

Empirical Estimation of Attributes Influencing Warehouse/DC Operations

Washington State Warehouse Industry

by

Eric Jessup, Quinton Pike and Ken Casavant

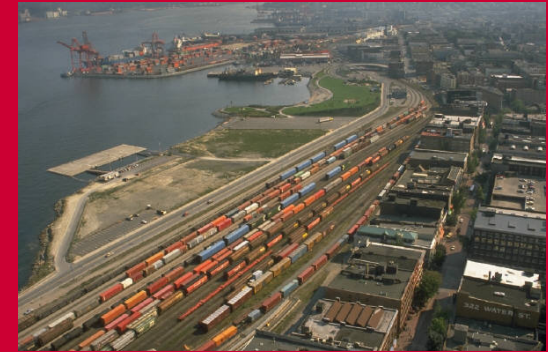
*Assistant Professor, Graduate Student and Professor
School of Economic Sciences
Washington State University*

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....Part of a Larger Study

- **Collect data / information related to Warehouse / Distribution Center Operations, Functions and Transportation Characteristics**
- **Describe/Evaluate these Characteristics**
 - SFTA Research Report #13 at
 - http://www.sfta.wsu.edu/research/reports/research_pr.htm
- **Empirically Investigate What Factors Influence Operations**

Data Collection

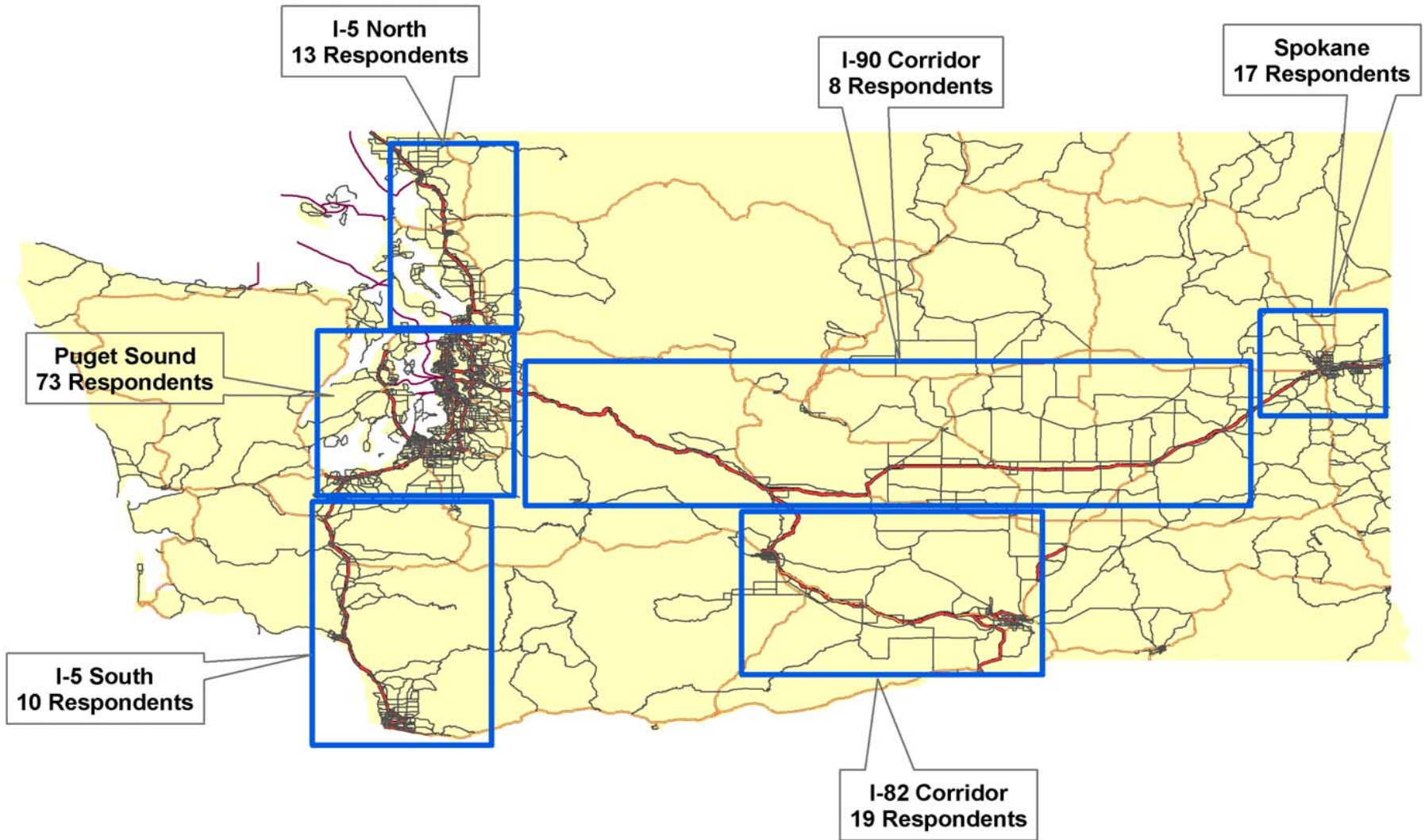
- **Mail Survey on a total of 973 Warehouse/Dist. Ctr. located throughout WA.**
- **Survey method consisted of a 4 step process in 3 sets of mailings.**
 1. **1st Mailer**
 2. **Postcard Follow up**
 3. **2nd Mailer**
 4. **Phone Call Follow up**



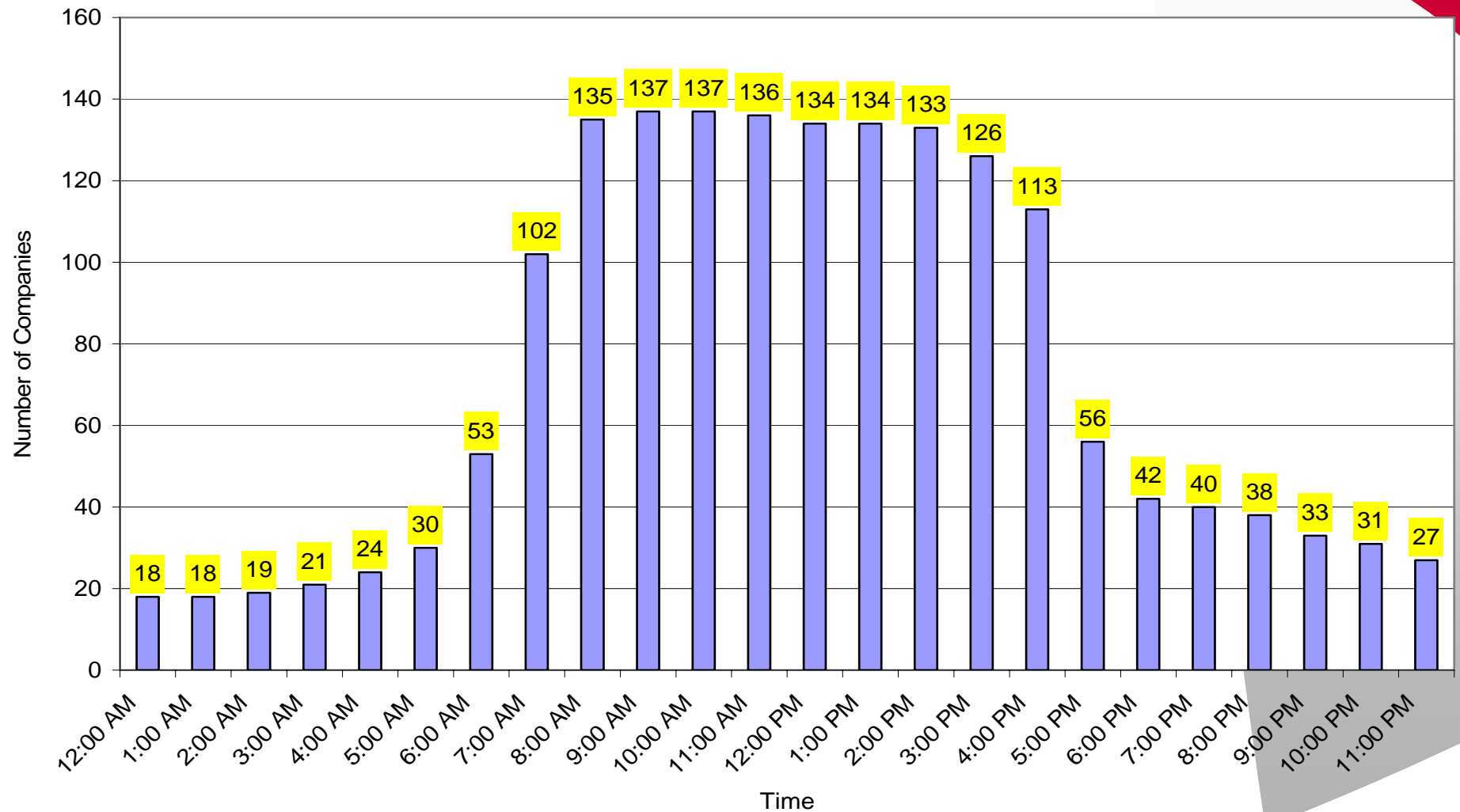
Survey Response

- **Total Mailers Sent (973)**
- **Mailers Returned to Sender (97)**
- **Mailers Responded-No (115)**
- **Mailers Responded-Yes (140)**

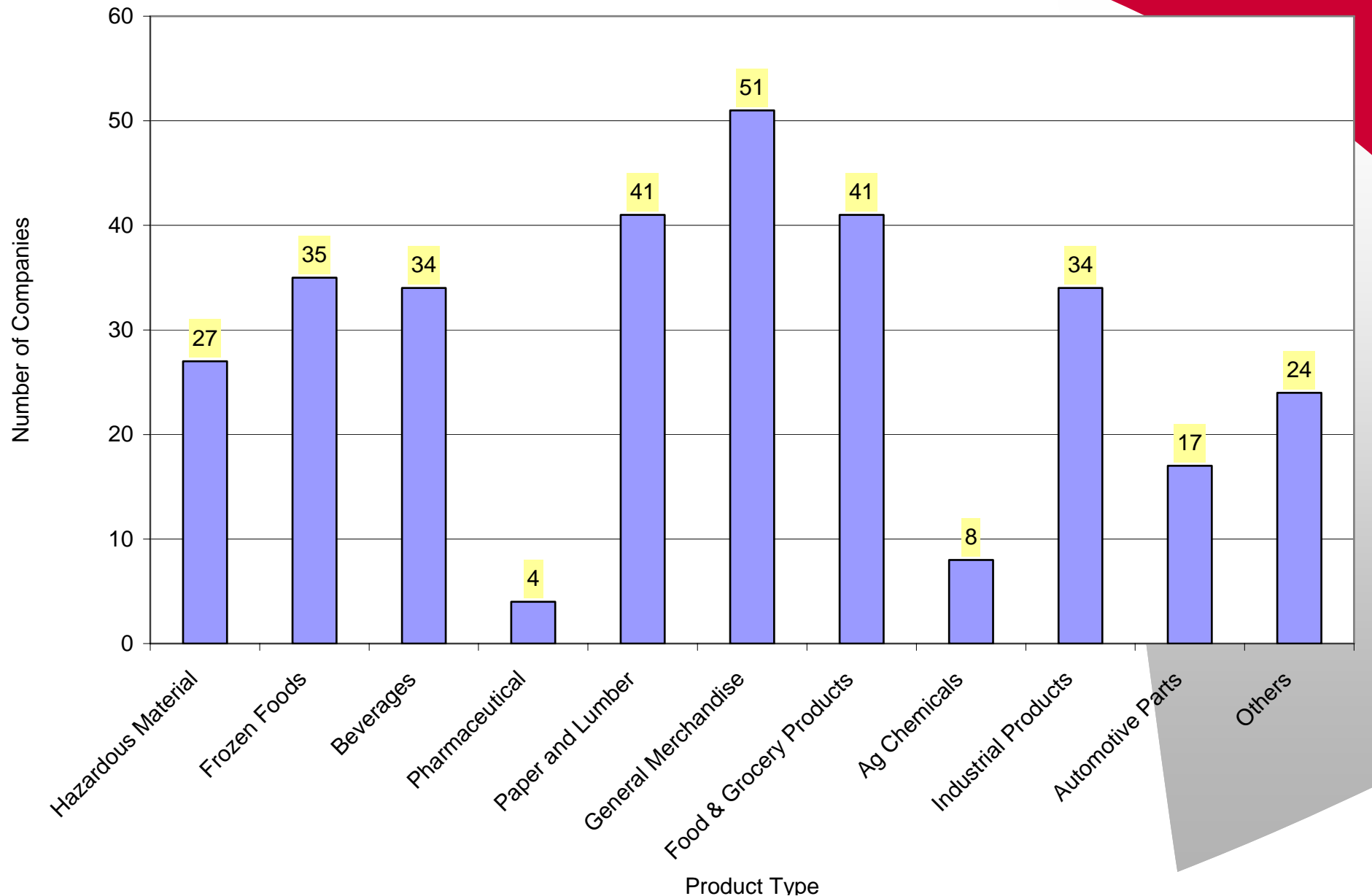
Warehouse/DC Sample Coverage Area



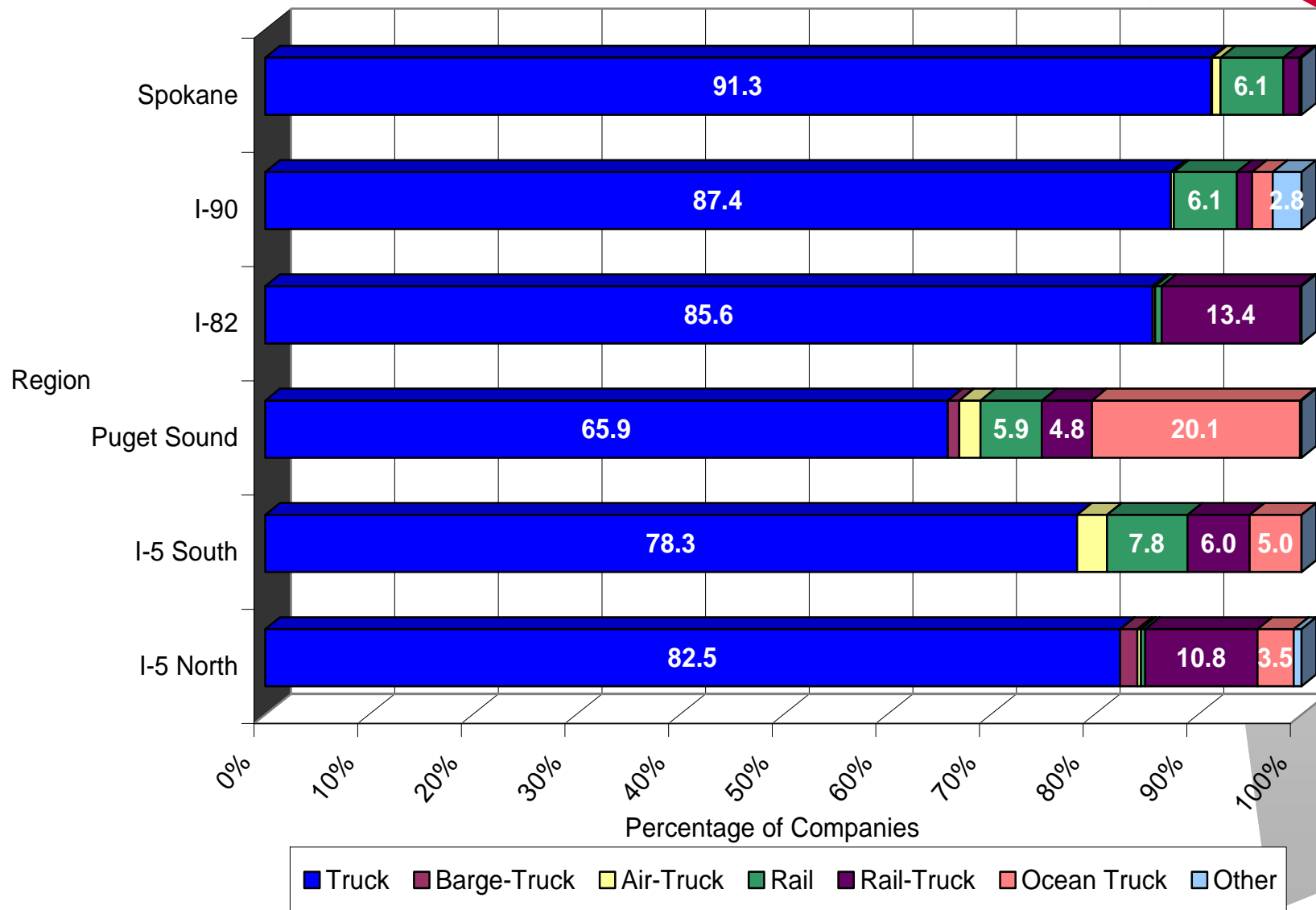
Hours of Operation



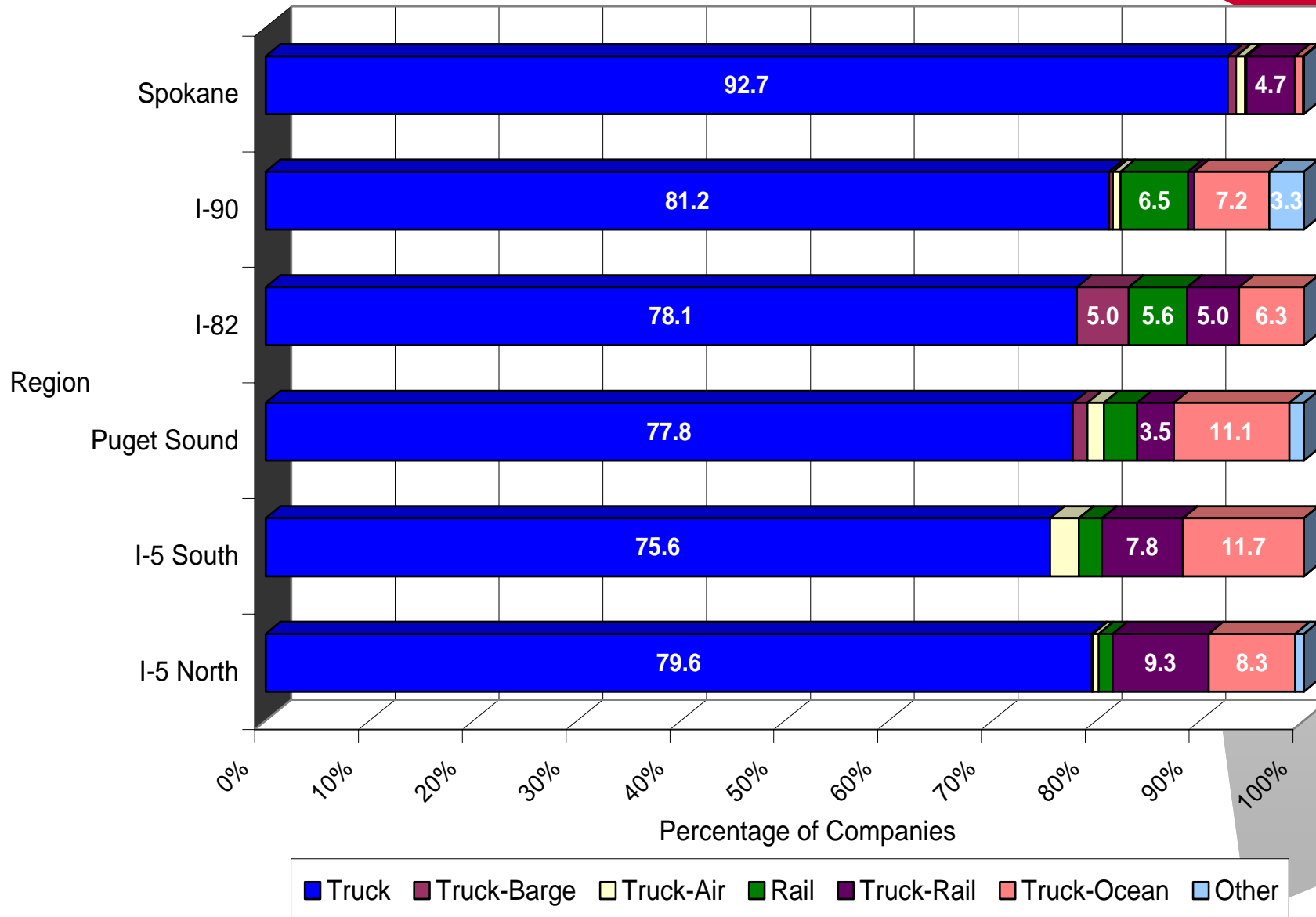
Product Type Handled



Inbound Shipment by Mode



Outbound Shipment by Mode



Variables

Variable	Type	Description
Bays	Continuous	Number of loading bays
Employ	Continuous	Number of Employees
Cdock	<i>Indicator</i>	Cross-Docking offered at facility (0=no, 1=yes)
Inpay	Continuous	Average Payload weight for inbound vehicles
Outpay	Continuous	Average Payload weight for outbound vehicles
Instops	Continuous	Number of prior stops made by inbound vehicles
Outstops	Continuous	Number of stops anticipated by outbound vehicles
Privflt	<i>Indicator</i>	Facility utilizes private truck fleet (0=no, 1=yes)
Threep1	<i>Indicator</i>	Facility utilizes 3PL (0=no, 1=yes)
Prodnum	Continuous	Number of different products handled at facility
Busnum	Continuous	Number of business services handled at facility
Modenum	Continuous	Number of mode capabilities available at facility
Public	<i>Indicator</i>	Public Warehouse (0=no, 1=yes)
Cold	<i>Indicator</i>	Cold Storage (0=no, 1=yes)
Contract	<i>Indicator</i>	Contract Warehouse (0=no, 1=yes)
Distctr	<i>Indicator</i>	Distribution Center (0=no, 1=yes)
Ofactype	<i>Indicator</i>	Other Facility Type (0=no, 1=yes)

Inbound Truckloads

All Washington		Eastern Washington		Western Washington	
Variable	Parameter Estimate	Variable	Parameter Estimate	Variable	Parameter Estimate
Intercept	14.29	Intercept	-41.00	Intercept	-14.91
Bays	0.89	Employ	0.87	Employ	-0.04
Privflt	-26.53	Busnum	20.49	Bays	1.50
Busnum	10.72	Public	64.69	Modenum	12.11
Cold	64.32			Cold	70.97
				Ofactype	28.21
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R ²	0.342	R ²	0.577	R ²	0.348

Outbound Truckloads

All Washington		Eastern Washington		Western Washington	
Variable	Parameter Estimate	Variable	Parameter Estimate	Variable	Parameter Estimate
Intercept	38.21	Intercept	-15.73	Intercept	20.87
Bays	3.41	Employ	1.29	Employ	0.05
ThreepI	-33.26	Public	102.70	Bays	2.23
Cold	45.84			Ofactype	42.66
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R ²	0.45	R ²	0.58	R ²	0.59

Summary Findings:

- **Inbound Trucks:**
 - **Statewide:**
 - **Cold Storage = More Truck Volume**
 - **Private Fleet = Less Truck Volume**
 - **Eastern:**
 - **# of Business Services Increase = More Truck Volume**
 - **Public Warehouse = More Truck Volume**
 - **# of Employees Increase = More Truck Volume**
 - **Western:**
 - **# of Employees Increase = Less Truck Volume**
 - **Cold Storage = More Truck Volume**
 - **Other Facility Type = More Truck Volume**

Summary Findings:

- **Outbound Trucks:**
 - **Statewide:**
 - **Cold Storage = More Truck Volume**
 - **3PL = Less Truck Volume**
 - **Eastern:**
 - **Public Warehouse = More Truck Volume**
 - **# of Employees Increase = More Truck Volume**
 - **Western:**
 - **# of Bays = More Truck Volume**
 - **Other Facility Type = More Truck Volume**

Inbound Truckloads

Domestic Warehouse		International Warehouse	
Variable	Parameter Estimate	Variable	Parameter Estimate
Intercept	7.737	Intercept	-21.46
Employ	0.534	Bays	0.86
Bays	2.617	Privflt	-35.02
Cdock	16.940	Inpay	0.0007
Inpay	-0.0004	Busnum	14.64
Ofactype	-14.300	Cold	77.40
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R ²	0.834	R ²	0.35

Outbound Truckloads

Domestic Warehouse		International Warehouse	
Variable	Parameter Estimate	Variable	Parameter Estimate
Intercept	-24.15	Intercept	-1.975
Employ	1.27	Bays	2.958
Threep1	-71.54	Outpay	0.0003
Prodnum	37.35	Cold	78.820
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R ²	0.75	R ²	0.566

Summary Findings:

- **Inbound:**
 - **Domestic:**
 - **Cross Docking = More Truck Volume**
 - **Other Facility Type = Less Truck Volume**
 - **International:**
 - **Cold Storage = More Truck Volume**
 - **Private Fleet = Less Truck Volume**
- **Outbound:**
 - **Domestic**
 - **3PL = Less Truck Volume**
 - **# of Products = More Truck Volume**
 - **International**
 - **Cold Storage = More Truck Volume**

Square Ft. of Warehouse Space

All Washington		Eastern Washington		Western Washington	
Variable	Parameter Estimate	Variable	Parameter Estimate	Variable	Parameter Estimate
Intercept	64,408	Intercept	81,444	Intercept	15,755
Contract	-38,177	Bays	7,322.4	Contract	-47,700
Ofactype	-34,667	Privflt	-91,786	Ofactype	-53,991
Employ	121.39			Employ	119.71
Bays	4,341.6			Bays	4,151.7
Privflt	-43,881			Threepl	2,959.3
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R ²	0.794	R ²	0.81	R ²	0.842

Domestic Warehouse		International Warehouse	
Variable	Parameter Estimate	Variable	Parameter Estimate
Intercept	-381.16	Intercept	74,518
Employ	486.13	Contract	-58,010
Bays	3,211.40	Ofactype	-52,937
		Employ	117.06
		Bays	4,360.6
		Privflt	-45,167
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R ²	0.694	R ²	0.822

Summary Findings:

- **Square Ft. Warehouse Space:**
 - **Statewide:**
 - **# of Bays = More Truck Volume**
 - **Contract Warehouse = Less Truck Volume**
 - **Private Fleet = Less Truck Volume**
 - **Other Facility Type = Less Truck Volume**
 - **Eastern:**
 - **# of Bays = More Truck Volume**
 - **Private Fleet = Less Truck Volume**
 - **Western:**
 - **# of Bays = More Truck Volume**
 - **Contract Warehouse = Less Truck Volume**
 - **3PL = Less Truck Volume**
 - **Other Facility Type = Less Truck Volume**

Questions ?

