestock Shipments from Producers, by Time Period and County.**

<b>County</b>	<b>Percent of Livestock Shipped</b>			
	<b>January-March</b>	<b>April-June</b>	<b>July-September</b>	<b>October-December</b>
<b>Asotin</b>	5.00%	40.00%	5.00%	50.00%
<b>Grant</b>	30.00%	20.00%	10.00%	40.00%
<b>Kittitas</b>	50.00%	10.00%	10.00%	30.00%
<b>Klickitat</b>	30.00%	30.00%	30.00%	10.00%
<b>Lewis</b>	20.00%	25.00%	30.00%	25.00%
<b>Pierce</b>	25.00%	25.00%	25.00%	25.00%
<b>Snohomish</b>	20.00%	30.00%	30.00%	20.00%
<b>Spokane</b>	19.67%	23.00%	25.67%	31.67%
<b>Whatcom</b>	17.50%	20.00%	27.50%	35.00%
<b>Yakima</b>	24.50%	39.50%	15.50%	20.50%

## Destination of Livestock Shipments

The destination/location of outbound livestock shipments from Washington producers is heavily concentrated within the state, accounting for over 78% of outbound shipments (Table 2.5). While these shipments include all types of shipments (farm to farm, farm to feedlot, farm to processor, feedlot to processor, etc), the majority of shipments leaving producer operations are destined for other producer locations, feedlots, or processors (Table 1.1). And the majority of these types of facilities and operations are located within close proximity of other producer locations in the state. The neighboring state with the second largest proportion of shipments is Idaho (15%), followed by Oregon (6%) and California (1%). The logistic and transportation efficiencies associated with moving live animals compared to packaged meat also heavily influences production and shipping patterns. This largely explains why processing and packaging facilities are located within relative close proximity of production.

**Table 2.5: Destination of Livestock Shipments from Producers.**

Destination	Percentage of Destination
	Percent
Washington	78.16%
Idaho	15.17%
Oregon	5.46%
California	1.21%
<b>Total</b>	<b>100.00%</b>

## V. TRANSPORTATION OF LIVESTOCK - PROCESSORS

Slaughter facilities are located throughout the state, but generally concentrated in specific geographic areas consistent with livestock production patterns. Facility sizes can range from the small town butcher who processes as few as one hundred head per year to commercial operations that handle 500,000 head per year. Custom slaughtering establishments must be licensed by Washington State Department of Agriculture in order to engage in the business of slaughtering animals for food consumption.

The volume/weight density of livestock that are received at processing facilities differs from that which leaves these facilities as a result of the processing that occurs. When livestock are received at the processing facility they are totaled in liveweight. However, after the process of slaughtering, making choice meat cuts, packaging and boxing; the distribution of processed meat is weighed and shipped in tons. The average daily head count of livestock that is received at the surveyed processing facilities is 1,025 (Table 3.1). The standard liveweight of cattle that are ready to be slaughtered is 1,200 lbs.

After the meat is packaged and boxed it is loaded into refrigerated trucks and shipped to various locations throughout the United States. There are 8 to 10 different sizes of boxed meat packages ranging from 20 to 70 lbs. The reported number of trucks leaving processing facilities is from 35 to 85 daily, with a payload capacity of roughly 41,000 lbs of processed meat per vehicle.

## Seasonality of Livestock Shipments

The percentage of livestock received at processing facilities peaks during the July-September time period (30%) while all other seasons are relatively equal in distribution of seasonal shipments (Table 3.1). The higher percentage during this time period reflects both the biological life cycle of cattle and the seasonal marketing of animals by producers prior to high feed demands during the winter months.

**Table 3.1: Percent of Inbound Livestock Shipments to Processors, by Time Period.**

Time Period	Livestock Received
	Percent
January-March	23.30%
April-June	23.30%
July-September	30.00%
October-December	23.30%
<b>Total</b>	<b>100.00%</b>
<b>Total Average Head Per Day</b>	<b>1,025</b>

It is interesting that while the seasonal distribution of inbound and outbound livestock shipments varies for producers and also for processors on inbound shipments, the outbound processed meat products from processors is equally distributed amongst all seasons (Table 3.2). These results may be misleading and a function of the survey design that lumped time periods into three month intervals. Traditionally, there is a peak of meat demand during the holiday season, but this pattern may only be evident if the distribution of shipments is evaluated on a monthly instead of quarterly basis.

**Table 3.2: Percent of Outbound Livestock Shipments from Processors, by Time Period.**

Time Period	Livestock Distributed
	Percent
January-March	25.00%
April-June	25.00%
July-September	25.00%
October-December	25.00%
<b>Total</b>	<b>100.00%</b>

## Destination of Packaged Meat

Outbound shipments of packaged meat from processing facilities in the state are heavily concentrated within the Pacific Northwest (58%), as provided in Table 3.3. Thus, the majority of outbound shipments of processed meat are supplying the demand for meat in restaurants and retail outlets throughout the Northwest. The region with the next largest

proportion of packaged meat shipments is the Southwestern U.S., accounting for 31% of all outbound shipments from Washington processors. The Northeast and Southeast U.S. markets represent only 5% of shipments, with no shipments heading to the Midwest/Great Plains. This is likely the result of the dominance of beef production and processing in the Midwestern/Great Plains states and the ability of production in this region to satisfy the regional demand from restaurants and retail outlets. Export shipments to Canada and international markets were also reported to be zero. However, this was due to the unfortunate timing of the survey shortly after the Bovine Spongiform Encephalopathy (BSE) outbreak in central Washington and the subsequent ban on Washington beef exports.

**Table 3.3: Destination of Packaged Meat from Washington Processors.**

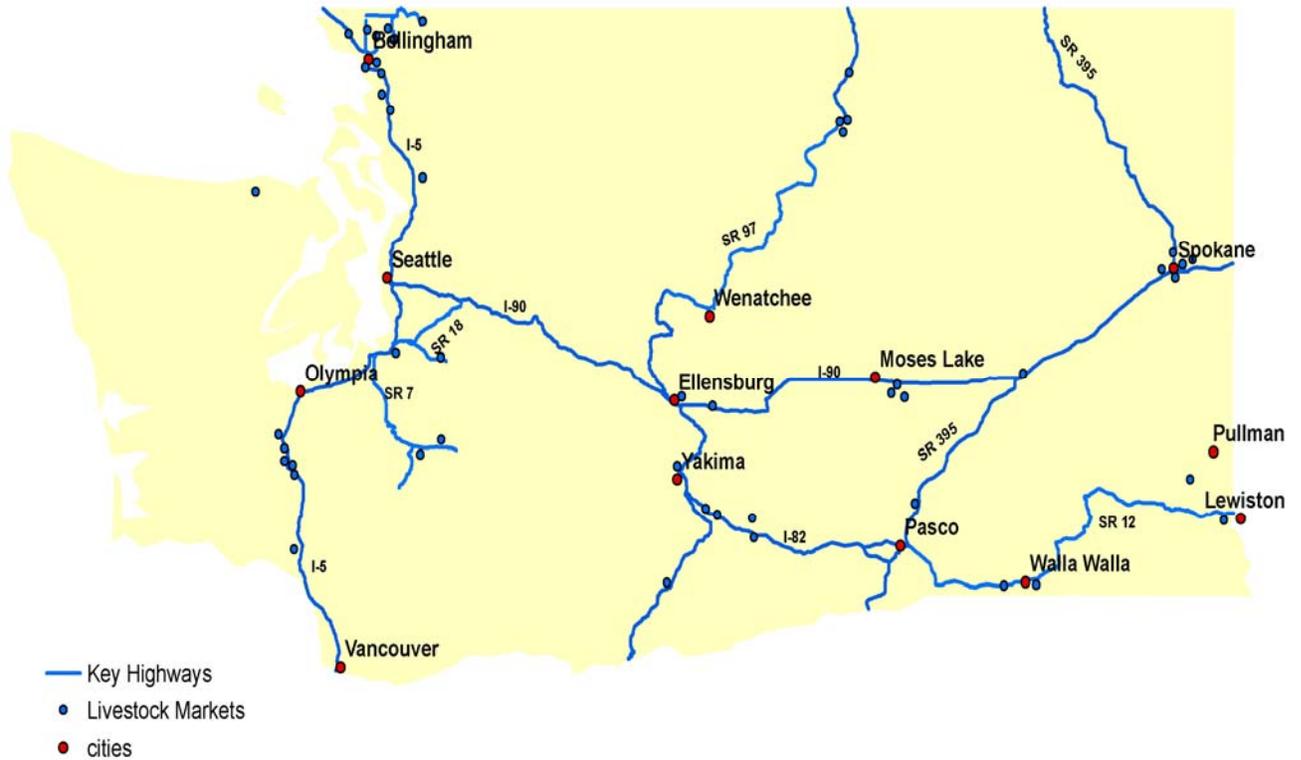
<b>Location</b>	<b>Percent Shipped</b>
	<b>Percent</b>
Northeastern US	5.00%
Southeastern US	5.00%
Midwest/Great Plains	-
Southwest US	31.00%
Pacific Northwest	58.50%
Mexico	0.50%
Canada	-
Ocean Port/Export	-
<b>Total</b>	<b>100.00%</b>

### **Primary Washington Highways Supporting Livestock Shipments**

Several key roads and highways throughout the state provide critical transportation access for both livestock producers and processors, as illustrated in Figure 1.4. These highways are those listed as most critical for livestock shipments by survey respondents and illustrated both the collection/assembly occurring from area producers and the distribution activities from processors. Those highways most critical in the central Washington regions include SR12, US97, US395, I-90 and I-82, supporting key livestock markets in the Tri-Cities region, Yakima, Moses Lake and Ellensburg.

Those highways and roads critical for western Washington livestock shipments include I-5, I-90, SR7, and SR18 providing accessibility to Oregon and California markets. I-5 and I-82 support the 5.46% (Table 2.5) of livestock shipments that are destined for Oregon. Majority of the 15.17% of Idaho bound shipments are traveled on I-90 and SR 12.

**Figure 1.4: Key Washington State Highways Supporting Livestock Shipments.**



## VI. SUMMARY / CONCLUSIONS

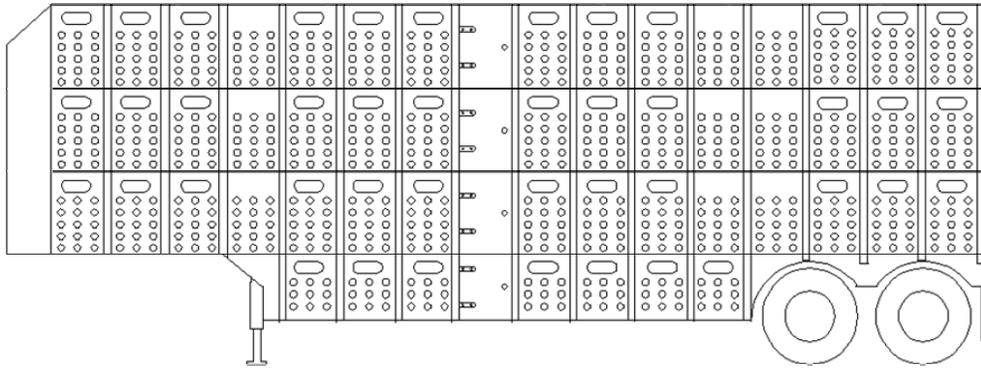
The movement of livestock has advanced significantly in the past 50 years. From river movements to trucking, the interstate road system was the turning point to more efficient movement. Before the growth of the interstate road system livestock was transported into major cities to be processed. Today, slaughter plants are located near the supply of animals. Due to this advancement, livestock can now be processed and boxed to be shipped country wide via truck. Currently, 100 percent of livestock is transported via truck within the United States.

Movements associated with the livestock industry can be broken down into three distinct categories; livestock to processing facilities, livestock to feedlots and livestock to farms. Each category presents distinctive traffic flows; heavy overlap of routes does exist. I-5, I-82 and I-90 support the majority of livestock shipments for all three categories. Many livestock farms and processing facilities lie on these routes, creating traffic on these major interstates.

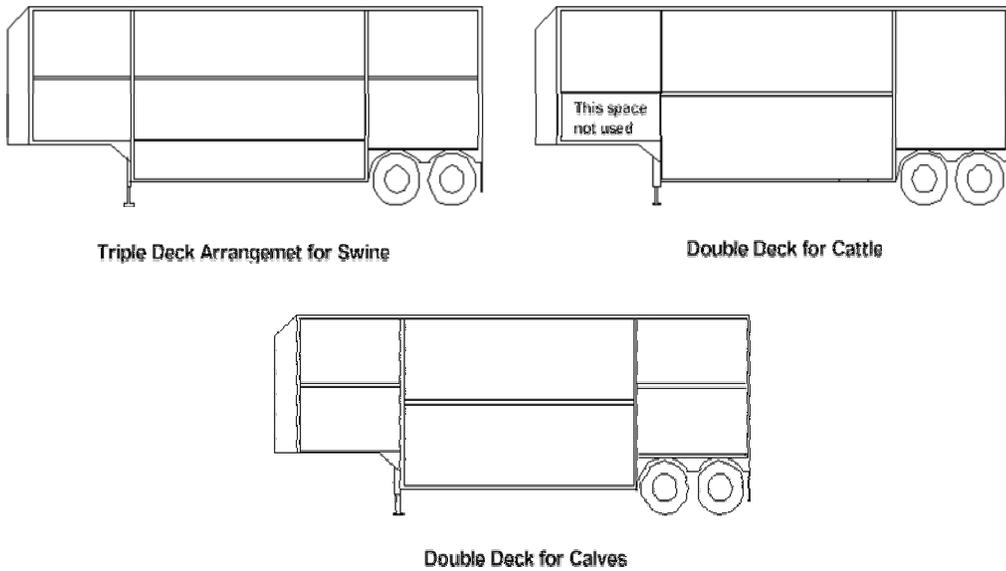
The livestock industry does not see any fluctuation in seasonality for demand. Processing facilities distribute processed meats consistently at 25% throughout the year. A large majority of livestock and processed meats are shipped within the Pacific Northwest. A significant amount of livestock are transported from areas located more than 50 miles from its final destination. Continued production and business within the livestock industry will remain to cause traffic over existing routes.

## APPENDIX

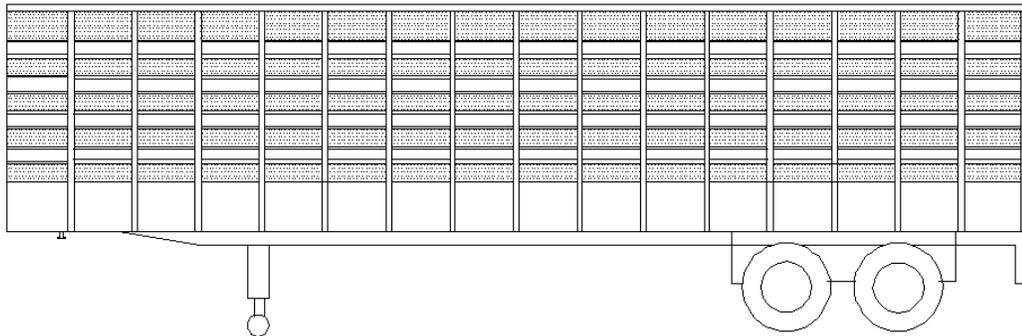
**Figure A.1: Possum belly trailer with punched sides.**



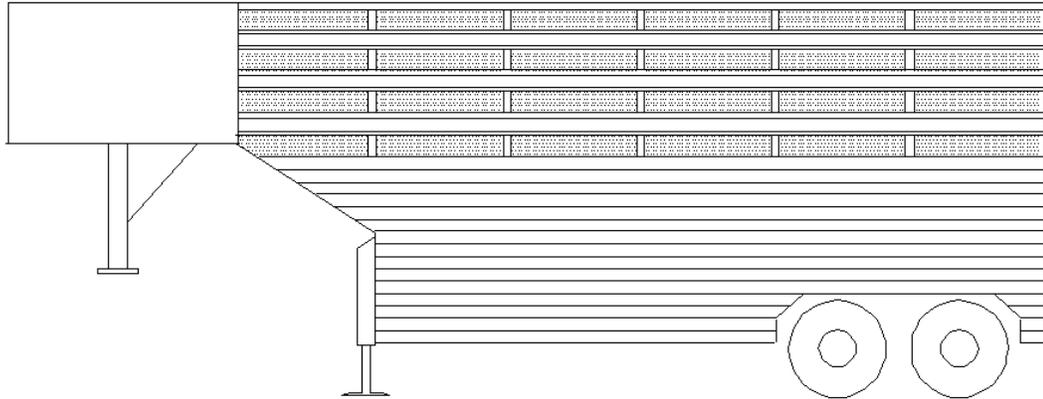
**Figure A.2: Typical configurations for possum belly trailers.**



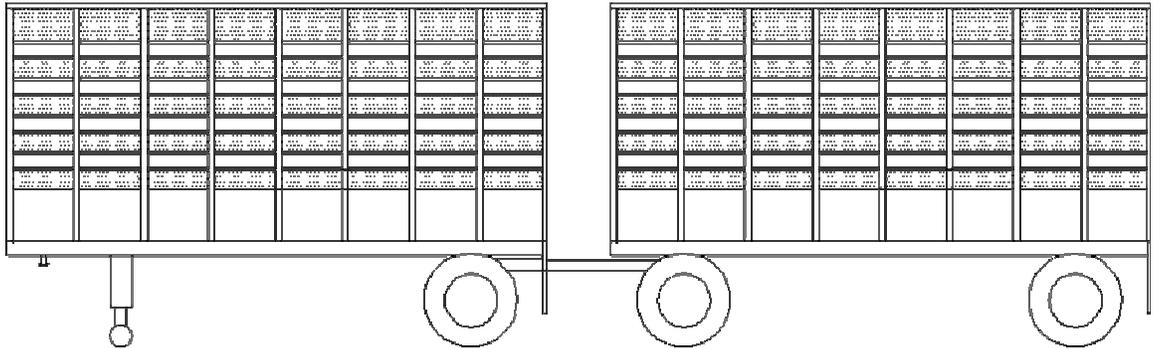
**Figure A.3: Straight livestock trailer with slatted sides.**



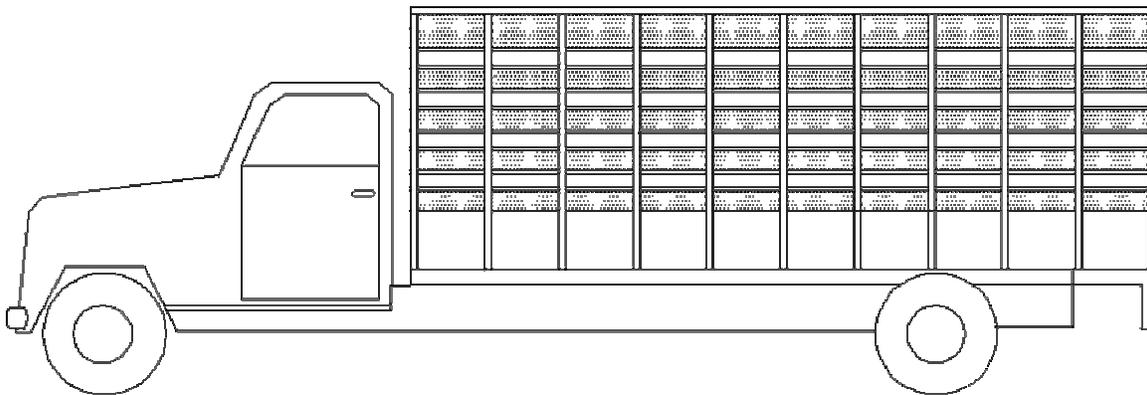
**Figure A.4: Gooseneck trailer with slatted sides.**



**Figure A.5: Pup trailers hooded in tandem (double).**



**Figure A.6: Straight truck with slatted sides.**



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