AN ABSTRACT OF THE THESIS OF

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Title: A STUDY OF TRANSPORTATION PRACTICES AND NEEDS IN THE WILLAMETTE BASIN, OREGON

Abstract approved: Redacted for privacy
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This study was undertaken to gather empirical data on the transportation practices of manufacturers, processors, and carriers in the Willamette Basin. Emphasis was placed on determining the adequacies of current transport facilities and the direction of future needs.

Specific objectives were: (1) To identify the transportation practices of manufacturers and processors in terms of major industry groups by consumer market areas; (2) To establish the nature of the restrictions, if any, imposed on manufacturers or processors in the Willamette Basin in terms of export markets; (3) To establish a basic inventory of carrier facilities in the Willamette Basin and identify carrier deficiencies; (4) To project future transportation needs and patterns in the Willamette Basin; (5) To specifically determine the possible future role of the Willamette River in the development of a Willamette Basin transportation complex.

The shipping practices of manufacturers and processors were studied to determine the relationship of transport practices to markets served. This required the development of data on primary markets by basic industry groups and by transport media used to reach these markets. Additionally the question of institutional and organizational inefficiencies were distinguished from the problems of geographical locations of markets.

An enumeration was made of carrier facilites in the Willamette Basin which revealed the magnitude of air passenger and freight operations, the usage of private and common carrier motor transport and the rail services available to Willamette Basin shippers. Results indicated the general absence of institutional and organizational inefficiencies in the existing transport sector.

An analysis of the potential for development of the Willamette River indicated that transport and handling costs of industrial traffic on the Willamette River would exceed the costs of land transport even on the longest hauls.

Fragmentary evidence indicated a possible future restriction may develop in terminal handling facilities, particularly facilities permitting intermodal transfers. Thus the hypothesis was advanced that investments in the development of terminal facilities might play a major role in the future development of the Willamette Basin's industrial development.

A Study of Transportation Practices and Needs in the Willamette Basin, Oregon

by

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CHAPTER 1

INTRODUCTION

That economic development requires an adequate transport sector is axiomatic. Douglass C. North, in his History of Economic Growth in the United States, states (6, p. 1):

> . . . the timing and pace of an economy's development has been determined by: (1) the success of its export sector, and (2): the characteristics of the export industry and the disposition of the income received from the export sector.

This situation is nowhere as obvious as in an underdeveloped economy with an inadequate transport structure. It is less obvious but no less important in a highly developed economy with a rapidly changing transport sector.

Therefore, assuming a competitive labor and resource base with no institutional barriers, the success of the export [1] sector will depend, to a large degree, upon two factors: (1) the efficiency of the transport sector, and (2) the location of consumer markets in relationship to competitive production areas.

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[1] Export as used in this context refers to export beyond the Willamette Basin and not necessarily an international movement.

This separation of transport efficiency from problems of physical location enables a consideration of those restraints upon export imposed by real or institutionally created inefficiencies in the actual flow of commodities from point to point as compared to those restraints which are imposed purely by relative distance from consuming markets.[2]

Transportational disadvantages can be offset by changes in transportation technology and by changes in transportation policies. A locational disadvantage can be overcome only by a shift or growth in consumption markets or by a decline in the comparative advantage of a competitive resource area. It should be noted here that a change in comparative advantage can be affected by changes in transportation technology particularly where innovations affecting long-haul economies improve the locational advantage of the more distant exporting area.

At the present time substantial changes are occurring in both transportation technology and transportation policies. As a result of the Transportation Act of 1958, and a more liberal regulatory policy in the area of rate making resulting from this act, the past decade has seen the emergence of high volume minimum weight rates for single cars and very high volume minimum weight rates based upon

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[2] This distinction may be somewhat arbitrary, but for the purposes of this discussion it is convenient and no less arbitrary than other definitions.

multiple car single movements. [3] At the present time a rate based on a 1,000,000 minimum weight is moving canned goods from Oregon to the Atlantic Seaboard (Transcontinental Freight Bureau Tariff Number 2F). The basis of these rate changes has been the evolution of a whole new generation of high speed, high capacity rail cars built upon the Timken tapered roller bearings for rail cars, an innovation of the mid-1950's. [4]

With the development of new rate levels and rate policies on the part of the western railroads, substantial changes were forced on the trucking industry in the West. The evolution of 100-ton rail hopper cars in vast numbers reduced the rail grain rate to only a fraction of its former level – from a level of $. 36 per hundredweight, Pasco to Portland in 1957 on a single 40,000 pound car, to a rate of $. 0925 in 1967 on multiple car movements. [5]

This reduction in the grain rate eliminated not only the grain trucker who ran in and out of the Willamette Valley in vast numbers in the late 1950's, [6] but also backhaul for the regular route common

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[3] Partial list of general rate reductions approved by the railroads on traffic moving to or from Oregon, provided by the Public Utilities Commission of the State of Oregon.

[4] See (2, pp. 337-341) for a discussion of this technology.

[5] Pacific Northwest Grain and Grain Products Association bulletin of 6-15-66.

[6] Wheat volume by truck grew from 310,000 bushels in 1950 to 10,240,000 bushels in 1957. See Exhibit A to verified statement of

carrier. Similar changes occurred in the areas of lumber, canned goods, frozen fruits and vegetables, and all large volume resource oriented movements, and again trucking movements were drastically restricted or totally eliminated.[7]

These changes in revenue sources for motor carriers compelled mergers and acquisitions among both regular and irregular route motor carriers.[8] Many old-line motor carriers serving the Willamette Basin — O. N. C., Pierce, Lee and Eastes, Martin Brothers, Interstate — and others were either bought out or merged into other lines. Additionally, other motor carriers such as Consolidated Freightways reduced the number of terminal facilities in the Willamette Basin.[9] Similar changes took place in the irregular route motor carriers serving the food processing industry. There emerged only a handful of larger regional and transcontinental carriers such as Little Audrey, Mid-West Coast, Willis Shaw, Exley, etc.

Frank P. Aughnay before the I. C. C., June, 1958, in opposition to a three percent increase on grain and grain products.

[7] Private correspondence with the operation principals of the major regular route common carriers serving Portland.

[8] An irregular route motor carrier operates on a for-hire basis to and from any points to which he has authority when a load is available. A regular route motor carrier operates on a daily scheduled basis between designated points for which he is certificated.

[9] Consolidated Freightways closed their Albany terminal and transferred its functions to Salem.

With the future growth of the Willamette Basin dependent on a continuing and growing export economy, it is desirable to know and appraise the relationship of the manufacturing and processing industries to the changing transport structure. In order to develop this relationship this study was initiated: to determine the restraints imposed upon export by transport policy and procedure and to separate these restraints from those which were purely locational.

If the transport sector is strong and viable in its competitive structure, it would meet the needs of the manufacturers and processors in the Willamette Basin. If the transport sector is functioning properly, the only real export restraint, all other things being equal, would be the problem of location. Thus, the general objective of this study was to test the adequacy of the transport structure in the Willamette Basin.

Objectives

Within this general objective the goal of this study was to define the position of Willamette Basin manufacturers and processors in terms of the transportational and locational restraints imposed upon them. Additionally, in view of the rapidity of change in transport technology, it was desirable to identify the basic shipping patterns of Willamette Basin manufacturers and processors in terms of their consumer markets. To accomplish these ends, five specific

objectives were defined:

1. To identify the transportation practices of manufacturers and processors in terms of major industry groups by consumer market areas.

2. To establish the nature of the restrictions, if any, imposed on manufacturers or processors in the Willamette Basin in terms of export markets.

3. To establish a basic inventory of carrier facilities in the Willamette Basin and identify carrier deficiencies.

4. To project future transportation needs and patterns in the Willamette Basin.

5. To specifically determine the possible future role of the Willamette River in the development of a Willamette Basin transportation complex.

Procedures

To accomplish these specific goals this study was divided into three phases: (1) A study of the transportation practices of the manufacturing and processing industries in the Willamette Basin, their markets, and the restrictions imposed by the existing transportation

complex; (2) an inventory of the existing carrier facilities and concepts; and (3) using projections of future levels of economic activity in the Willamette Basin make an assessment of possible future difficulties in providing efficient movement of goods and products from the Willamette Basin.

Assumptions

To facilitate the gathering of data on transportation in the Willamette Basin the following assumptions were made:

1. That the transportation requirements and practices of manufacturers and processors in the distribution of their products would be similar to the needs of wholesale distributors of similar products shipping in the market areas.

2. That the carrier cost patterns, which can be substantiated in common carrier operations, can be estimated for any carrier, private or public, performing a similar activity, by use of an average common carrier cost factor.

3. That the restrictive transportation movement for processors, manufacturers and distributors, is the outbound or distributive movement and not the inbound movement.

Geographic Area

The study area commonly accepted by all study groups is the area defined as the "Willamette Drainage Basin" by the State of Oregon Water Resources Board, see Figure 1. Although there are some deviations, the major portions of the study area consists of Benton, Lane, Linn, Clackamas, Marion, Multnomah, Polk, Washington, and Yamhill counties. The only significant departure between county boundaries and drainage area boundaries occurs in Lane county. However, only six percent of the population of Lane county is in the western part of the county lying outside of the basin drainage (12).

Firm Data

Data on manufacturing and processing firms were developed in two stages. First, a complete inventory of all manufacturing and processing firms in the basin was developed. To develop this list, field enumerators, working from published lists and state sources, developed as complete a compilation as possible. This list was then taken into each community in the basin where it was reviewed by local Chambers of Commerce, power and light companies, county agents, and similar agencies. Additions and deletions were made in accordance with the information available from these

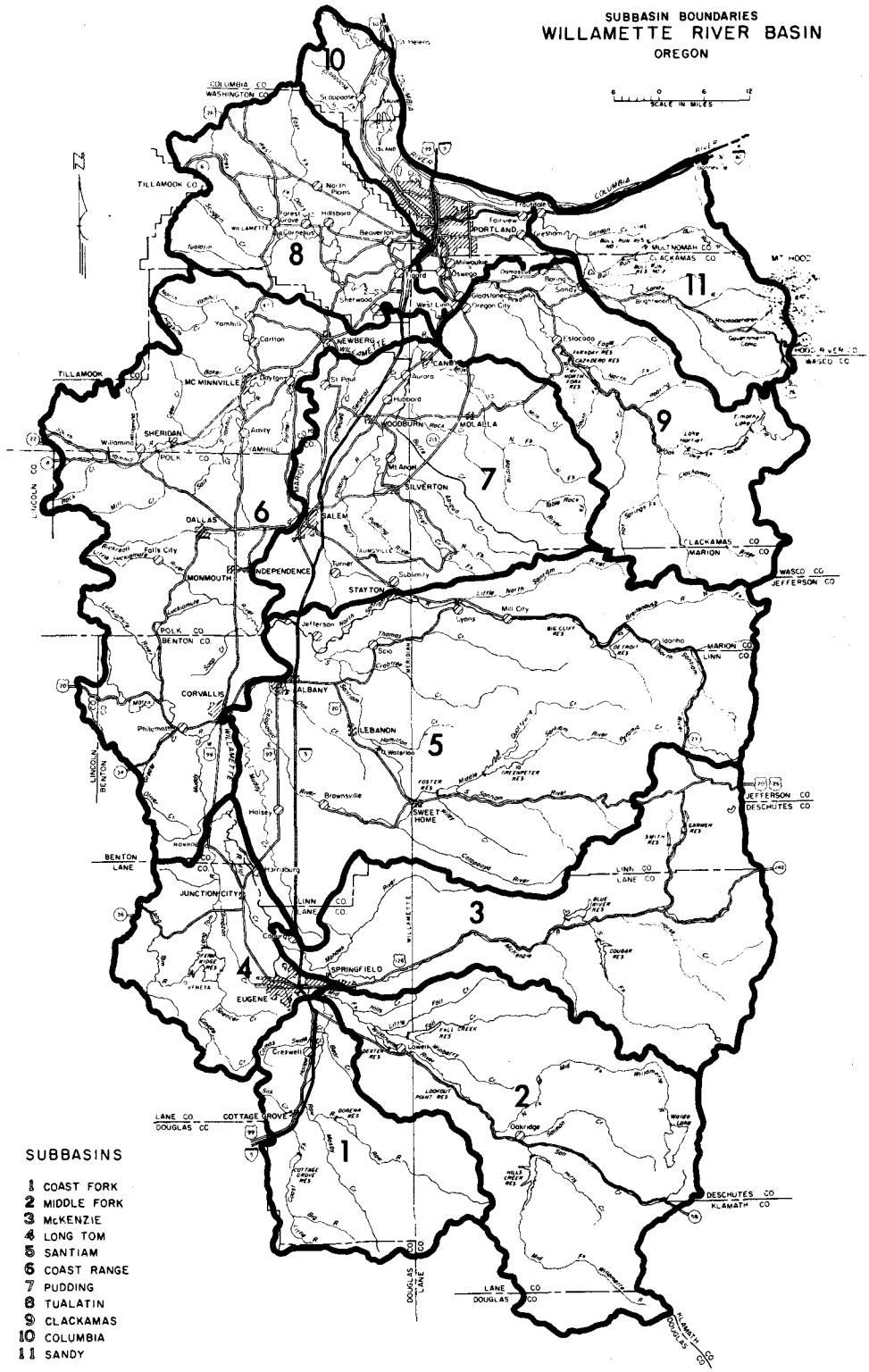

Figure 1. Willamette River Basin.

sources. Each firm on the list was then contacted and interviewed briefly. During this interview, the age of the firm, the number of employees, the nature of the business, and its primary markets were determined. In the course of this enumeration, 2,453 manufacturing and processing firms were identified and interviewed.

Second, on the basis of the data gathered above, a comprehensive schedule (see Appendix I) was developed and mailed to each of the 2,453 firms identified. From this complete enumeration, 1,590 (63 percent of all firms identified) completed and returned usable schedules. Additional schedules were returned in such a manner that they could not be used or the respondent firm had gone out of business in the interim period between the two enumerations.

Carrier Data

A complete inventory was made of carriers operating in the Willamette Basin listing, where feasible, physical location of their facility, number of employees, local delivery equipment, average number of pieces of transport equipment, and/or volume handled. These data are complete for motor carriers and airlines; however, the rail data were more difficult to obtain, primarily because of the difficulties involved in separating data for a small geographic subsector from reports and schedules developed for a total area. As a result railroad data are less definitive.

Motor freight operating costs were obtained from four regulated common carriers and one private fleet. These common carriers were divided into two large transcontinental motor carriers and two small regional carriers. All estimates of motor vehicle operating costs are predicated upon the data obtained from these fleets.

Additional information on the nature of the motor freight industry, public and private, serving the Willamette Basin was obtained from volume traffic counts conducted at various intersections on Interstate 5 and from interviews conducted at truck service stations located throughout the Willamette Basin.

CHAPTER 2

TRANSPORTATION PRACTICES OF MANUFACTURING AND PROCESSING FIRMS IN THE WILLAMETTE BASIN

Transportation activities in the Willamette Basin reflect, to a considerable degree, the industrial composition of the basin. For this reason it was necessary to develop an accurate measure of the manufacturing and processing industries in the basin before an attempt was made to evaluate the shipping patterns and requirements of the area.

Age and Size

Data gathered in the initial field inventory give a clear picture of the composition of industry in the Willamette Basin. Table 1, Distribution of All Firms by Age of Firm and Number of Employees, indicates the industrial community in the Willamette Basin consists primarily of small, stable firms. In excess of 50 percent of all firms employ ten or fewer people, while 75 percent employ 30 or less people. In excess of 65 percent of all these firms are more than ten years old, with a considerable number of very old firms. Almost ten percent of all firms in the basin are more than 50 years old.

Table 1. Distribution of All Firms by Age of Firm and Number of Employees. [1/]

Number of Employees *	Age of firm in years								Total	Percent of total by number of employees	Average age	Accumulated percent of total
	0-2	2-4	6-10	11-15	16-25	26-35	36-50	51+				
0	-----	-----	-----	-----	1.0	-----	1.0	-----	2.0	0	28.0	53.2
1-10	112.0	186.0	242.5	183.0	294.0	111.0	110.0	67.0	1305.0	53.2	18.1	68.7
11-20	17.0	45.0	62.0	48.0	90.0	49.0	38.0	31.0	380.0	15.5	21.5	68.7
21-30	13.0	12.0	26.0	27.0	41.0	17.0	32.0	16.0	184.0	7.5	24.0	76.2
31-50	3.0	12.0	27.0	25.0	38.0	21.0	26.0	30.0	182.0	7.4	28.1	83.6
51-70	4.0	6.0	12.0	16.0	20.0	17.0	20.0	13.0	108.0	4.4	27.9	88.0
71-100	3.0	5.0	16.0	9.0	30.0	10.0	11.0	22.0	106.0	4.3	28.7	92.3
101-150	2.0	3.0	13.0	6.0	17.0	5.0	10.0	9.0	65.0	2.6	26.0	94.9
151-200	1.0	-----	3.0	1.0	8.0	4.0	9.0	6.0	32.0	1.3	34.3	96.2
201-300	-----	5.0	4.0	5.0	11.0	3.0	6.0	5.0	39.0	1.6	26.1	97.8
301-400	1.0	-----	3.0	2.0	6.0	2.0	1.0	2.0	17.0	.7	23.8	98.5
401-500	-----	1.0	-----	-----	2.0	1.0	2.0	1.0	7.0	.3	35.4	98.9
Over 501	-----	1.0	5.0	3.0	6.0	1.0	2.0	8.0	26.0	1.1	33.2	99.9
Total	156.0	276.0	413.0	325.0	564.0	241.0	268.0	210.0	2453.0	99.9	21.5	
Percent of total by age of plant	6.4	11.2	16.8	13.2	23.0	9.8	10.9	8.6	99.9			
Average employees	15.8	22.8	34.2	44.0	41.5	33.7	47.6	80.7	40.1			

* This includes the average number of employees over the year, other than those hired for seasonal peaks.

[1/] Data gathered in January, 1966 covering calendar year 1965.

A review of Table 2, Distribution of Firms by Age of Firm for Major Industry Groups, which breaks the age of the firm down by major industry groups, shows this age stability extending across all major industry groups without any significant variations.

Products

The classification of firms into major industry groups belies the wide range of products produced in the Willamette Basin. These range from agricultural products of all types, bagged, bulk, fresh, canned, and frozen to destroyer escorts, rail cars and large diesel highway tractors. A firm in Albany supplies replacement pants pockets for the nation's laundries while Portland firms supply intricate electronic devices; the extent of the product mix requiring transport is as broad as the agricultural and technological capabilities of our society. The shipping needs of the basin are not, as they are often pictured, limited to the need for exporting agricultural products and lumber.

Markets

Just as the product mix among Willamette Basin manufacturers and processors is broad and complex so are the markets these firms serve. Products from the Willamette Basin move to every state in the union, including Alaska and Hawaii, and to many nations of the

Table 2. Distribution of Firms by Age of Firm for Major Industry Groups. [1/]

	Age of firm								Total	Average age per firm
	0-2	3-5	6-10	11-15	16-25	26-35	36-50	51+		
Food and kindred products	14	22	31	37	70	61	55	32	322	26.6
Textile mill products	1	2	4	--	3	3	1	6	20	29.8
Apparel and other finished products made from fabrics and similar materials	3	7	13	9	21	7	14	6	80	24.0
Lumber and wood products, except furniture	38	62	82	71	88	18	11	12	382	14.0
Furniture and fixtures	12	21	37	20	31	9	16	4	150	17.0
Paper and allied products	1	3	9	6	4	2	8	4	37	24.2
Printing, publishing and allied industries	8	27	34	27	44	31	48	60	279	31.3
Chemicals and allied products	7	16	18	15	21	10	7	5	99	17.8
Petroleum refining and related industries	3	2	5	4	7	6	1	--	28	16.7
Rubber and miscellaneous plastics products	4	10	5	5	3	2	1	2	32	13.1
Leather and leather products	1	--	4	1	4	4	4	3	21	32.7
Stone, clay and glass products	8	21	29	26	43	15	12	13	167	20.1
Primary metal industries	3	2	6	2	19	2	6	6	46	24.0
Fabricated metal products, except ordnance, machinery and transportation equipment	18	19	46	33	63	21	29	22	251	21.8
Machinery, except electrical	17	26	37	33	65	24	27	16	244	20.9
Electrical machinery, equipment and supplies	5	9	15	13	21	4	8	1	76	16.6
Transportation equipment	8	11	14	9	26	8	6	3	85	17.8
Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks	2	5	9	4	10	2	4	3	39	19.7
Miscellaneous manufacturing industries	3	12	15	10	21	12	10	12	95	23.6

[1/] Data gathered in January, 1966.

world. All forms of transport are of considerable importance to Oregon and to the Willamette Basin.

Table 3, Demand Markets for Commodities Produced in the Willamette Basin by Geographic Location of Demand for Major Industry Groups by Percentage of Sales, illustrates the importance of every geographic area to one or more major industry groups. Some Willamette Basin products are consumed primarily within Oregon and its immediate neighbors; others move heavily to mid-west, eastern, or foreign markets.

The importance of transportation to the Willamette Basin is clearly defined in Table 3. Oregon, including the Willamette Basin, constitutes less than 30 percent of the market for 9 of the 18 major industry groups. For 7 of the 18 major industry groups the midwest constitutes from 33 percent to 52 percent of the total demand market. The movement of goods over a considerable distance is a problem of every major industry group and of nearly every manufacturing and processing firm in the basin.

Shipping Patterns

Table 4, Distribution of Respondent Firms by Type of Transportation for all Industry Groups, Expressed as a Percentage of Sales, defines the current shipping practices of firms located in the Willamette Basin. The majority of the goods manufactured or processed in

Table 3. Demand Markets for Commodities Produced in the Willamette Basin by Geographic Location of Demand for Major Industry Groups by Percentage of Sales. *1/ 2/ 3/

	Willamette Basin	Oregon other than Willamette Basin	Wash-ington	Cali-fornia	Idaho and Montana	Utah and Nevada	Arizona, Colorado, Wyoming & New Mexico	Hawaii and Alaska	Midwest and East	Foreign	Undistributed	Semi-mfgd. products consumed in future manufacture
Food and kindred products	50.1	8.0	9.2	11.5	1.1	.4	.3	.6	4.4	.9	13.0	.2
Textile mill products	3.8	.8	8.8	9.2	.3	.1	.1	----	.3	----	75.9	.6
Apparel and other finished products made from fabrics and similar products	8.0	2.9	7.8	15.9	3.2	.7	2.2	.8	41.0	----	15.9	.6
Lumber and wood products except furniture	10.4	4.2	4.4	9.6	.9	.8	1.2	.4	34.4	1.7	23.0	8.4
Furniture and fixtures	29.6	5.3	17.9	26.5	4.1	1.7	1.0	4.6	3.8	----	5.0	.2
Paper and allied products	11.5	4.1	11.2	52.4	2.5	1.8	1.0	1.1	7.4	.7	5.5	.4
Printing, publishing and allied industries	76.6	5.6	6.9	1.8	.7	----	----	.8	.1	----	7.4	----
Chemicals and allied products	22.2	15.3	18.1	3.9	5.7	.6	.6	.3	6.2	.5	18.4	8.2
Petroleum refining and related industries	56.8	19.6	18.9	.9	2.2	----	----	.13	----	.3	----	----
Rubber and miscellaneous plastic products	30.6	10.1	27.6	4.1	5.2	.9	----	2.0	5.3	2.0	11.7	----
Leather and leather products	68.8	2.9	5.8	4.8	2.4	1.0	.2	.1	2.4	----	11.4	----
Stone, clay and glass products	69.4	12.4	14.6	.4	2.0	.2	----	.1	.3	----	.3	----
Primary metal industries	19.2	5.4	9.6	17.2	2.9	.3	.3	1.9	33.3	3.4	4.7	----
Fabricated metal products, except ordnance, machinery, and transportation equipment	31.4	8.2	11.9	6.9	1.9	.5	.4	.8	17.5	7.0	3.2	9.6
Machinery, except electrical	13.3	6.4	6.5	6.6	1.7	.5	1.3	.5	33.1	21.7	8.3	----
Electrical machinery, equipment and supplies	14.0	6.3	3.0	11.6	.8	.7	1.5	.2	38.9	17.2	5.0	----
Transportation equipment	8.2	6.2	5.2	16.7	1.4	.7	.7	2.4	52.0	3.2	.7	----
Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks	18.9	5.6	4.7	9.1	1.5	1.0	1.3	1.3	38.4	5.5	11.9	----
Miscellenaous manufacturing industries	35.7	9.8	9.8	4.2	2.5	1.0	.1	.4	1.0	.7	34.7	----

* Data drawn from the mailed samples of the total population.

1/ Data gathered in January, 1966.

2/ Due to the variance in goals this data will not correlate with the data developed in the report on Economic Prospects. This variance results from the allocation of undistributed commodities and the re-allocation of intermediate products to the definition of final products in the Economic Prospects report.

3/ Demand Markets shown are the points of initial sale and do not reflect the ultimate markets where products were subject to further manufacture, processing or redistribution.

Table 4. Distribution of Respondent Willamette Basin Processors and Manufacturers by Types of Transportation for all Industry Groups, Expressed as a Percentage of Sales, 1965.*

Type of Transportation Used	Percent of Sales
Company truck	19.5
Customer truck	6.1
Leased truck	2.8
Contract carriers	4.1
Motor freight	30.9
Piggy back	1.3
Railroad other than piggy back	24.2
Air	2.2
Water	2.3
Parcel post	1.7
Other	2.5
Undistributed	2.5

* Data drawn from the mailed samples of the total population.

the basin are moved by some form of motor transport, 63.4 percent if measured as a percentage of sales. Railroad freight, including piggyback, would seem to constitute a relatively small portion of the total movement of Willamette Basin freight; however, if the measurement could be made in ton miles of cargo movement, the rail would show to considerably better advantage. Accurate data in terms of total ton miles of freight moved by different Willamette Basin groups are not available. Nationally, in 1965, railroad movement

constituted 42.87 of all ton miles of freight moved, while motor truck constituted 22.56 percent (1, p. 8).

The choice of transport form varies from industry to industry. Table 5, Distribution of Firms by Type of Transportation for Willamette Basin Major Industry Groups as a Percentage of Sales, shows this very clearly. The use of a particular form of transport in one industry varies greatly from that used in the next. The usage of the various modes of transport is discussed below along with the characteristics of the industry groups utilizing them.

Motor Freight Usage

Development of the motor transport sector is an accepted fact. Major common carriers (motor) have been in existence since the 1930's. Private fleets have been growing both in size and numbers for the past two decades. The extent of this growth in motor transport, although often underestimated, is clearly indicated in Table 4, page 18. Twenty-five percent of all goods produced or manufactured in the Willamette Basin are moved on private trucks owned by either the manufacturer-processor or the purchasing company. An additional seven percent use a leased truck or a contract hauler. Thirty-two and a half percent of all goods manufactured or processed in the Willamette Basin move by user controlled truck.

Table 5. Distribution of Firms by Type of Transportation for Willamette Basin Major Industry Groups Expressed as Percentage of Sales. * [1/]

	Company truck	Customer truck	Leased truck	Contract carrier	Motor freight	Piggy back	Railroad other than piggy back	Air	Water	Parcel post	Other	Undis-tributed	Total[2/]
Food and kindred products	53.5	5.4	3.6	1.4	16.2	.8	13.2	----	.9	.1	.2	4.5	99.8
Textile mill products	1.3	.1	----	2.0	34.2	1.3	.2	1.7	----	17.6	40.3	1.2	99.9
Apparel and other finished products made from fabrics and similar materials	5.6	1.0	----	.1	61.4	----	3.5	1.4	----	6.4	8.4	12.2	100.0
Lumber and wood products, except furniture	7.6	6.2	2.7	5.2	4.6	1.6	69.8	----	1.6	----	----	.4	99.7
Furniture and fixtures	25.9	2.8	7.1	1.1	28.2	2.8	27.5	.1	1.4	.2	.4	2.6	100.1
Paper and allied products	3.3	.6	3.9	1.6	28.7	.4	58.6	----	2.4	.2	.5	----	100.2
Printing, publishing and allied industries	29.9	4.2	2.0	6.1	17.6	.1	.7	.1	----	10.5	23.4	5.5	100.1
Chemicals and allied products	10.1	16.3	4.4	4.2	37.9	.1	9.5	.1	.8	.9	.1	15.6	100.0
Petroleum refining and related industries	28.9	23.1	1.3	16.3	21.5	----	8.9	----	----	----	----	----	100.0
Rubber and miscellaneous plastic products	14.6	2.2	----	.7	77.1	.1	.1	.2	.9	2.2	1.8	----	99.9
Leather and leather products	6.4	----	----	7.2	21.7	----	----	----	----	13.7	50.8	.2	100.0
Stone, clay and glass products	45.0	14.2	1.7	12.3	13.1	.6	6.0	.1	4.8	.5	----	1.7	100.0
Primary metal industries	9.9	3.9	----	15.2	34.8	11.3	18.1	1.6	3.0	1.0	1.3	----	100.1
Fabricated metal products, except ordnance, machinery, and transportation equipment	17.5	7.6	3.7	7.9	48.5	.8	7.9	.7	2.9	1.8	.5	.3	100.1
Machinery, except electrical	17.3	6.2	3.2	5.5	50.9	.9	7.9	.9	3.5	1.8	.1	1.9	100.1
Electrical machinery, equipment and supplies	3.3	9.0	----	.3	48.8	----	3.8	26.2	3.3	1.0	.1	4.0	99.8
Transportation equipment	2.8	7.7	3.6	.7	70.6	.3	5.4	1.1	5.7	.7	.9	.3	99.8
Professional, scientific, and controlling instruments; photographic, and optical goods; watches and clocks	10.6	.4	----	----	49.9	----	4.1	6.7	4.8	15.6	5.7	2.3	100.1
Miscellaneous manufacturing industries	26.9	4.3	13.3	1.0	28.8	----	3.9	10.3	.4	7.6	2.2	1.3	100.0

* Data taken from the mailed samples of the total population.

[1/] Data gathered in January, 1966.

[2/] These figures differ from 100 percent because of rounding error.

An additional 30.9 percent moved by common carrier (motor). In total 63.4 percent of all goods produced or processed in the Willamette Basin move by some form of motor truck. These figures do not include piggyback which accounts for an added 1.3 percent of the goods produced.

The type of transportation used, differentiated by major industry groups, is given in Table 5, page 20. This table clearly illustrates the strong differences existing in the transportation patterns of major industry groups and highlights the part played by private trucks in certain industries. The use of private transport ranges from a low of 3.3 percent of total sales in the paper and electrical equipment industries to a high of 53.5 percent in the food industry.

The source of this variance from industry group to industry group is difficult to identify. Table 6, Total Private Truck and Common Carrier Usage by Industry Groups as a Percent of Total Sales, suggests a crude correlation between market concentration and the use of truck; however, even here the correlation is shadowy and suggests the significance of many other factors. There is no significant correlation between the use of private truck and any of the factors shown. Much additional data will have to be gathered before the decision to use truck can be predicted for any industry.

Table 6. Total Private Truck and Common Carrier Usage of Willamette Basin Processors and Manufacturers by Industry Groups as a Percentage of Total Sales, 1965.

	Private truck	Common motor carrier	Total truck	Percent of total sales in Willamette Basin	Percent of total sales in Oregon and Washington including Willamette Basin	Percent of total sales in Oregon, Washington, and California including Willamette Basin
Food and kindred products	63.9	16.2	80.0	50.1	67.3	78.8
Textile mill products	3.4	34.2	37.6	3.8	13.4	22.6
Apparel and other finished products made from fabrics and similar material	6.7	61.4	68.1	8.0	18.7	34.6
Lumber and wood products, except furniture	21.7	4.6	26.3	10.4	19.0	28.6
Furniture and fixtures	36.9	28.2	65.1	29.6	52.8	79.3
Paper and allied products	9.4	28.7	38.1	11.5	26.8	79.2
Printing, publishing and allied products	42.2	17.6	59.8	76.6	89.1	90.9
Chemicals and allied products	35.0	37.9	72.9	22.2	55.6	59.5
Petroleum refining and related industries	69.6	21.5	91.1	56.8	95.3	96.2
Rubber and miscellaneous plastic products	19.5	77.1	96.6	30.6	68.3	72.4
Leather and leather products	13.6	21.7	35.3	68.8	77.5	82.3
Stone, clay and glass products	73.2	13.1	86.3	69.4	96.4	97.0
Primary metal industries	29.0	34.8	63.8	19.2	34.2	51.4
Fabricated metal products, except ordnance, machinery, and transportation equipment	36.7	48.5	85.2	31.4	51.5	58.4
Machinery, except electrical	32.2	50.9	83.1	13.3	26.2	32.8
Electrical machinery, equipment and supplies	12.6	48.8	61.4	14.0	23.3	34.9
Transportation equipment	14.8	70.6	55.4	8.2	19.6	36.3
Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks	11.0	49.9	60.9	18.9	29.2	38.3
Miscellaneous manufacturing industries	45.5	28.8	74.3	35.7	55.3	59.5

Rail Freight Usage

The raw percentage of goods processed or produced in the Willamette Basin which was moved by rail (25.5 percent) was lower than anticipated; however, as stated above this figure does not reflect ton-miles which is the normal comparative unit of measurement. Rail plays a large and important role in the marketing of Willamette Basin goods, and in terms of comparative values rail constitutes nearly as large a percentage of total sales (25.9 percent) as does common motor carrier (30.9 percent). Where this comparison is made in terms of percentage of employment, railroad movement represents 27.6 percent of all employment, while common motor carrier constitutes 26.5 percent of total production measured in terms of employees.

Air and Water Freight

Air freight comprises a very small percentage of the total movement of Willamette Basin goods. The interesting item, in air freight, is that although air freight movement represents only 2.2 percent of all movement as a percentage of total sales, it represents 4.2 percent of employees involved in production reflecting a considerably higher value moving via air than by other transport mediums.

Water movement of Willamette Basin commodities was relatively limited. The figures for water, by percent of sales or percent

of employment are relatively comparable, 2.3 percent as percentage of sales, 2.7 percent as a percentage of employment.

The impact of water and air movements of goods from Willamette Basin processors and manufacturers is lost in an aggregated figure. Table 5 shows a strong usage of air, 10.3 and 26.2 percent of sales, for only two industry groups. At the same time water movement was important to only seven major industry groups.

Transportation Disadvantages for Willamette Basin Shippers

The problem of location is difficult to separate from the problem of transportation and can be most clearly illustrated by specific examples. The concept of locational advantage can best be understood by considering two separate producing areas to each of which, as the result of using identical transportation technology, there accrues no advantage other than the time saved and the resulting cost benefits from one firm being closer to the market than the other. In this situation, identical goods are moved by identical means to a common market. The supplier who is more distant from the common market is penalized the freight cost difference imposed by the additional distance to the market his goods must travel as compared to the goods of his competitor as well as the time delay which the additional distance imposes. This inability to supply a market under identical terms of time and cost imposes a locational disadvantage. Neither

the disadvantage of time or cost is a transportation problem. They are a problem of location only.

Contrast this to a situation where two equal production areas are the same distance from the consuming market, but one accrues a time and cost advantage through the use of improved transportation techniques or a cost advantage through more favorable pricing. In this second situation, the firm that is placed at a competitive disadvantage suffers strictly from a transportation disadvantage imposed by one or more of the transportation mediums.

Actual market situations do not parallel either example in their entirety, but are composites of the two situations. For classification and evaluation, it is necessary to categorize as transportation disadvantages all of those situations where transportation technologies or practices place one area at a disadvantage to a competitive area, regardless of the distance of either from its market. At the same time if comparable or superior transportation technologies or practices are utilized and one area suffers a disadvantage due to market proximity, this disadvantage must be categorized as locational.

A major question in evaluating transportation in the Willamette Basin is what restraints do current transportation facilities and practices impose upon Willamette Basin manufacturers and processors ? To evaluate this situation, respondent firms were asked to list the disadvantages of a Willamette Basin location and then were specifically

asked, "Do you consider transportation services in the Willamette Basin adequate for your needs ?"

Table 7, Number of Firms Reporting Major Categories of Advantages and Disadvantages of Operating in the Willamette Basin, and Table 8, Disadvantages of Locating in the Willamette Basin, Number of Firms Reporting by Major Category, give the disadvantages of locating in the Willamette Basin. Of the 1,590 respondent firms, 371 reported some form of transportation disadvantage. Three hundred and sixty-four complaints involved freight and seven involved passenger service. The passenger service complaints were all concerned with the question of air service and were all from the Albany-Corvallis area. The 364 complaints on freight service are broken down in Table 9, Transportation Disadvantages of Locating in the Willamette Basin by Type of Disadvantage. There are six complaints on the inequity of specific rates in certain areas, not high rates in general; there are 11 complaints on westbound rates that are lower than eastbound rates; there are three "no rail service" complaints; five "poor rail service" complaints; and 10 complaints involve car shortages.[10] The balance of the complaints are concerned with the distance to market and the costs involved in servicing these markets. The equity of the costs is not questioned, the only concern is the locational disadvantage involved and the resultant competitive disadvantage. There are 263 firms who report a location disadvantage in

[10] A study of these specific complaints shows that 3 of the 5 "poor rail service" complaints were filed by one individual completing forms for three branches of one firm. The balance of the complaints are distributed across the entire gross income spectrum and are found in all industries.

Table 7. Number of Firms Reporting Major Categories of Advantages and Disadvantages of Operating in the Willamette Basin, 1965.

Category	Number of Firms	
	Advantage	Disadvantage
Transportation		
Passenger	14	7
Freight	224	309 *
Physical resources	311	140
Labor	174	108
Service Facilities	20	31
Markets		
Supply	130	119*
Demand	574	91*
Living amenities	88	---
Taxation	---	98
Government	---	6

* In tabulating data, market complaints involving transportation have been added to the transportation disadvantages in the discussion. There is a total of 371 disadvantages that are transportation-oriented.

Table 8. Disadvantages of Locating in the Willamette Basin, Number of Firms Reporting by Major Category, 1965.

	None	Physical resources	Labor	Supply markets	Demand markets	Living amenities	Trans-portation	Service facilities	Government	Taxes
Food and kindred products	78	21	14	3	9	--	38	--	2	11
Textile mill products	1	1	3	2	1	--	5	--	--	2
Apparel and other finished products made from fabrics and similar materials	15	--	7	5	1	--	12	--	--	--
Lumber and wood products, except furniture	73	53	12	3	4	47	57	1	--	17
Furniture and fixtures	40	4	8	7	3	--	11	1	2	2
Paper and allied products	5	--	3	1	5	--	10	--	--	2
Printing, publishing and allied industries	74	1	3	5	14	--	10	--	--	6
Chemicals and allied products	30	9	2	10	5	--	10	--	1	8
Petroleum refining and related industries	4	3	--	--	1	--	5	--	--	3
Rubber and miscellaneous plastic products	4	4	1	3	1	--	3	--	--	--
Leather and leather products	1	--	2	5	1	--	5	--	--	--
Stone, clay and glass products	40	18	2	2	10	--	4	1	--	3
Primary metals industries	12	3	3	2	2	--	6	1	1	5
Fabricated metal products, except ordnance, machinery, and transportation equipment	65	7	17	15	8	--	34	--	1	9
Machinery, except electrical	57	3	21	22	6	--	45	2	--	15
Electrical machinery, equip. and supplies	11	2	4	24	4	--	21	5	1	5
Transportation equipment	13	--	2	7	3	--	15	--	--	--
Professional, scientific, and controlling instruments; photographic and optical goods, watches and clocks	12	--	1	5	--	--	2	--	--	--
Miscellaneous manufacturing industries	16	4	2	4	2	--	8	1	--	2

Table 9. Transportation Disadvantages of Location in the Willamette Basin by Type of Disadvantage, 1965.

Disadvantage	Number of Firms Reporting
Rate inequities	6
Westbound rate cheaper than eastbound	11
No rail service	3
Poor rail service	5
Car shortage	10
Poor location in terms of major markets and resulting comparative rate disadvantage	263
Supply markets too far distant: comparative rate advantage accruing to other producing areas	59
No major complaint, but . . .	5
Total	362 *

* Some firms listed more than one disadvantage.

regard to demand markets, and 59 firms that report a disadvantage with regard to supply markets. Thirty-five complaints are on inequitable rate structure and poor service, the residual 322 complaints are locational in their nature.[11]

A study of carrier equipment, operating practices, and rate making practices in the Northwest, as compared to the nation, indicates that, in general as indicated above, any disadvantage accruing to Willamette Basin shippers is primarily a locational problem. This is a problem which, with the rapidly developing markets to the north and south, may well solve itself in a short period of time.

This condition of locational disadvantage is further corroborated by a review of answers to the question "Do you consider transportation services in the Willamette Basin adequate for your needs?"[12] A review was made of the answers given by 371 of the firms who listed a transportation or a locational disadvantage. Of the 371 firms, seven, all located in the central valley area — Albany, Corvallis, Lebanon — listed poor air service as their only complaint. Among the 359 firms who complained about freight or location disadvantages, 75 stated that transportation was inadequate and 278 stated it was adequate. The complaints of the 75 firms who replied that service was not adequate

[11] The above figures will not add to the total of 371 due to multiple complaints from some firms.

[12] No attempt was made to define the term adequate. Each shipper weighed the adequacy of the service rendered against his own concept of adequacy.

were reviewed and are summarized in Table 10, Breakdown of Respondent Complaints Involving Transportation Facilities.

From 1,590 responses less than five percent of the firms replied negatively to the adequacy of transportation services offered. Of this five percent, 50 firms, or two-thirds of all negative responses, were outside Portland, and nearly all of these are beyond the Portland metropolitan areas. It can be concluded, based upon the response of Willamette Basin industry, that, with the exception of marginal levels of service offered in smaller mid-basin communities, both the quality and quantity of transportation services offered Willamette Basin shippers are construed to be adequate by the processors and manufacturers in the Willamette Basin.

It must be concluded from this study of manufacturers and processors that the problem facing the Willamette Basin shipper in the form of high input costs and high distribution costs are imposed by their distance from primary markets and not by transportation disadvantages per se. Additionally, it must be pointed out that this distance is quite generally recognized by the shipper; it is commonly agreed that the transport sector is viable and competitive.

Table 10. Breakdown of Complaints from Respondent Manufacturers and Processors Involving the Adequacy of Transportation Facilities in the Willamette Basin, Oregon, 1965.

PORTLAND firms		
Total complaints		25
Not Specified[1/]	19	
Desire state-wide United Parcel service	3	
D.F. car shortage	1	
Rail car shortage	2	
ALBANY, CORVALLIS, SWEET HOME, LEBANON, PHILOMATH, HARRISBURG, BROWNSVILLE firms		
Total complaints		18
Not Specified	14	
Air freight	4	
EUGENE, SPRINGFIELD, COTTAGE GROVE firms		
Total complaints		16
Not Specified	16	
SALEM, DALLAS, MILL CITY, CARLTON, STAYTON, MC MINNVILLE, CANBY, WOODBURN, FOREST GROVE firms		
Total Complaints		10
Not Specified	10	
BEAVERTON, HILLSBORO, MILWAUKIE, TUALATIN firms		
Total complaints		6
Not Specified	6	

[1/] Where a response indicated some form of dissatisfaction, but this dissatisfaction was not specifically defined, the complaint was listed as not specified.

CHAPTER 3

CARRIER OPERATING PRACTICES IN THE WILLAMETTE BASIN

Meaningful measurements of small segments taken from a complete carrier system are difficult, if not impossible, to make. The Willamette Basin cannot be isolated out of a carrier's total system. Therefore, a considerable amount of field work was carried out to establish the direction of carrier developments and to identify those practices which could have impact on future growth in the Willamette Basin. While statistically this information is less then optimum, it corroborates the data developed from the survey of the Willamette Basin processors and manufacturers.

Air Transport

The Willamette Basin is served by nine regular route, scheduled, passenger and freight air carriers who operate out of the Portland metropolitan airport.[13] In addition to the Portland facility the basin is serviced by one or more regular route carriers operating out of Salem, Corvallis, and Eugene.

In the year 1966, 1,741,167 passengers flew in and out of the Willamette Basin. These combined facilities also handled a total of 48,926,631 pounds of air cargo.[14] This air cargo, including all mail

[13] In addition, Portland is also served by one all-freight carrier.

[14] See Appendix II for a complete breakdown of passenger and cargo by facility.

handled by air, is the equivalent of 1630 truck loads of cargo at an average of 30,000 pounds per set of equipment.

A study of the appendix tables shows that both passengers and freight movements have had a steady and substantial growth over the past twelve years and there is no reason to anticipate any change in this growth pattern on the passenger side.[15] In terms of air freight, however, a substantial growth is anticipated with the development of new jumbo jet airliners. The extent of this growth will depend to a large degree on the ability of air cargo carriers to develop motor freight competitive rate levels and integrate pick up and distribution systems.

Rail Transport

The Willamette Basin is served by four transcontinental rail carriers, two of them operating jointly into Portland via the S. P. and S. All four of these roads are progressive and aggressive lines utilizing new, high capacity cars and developing new concepts in rate making.

The most dramatic developments in the rail transport sector have been the rapid growth of the Trailer on Flat Car (TOFC) concept in and out of the Willamette Basin and the development of multiple car rates. Both of these developments

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[15] See Appendix II

promise considerable advantage to the shippers of goods to and from the Willamette Basin.

The development of high speed hopper cars for grain and the resultant major cuts in grain rates to the basin have resulted in the shift of the grain movement from truck back to rail. At the present time grain rates from Eastern Oregon are approximately 50 percent of the rate level of 1957. Additionally, new high speed roller bearing cars are being utilized for the movement of wood chips, canned goods, lumber and plywood.

The evolution of the tapered roller bearings and the resultant larger and faster cars have been important in the lowering of rail rates on basic commodities and in the shortening of the time interval from the Willamette Basin to its primary markets.

The development of the new high speed, high capacity cars has reduced and will further reduce the total number of cars required to service the Oregon and Willamette Basin markets. This reduction in total number of cars combined with new switching yards and car handling facilities assures the Willamette Basin a continuing high level of rail service.

Specific data on rail facilities for each line servicing the Willamette Basin is found in Appendix III.

Truck Transportation

Growth in the motor transport section takes a different trend than growth in rail and air movements. Where rail and air carriers are working to develop new concepts compatible with their new technologies, the trucking industry is adjusting to changes in the competitive structure. The trucking industry has experienced a considerable number of mergers and absorptions as well as the total disappearance of a great many independent gray area carriers.[16] This reduction in the number of for-hire carriers has occurred simultaneously with the emergence of a substantial private transport fleet.

A study of the flow of regular route common carrier motor trucks verified the development of the private truck sector indicated by the survey of manufacturers and processors. Counting stations were located at the intersection of I-5 and Oregon 20 in Albany, Ore. and at I-5 and Oregon 62 in Medford, Ore. A similar count was taken at Bakersfield, California for purposes of verifying the data. The results are given in Table 11, Motor Transport Traffic Pattern Observations, by Percentage of Total Motor Transports.

The regular route common carrier comprises 40 percent of

[16] A gray area carrier is a for-hire motor carrier who operates without any legal authority to operate, usually by using a buy and sell arrangement to evade the I. C. C. regulations.

Table 11. Motor Transport Traffic Pattern Observations, by the Percentage of Total Motor Transports, 1966.

Observation Point *	Regular Route Common Carrier	Others	Moving Vans	Total
1	40.47	56.59	2.95	100.01
2	39.60	56.70	3.70	100.00
3	40.50	56.90	1.70	100.00

*

Observation Point 1 - I-5 at Albany, Oregon

Observation Point 2 - I-5 at Medford, Oregon

Observation Point 3 - I-5 at Bakersfield, California

Data collected in sets of 3 periods of 4 hours each: Tuesday 22:00 hours to Wednesday 02:00 hours; Wednesday 22:00 hours to Thursday 02:00 hours; Thursday 13:30 hours to 17:30 hours. (Hours chosen to avoid end of week's schedules - all rigs moving Tuesday, Wednesday and Thursday.)

the total motor transport movement at all points on I-5 despite the fact that the flow of transports varied from a low of 50 trucks in four hours to a high of 1 northbound truck every 45 seconds. The residual transports are irregular route, specialized carriers and private fleets.

The for-hire sections of the Willamette Basin motor transport industry is still sizable. Table 12, Summary of For-Hire Motor Carrier Equipment and Personnel in the Willamette Basin, breaks out the for-hire motor carrier personnel and equipment, in the Willamette Basin, by type of carrier. At the time of the study in the summer of 1966 the for-hire motor carrier industry employed 6807 people and operated 1548 diesel tractors.

The long run role of motor transport is yet to be defined. With the changes taking place in rail and air technology there is much change yet in store for the motor freight industry. The rapid growth of a private transport sector gives the strongest suggestion to the future role of the truck. Devoid of the requirement shared by rail and air for large fixed terminals the truck possesses the flexibility and mobility that assures it a permanent place in the distribution scheme. Ultimately, the role of the truck in the Willamette Basin will be the provision of rapid service to relatively close markets.[17]

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[17] This growth may be strengthened by current legislative trends to greater size and capacity for trucks.

Table 12. Summary of For-Hire Motor Carrier Equipment and Personnel in the Willamette Basin, 1965.

	Total All Carriers	Common Carrier Regular Route	Common Carrier Irregular Route	Other Carriers (Contract, Log, etc.)	Moving Vans
Total Employees	6807	4130	861	1538	278
Local Drivers	2977	1805	223	809	140
Line Drivers	1524	914	376	203	31
Straight Truck Equipment	1445	955	89	295	106
Diesel Power	1548	750	339	426	33
Gas Power	812	429	83	230	70
Other Power	498	188	145	132	33
24'-27' Trailers	1645	1352	149	136	8
Semi-Trlrs.	1018	510	263	223	22
Flatbed Trailers	437	172	140	103	22
Furniture Vans	134	19	13	20	82
Tankers	208	98	72	38	0
Lowboy Trailers	96	27	27	41	1
Logging Trailers	103	2	8	93	0
Other Trailers	162	68	14	80	0
Intra-State	189	82	17	65	25
Inter-State	112	41	16	36	19

Water Transport

The Port of Portland serves as a world port of the Pacific and its cargo flow represents goods moving to and from many regions of the nation. Of considerable importance to the Willamette Basin and a substantial contributor to the economy of the Portland area, the Port moves only two percent of the goods produced or processed in the Willamette Basin. For this reason no inventory was compiled of the facilities of the Port nor was a compilation made of the tonnage moved through the Port.

Of particular concern was the Middle Willamette River and its potential as a navigable water. At the present time traffic on the upper and middle river above the locks is primarily restricted to log storage, the movement of log booms, and the flow of input commodities into the paper mill located on the locks.

In the absence of any real movement on the river a study was made of the volume of movement and type of commodity supporting navigation systems on other short rivers. This material is given in Appendix IV.

It should be noted in Appendix Table 1, Changes Over Time in Various River Basins Using as a Base the Period 1954 Through 1956, that while the other river systems showed a continual increase in tonnage moved over the base years the Willamette River showed a substantial decrease. The cause for this can readily be seen by

examining the detailed commodity breakdown in Appendix Table 2, Movement of Selected Commodities by River Systems, 1953-1963. While other river systems have substantial quantities of basic materials which are readily available for water movement, the Willamette River, basically dependent upon the lumber industry, does not have large tonnages immediately accessible to the river, and the promise of more lumber to the river is dim in view of a long run decline in total yield.

In the absence of the emergence of any substantial new high volume resource on the upper and middle river system, a maintenance of the status quo is suggested as the best achievable river volume.

CHAPTER 4

PROJECTIONS FOR FUTURE TRANSPORTATION PRACTICES IN THE WILLAMETTE BASIN

Projections in this section are based on those projections made in the Economic Study of the Willamette River Basin (11).

Utilizing the projections of the Willamette Basin Task Force and the data developed during the conduct of the Willamette Basin Transportation Study, it is possible to project the trends that transportation developments will take, given the existing and emerging technologies.

The two largest existing users of the transportation complex of the Willamette Basin are agriculture and lumber. The projections for agriculture and lumber are given in Table 13, Estimated Crop Production, 1959-61 and Projections for 1980, 2000 and 2020, Willamette River Basin, Oregon; Table 14, Food and Kindred Products Employment, 1960, and Projections for 1980, 2000 and 2020, Willamette River Basin, Oregon; Table 15, Estimated Production of Forest Products, Willamette River Basin, 1963-2000; and Table 16, Employment in Forest Product Industries, Willamette River Basin Study Area, 1964, 1980, 2000, 2020.

The above tables indicate that agriculture is going to show the largest tonnage volume increase with wood products showing more of

Table 13. Estimated Crop Production, 1959-61 and Projection for 1980, 2000 and 2020, Willamette River Basin, Oregon.

Crop Product	Unit	1959-61 [1]	1980	2000	2020
		Thousands	Thousands	Thousands	Thousands
Small grains and corn: Total	Tons	336.9	541.2	746.9	979.6
Wheat	Tons	93.2	139.4	-----	-----
Barley	Tons	105.9	143.3	-----	-----
Other [2]	Tons	137.8	258.5	-----	-----
Other grain [3]	Acres	9.5	6.7	-----	-----
Potatoes	Cwt.	590.3	924.4	1,275.7	1,673.2
Hay	Tons	330.8	462.5	638.2	837.1
Hops	Lbs.	4,157.7	4,159.8	5,740.5	7,529.2
Forage seeds:					
Total	Lbs.	205,259.0	193,800.0	267,444.0	350,778.0
Ryegrass	Lbs.	155,870.0	125,970.0	-----	-----
Other [4]	Lbs.	49,389.0	67,830.0	-----	-----
Mint	Lbs.	625.3	875.4	1,208.1	1,584.5
Vegetables:					
Total	Cwt.	6,614.3	11,896.1	16,416.6	21,531.9
Snap beans	Cwt.	1,867.3	3,925.7	-----	-----
Sweet corn	Cwt.	1,855.6	3,806.8	-----	-----
Other [5]	Cwt.	2,891.3	4,163.6	-----	-----
Fruits and nuts:					
Total	Tons	112.0	189.7	261.8	343.4
Strawberries	Tons	35.7	70.2	-----	-----
Other berries	Tons	20.5	39.8	-----	-----
Filberts	Tons	9.5	9.5	-----	-----
Other [6]	Tons	46.3	70.2	-----	-----

[1] Base period data are from Statistical Reporting Service, U.S.D.A. Portland, Oregon and the Extension Service, Oregon State University, Corvallis.

[2] Rye, oats and all corn.

[3] Speltz, cheat and other miscellaneous grains including experimental grain crops.

[4] Clover, fescues, bentgrass, Austrian peas, bluegrass and vetches.

[5] Asparagus, broccoli, carrots, lettuce, cabbage, cauliflower, cucumbers, onions, celery, beets, tomatoes, and squash.

[6] Apples, cherries, pears, peaches, prunes, plums, grapes and walnuts. Economic Research Service, Portland, Oregon.

Economic Base Study, Willamette Basin Task Force, page A46.

Table 14. Food and Kindred Products Employment, 1960, and Projections for 1980, 2000, and 2020, Willamette River Basin, Oregon.

	Number of Employees			
Year	Upper subarea	Middle subarea	Lower subarea	Total
1960	1,372	4,319	9,116	14,807
1980	1,050	4,070	8,040	13,400
2000	1,050	3,310	6,540	10,900
2020	770	2,430	4,800	8,000

Economic Research Service, Portland, Oregon

Economic Base Study, Willamette Basin Task Force, page A59.

Table 15. Estimated Production of Forest Products, Willamette River Basin, 1963-2020.

		Lumber and Wood Products			
		Lumber	Plywood Veneer	Misc.	Pulp and Paper
		MM.bd.-ft.	MM.sq.ft, $\frac{3}{8}$"	MM. bd.-ft.	Thousand Tons
1963	Lower Basin	671	432	34	517
	Middle Basin	1198	1734	66	234
	Upper Basin	1240	1348	100	123
	Total	3109	3514	200	874
1980	Lower Basin	347	650	39	945
	Middle Basin	798	2645	77	430
	Upper Basin	827	2105	116	225
	Total	1972	5400	232	1600
2000	Lower Basin	198	620	34	1080
	Middle Basin	440	2550	66	450
	Upper Basin	462	2030	100	270
	Total	1100	5200	200	1800
2020	Lower Basin	162	620	27	1080
	Middle Basin	360	2550	53	450
	Upper Basin	378	2030	80	270
	Total	900	5200	160	1800

Economic Base Study, Willamette Basin Task Force, page B26.

Table 16. Employment in Forest Product Industries, Willamette Basin Study Area[1/], 1964, 1980, 2000, 2020.

	Basin Area	Lumber and Wood Products	Paper and Allied Products	Total
1964	Lower	7,547	3,705	11,252
	Middle	11,040	1,230	12,270
	Upper	15,080	302	15,382
	Total	33,667	5,237	38,904
1980	Lower	5,850	4,000	9,850
	Middle	9,300	1,200	10,500
	Upper	12,400	300	12,700
	Total	27,550	5,500	33,050
2000	Lower	4,375	3,500	7,875
	Middle	7,100	1,100	8,200
	Upper	9,500	300	9,800
	Total	20,975	4,900	25,875
2020	Lower	3,750	3,200	6,950
	Middle	6,500	900	7,400
	Upper	8,600	300	8,900
	Total	18,850	4,400	23,250

[1/] Columbia County not included.

Economic Base Study, Willamette Basin Task Force, page B28.

a shift than an increase, other than in the area of pulp and paper. Employment projections for these industries indicate that the current production locations will tend to remain constant.

Table 5, page 20, establishes the basic shipping pattern for each of these industries. The food and kindred product industry depends heavily upon motor transport, particularly private truck, while the lumber industry relies heavily upon rail movement. The development of new high volume, multiple use car rates in the food industry may alter the pattern to some extent; however, transport trends here will depend more on where new markets develop. Much of the difference in the two industries is dictated by the locations and concentrations of shippers and receivers. The paper industry tends to ship to a few less geographically diversified markets in greater volume than the food industry which generally has restricted distribution warehouse capacity, particularly for frozen foods, and tends to ship direct to chain store warehouses, often in part lot loads.

The basic decision in the food industry as to form of transport used will most often be made on the basis of the level of usage that can be developed from the industry's transports. Table 17, Computational Guide to Daily Operating Costs, which was developed from the actual cost data of a major Northwest food firm, provides for the computation of operating costs per hour where refrigerated transports are

Table 17. Computational Guide to Daily Operating Costs. *

	$\frac{a + AC}{hr}$ ($\frac{54.151+11.35}{hr}$) [2/]	w [1/] ($4.48)	f_1 ($2.69)	f_2 ($.375)
1	$ 65.50	$ 4.48	$ 2.69	$ .38
2	32.75	9.96	5.38	.75
3	21.83	13.44	8.07	1.13
4	16.38	17.92	10.76	1.50
5	13.10	22.40	13.45	1.88
6	10.92	26.88	16.14	2.25
7	9.36	31.36	18.83	2.63
8	8.19	35.84	21.52	3.00
9	7.28	40.32	24.21	3.38
10	6.55	44.80	26.90	3.75
11	5.95	49.28	29.59	4.13
12	5.46	53.76	32.28	4.50
13	5.04	58.24	34.97	4.88
14	4.68	62.72	37.66	5.25
15	4.36	67.20	40.35	5.63
16	4.09	71.68	43.04	6.00
17	3.85	76.16	45.73	6.38
18	3.64	80.64	48.42	6.75
19	3.45	85.12	51.11	7.13
20	3.28	89.60	53.80	7.50
21	3.12	94.08	56.49	7.88
22	2.98	98.56	59.18	8.25
23	2.85	103.04	61.87	8.63
24	2.73	107.52	64.56	9.00

To compute TC_d sum the various time factors on the specific run in question, and using these time factors sum the input cost for each time factor and divide by the total number of hours actually involved.

[1/] Be certain to convert all premium time to straight time: e.g. 4 hours at 1-1/2 times becomes 6 hours.

[2/] $a + AC$ are always $65.50 and must be totaled in as such.

* Transportation Research and Marketing Computational Procedures for Time Correlated Costs.

$4.48 = fully costed wage
f_1 = diesel fuel/hour of operation, State and Federal tax included.
f_2 = gasoline for each hour of refrigeration, State and Federal tax included.

required.[18] In this model a = total fixed cost: depreciation, maintenance, insurance and license costs; AC = accessorial costs: telephone, rent, supervision, scale fees, etc.; w = actual fully costed wage; f_1 = diesel fuel per hour of tractor operation; f_2 = gasoline per hour of refrigeration operation. Utilizing the costs given in Table 17 it can be seen that on a 14 hour run from Portland to San Francisco (where 16 hours wages are paid and 14 hours fuel is consumed) a total transport cost is incurred of $65.50 + $71.68 + $37.66 + $6.00 = $180.84 or only $.277 per mile on the 652 mile run. Likewise, lengthening the run to Los Angeles, or 24 hours wages and 22 hours tractor usage, it is possible to develop a cost of $65.50 + $107.52 + $59.18 + $9.00 = $241.20 or $.247 per mile on a 976 mile run.

Recognizing the geographic diversification of the food market plus the desirability of institutional control, it will be desirable to transport food and kindred products by motor transport, particularly private transport, as long as traffic on the freeway systems allows the maintenance of reasonable speed performances.

With increased rail capacity in the form of 100 ton, high speed

---

[18] This is a non linear cost model estimating total cost on the basis of time correlated costs. See (4, p. 43) for a discussion of non-linear costs. This procedure varies from the usual cost procedure where $C_M = TC/TM$ (C_M = Cost per mile).

cars and increased truck capacity in the form of new multiple lane North-South freeways, increased transport requirements should not create any substantial burdens on the transport system in either of these transport mediums.

Turning to the other basic commodity groups it is possible to suggest, utilizing Tables 5 and 6 in conjunction with the computational guide, that as the distance increases the decision to use rail or air, in comparison to motor truck, will be determined by the value of the commodity and the nature of the market. Where distribution loads are required trucks will continue to dominate; where large volume shipments can be destined to a single receiver, such as the 1,000,000 pound canned goods movement, the rail will predominate. Air freight will dominate relatively dense, high value moves.

In view of the fact that continuing rate competition in the market indicates that there tends to be a surplus of transport facility over time, and in view of the fact that the survey of Willamette Basin manufacturers and processors indicated general satisfaction with service, it appears safe to assume that the interests of the community are being served by the present competitive transport complex. However, it appears that there may well be a restriction developing in rail terminal facilities which are being constrained by urban growth and community zoning restrictions. It may well benefit the total community if attention is turned to the development of freight

terminal facilities to handle future switching loads.

Nothing in the above considers the potential of the Willamette River as a navigable waterway. This omission reflects the absence of usable general commodity transport on the river at the present. In the absence of any volume commodity, such as wheat on the Columbia, which could be readily adapted to bulk handling on the river, the commodities available for river transport are processed or manufactured goods originating from off-river firms, such as paper, seed, plywood and similar commodities moving in relatively high volumes.

To determine the feasibility of water transport for these commodities it was necessary to determine what economic advantage, if any, would accrue to the use of barge for the movement of these commodities. In the absence of good data on the cost of navigation on the Willamette River it was necessary to consider the possibility of water transport from a different point.

Using the data generated on daily truck costs and loading performance figures developed from common carrier data, it was possible to develop a comparative cost model which defined the residual monies available for water transport over the alternative procedure of handling goods direct by truck to Portland.

In the development of the comparative cost model the following assumptions were made:

1. That all tonnage would occur off river, but all plants would be within 1/2 hour travel time of the river.

2. That all firms within the Willamette Basin are within two hours of Portland via the freeway.

3. That the established freight handling performance figures for the trucking industry would be valid estimates of cross dock cargo handling performance at the barge docks and at the terminal facilities in Portland.

Such movements, if they were available, would require a truck movement to the river and then a rehandling to the barge.

Assuming a loading performance of 7500 pounds per man hour on packaged goods[19] and an average movement of 30 minutes by truck from plant to river facility compared to a maximum 2 hour run from any point in the valley to Portland docks, the cost of using the river became:

$$TC_R = (.5)(Trc_{hr}) + (\frac{GW}{7500})(Trc_{hr}) + (\frac{GW}{7500})(RFHC_{hr})(2)$$

$$+ BC + (\frac{GW}{7500})(BHC_{hr}) + (\frac{GW}{7500})(\Delta_{hr})$$

[19] 7500 pounds per man hour is the average full load production figure for 12 major regular route common carrier terminals in the West.

where

TC_R = Total cost river

$.5\ Trc_{hr}$ = Truck cost for 30 minutes over-the-road run

GW = Gross weight of product

7500 = standard production per man hour

Trc_{hr} = Truck cost per hour

$RFHC_{hr}$ = River facility handling cost/hour

2 = Number of handlings at river - once off truck, once on barge[20]

BC = Barge transport cost

BHC_{hr} = Barge loading and unloading cost/hour

Δ = Port terminal handling cost

and the real revenue available for the use of the river becomes:

$$TC_R = (2)(Trc_{hr}) + (\frac{GW}{7500})(Trc_{hr}) + (\frac{GW}{7500})(\Delta_{hr})$$

$$-[(.5)(Trc_{hr}) + (\frac{GW}{7500})(Trc_{hr}) + (\frac{GW}{7500})(RFHC_{hr})(2)$$

$$+ (BC) + (\frac{GW}{7500})(BHC_{hr}) + (\frac{GW}{7500})(\Delta_{hr})].$$

By subtracting the common terms this gives:

$$TC_R = (1.5)(Trc_{hr}) - [(\frac{GW}{7500})(RFHC_{hr})(2) + BC + (\frac{GW}{7500})(BHC_{hr})].$$

Assuming a 45,000 pound load and using the cost data from the

[20] This assumes a requirement to stockpile inventory at the barge facility. Cost would be reduced by one handling if loaded directly to the barge.

computational guide, less refrigeration costs, for a 16-hour day of

$$\frac{\$65.50 + \$71.68 + \$43.04}{16} \quad \text{or} \quad \$11.26 = \text{Trc}_{hr}$$

it becomes possible to compute a dollar figure available for the river transport less the capital cost of handling facilities which cannot be estimated from the data available.

Thus the money available for a river system is equal to

$$(1.5)(11.26) - [(\frac{45,000}{7500})(\text{RFHC})(2) + (\text{BC}) + (\frac{45,000}{7500})(\text{BHC}_{hr})]$$

which equals

$$\$16.89 - [(6)(\text{RFHC})(2) + (\text{BC}) + (6)(\text{BHC})].$$

From the above it can be clearly seen that from the beginning there was only $16.89 to handle 45,000 pounds twice and move it to Portland. The added handling cost alone would add 18 hours labor, which at $4.48 would add $80.64. There is no residual for river handling if the goods must first be trucked to the water.

There is no potential usage of the river where packaged goods originate off the river and must be handled off of motor transports as an alternative to trucking them to Portland which is only two hours away from any point in the basin by truck.

Any further development of river navigation must then be

predicated on a continuation of the present levels of usage unless some new commodity, not now seen, develops. This does not mean an upgrading of, or replacement of the present facility is not justified, but rather that the justification must be made on the basis of existing traffic volumes as far as the transport requirements of the Willamette Basin are concerned.

CHAPTER V

SUMMARY

The study of Willamette Basin processors and manufacturers revealed that the Willamette Basin has an adequate transport service in terms of physical facilities, new technologies, and rate-making concepts. The Willamette Basin is a disadvantaged area in terms of location. Demand markets of any magnitude for Willamette Basin commodities are distant and these markets usually have alternative sources of supply in closer proximity.

New rail and truck technologies are putting these markets closer both in terms of time and cost. For many of the larger industries the new multiple car rates may well help overcome locational disadvantages. At the same time the promise of new jumbo air transports may well put premium produce of the Willamette Basin fields and ocean into distant markets at competitive prices.

The area of greatest restriction to future transport growth appears to be terminal facilities. The most effort should be devoted to the development of new high capacity, integrated, inter-modal terminals creating a facility where Oregon shippers can exploit the transport media most capable of serving any specific need best. Evidence of this restriction is fragmentary and the compilation of

extensive data in this area was beyond the scope of this investigation. However, the hypothesis must be advanced that investments in intermodal terminal facilities could play a major role in future development of the Willamette Basin's resources.

The Willamette Basin transport sector is growing with the Willamette Basin's needs. With projections showing more of the same for most Willamette Basin industries, indications were that transport growth would continue along present trend lines. There was no suggestion of either phenomenal transport growth or impending transport problems. The substantial increase in physical capacity of rail cars resulting from recent technological innovations and the promise of greater truck capacity resulting from legislative changes promise substantial added capacity without any great increase in vehicle numbers.

Development of the Willamette River as a navigable waterway showed no promise. Alternative forms of transport offer Willamette Basin manufacturers and processors greater potential economy than the river.

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APPENDICES

APPENDIX I

WILLAMETTE BASIN INDUSTRIAL INVENTORY

FIRM -

Principal product or products manufactured or processed?

_____

_____

1965 gross annual sales: Estimated $_____

or

Actual $_____

Market areas served? (Estimate by percentage of gross annual sales)

Willamette Basin	_____%	Colorado	_____%
		Wyoming	_____%
Oregon other than Willamette Basin	_____%	New Mexico	_____%
Washington	_____%	Hawaii	_____%
California	_____%	Alaska	_____%
Other Western states -		Balance of U.S.	_____%
Idaho, Montana	_____%	Foreign	_____%
Utah, Nevada	_____%	TOTAL	100%
Arizona	_____%		

1. How many plants does your company operate? _____

2. With respect to the plant's present ownership, was this plant established as a new business, branch plant, plant relocated from outside the Willamette Basin, or has it been acquired by the company subsequent to its establishment?

_____New business

_____Branch plant

_____Relocated plant: Original location? _____

_____

_____Acquired subsequent to establishment.

How long ago ?_____

Initial product or service of original plant?

_____

3. Why was this plant located in the Willamette Basin? _____

_____

_____

4. Have manufacturing activities at one time carried out in this plant been transferred to non-Willamette Basin locations, or has expansion of certain manufacturing activities originally carried out in this plant resulted in the establishment of new operations in non-Willamette Basin locations?

_____Yes _____(Specify transferred or expanded)

_____No _____Unknown

5. Is there any likelihood of this plant being relocated or a new plant being built producing similar products outside of the Willamette Basin in the forseeable future?

_____Yes _____No _____Unknown

6. For a company in your line of manufacturing, what are the major disadvantages of a Willamette Basin location? _____

_____

7. For a company in your line of manufacturing, what are the advantages of a Willamette Basin location? _____

_____

_____

8. Would you consider your line of manufacturing "footloose" in the sense that location is not of particular importance for the firm's success -- it might be equally profitable in almost any State (except Alaska and Hawaii)?

_____Yes _____No _____Unknown

9. How are your products moved from plant to buyer? (Estimate percentage for each type of carrier. Include transportation on f.o.b. sales.)

Company's truck	_____%	Railroad other than piggy back	_____%
Customer's truck	_____%	Air	_____%
Leased truck	_____%	Water	_____%
Contract carrier	_____%	Parcel post	_____%
Motor freight	_____%	Other	_____%
Piggy back	_____%	Total	100 %

10. Do you consider transportation services in the Willamette Basin adequate for your needs?

_____Yes _____No _____Unknown

Completed by _____

Title _____

OSU-WB-3 (USE BACK OF SHEET FOR FURTHER COMMENT IF DESIRED)

APPENDIX II

AIRPORT ACTIVITY IN THE WILLAMETTE BASIN

The following pages show activities at the four major airports in the Willamette Basin - Portland International, McNary Field - Salem, Mahlon Sweet - Eugene, and Corvallis Municipal.

PORTLAND INTERNATIONAL AIRPORT

TOTAL TRAFFIC AT THE PORTLAND INTERNATIONAL AIRPORT 1941 THROUGH 1966 [1/]

Year	PASSENGERS IN AND OUT	MAIL (TONS)	AIR EXPRESS (POUNDS)	AIR FREIGHT (POUNDS)	TOTAL AIR CARRIER OPERATIONS	LOCAL AND ITINERANT GENERAL AVIATION
1941	99, 000 *	(1)	(1)	(1)	(1)	(1)
1942	106, 000 *	"	"	"	"	"
1943	166, 000 *	"	"	"	9, 151	"
1944	165, 000 *	"	"	"	13, 075	"
1945	205, 000 *	"	"	"	17, 787	"
1946	235, 000 *	"	"	"	27, 465	"
1947	285, 000 *	"	"	"	34, 171	"
1948	310, 000 *	"	"	"	33, 125	"
1949	370, 000 *	"	"	"	34, 145	31, 346
1950	399, 000 *	"	"	"	34, 336	31, 758
1951	388, 000 *	"	"	"	37, 437	52, 692
1952	471, 008 *	1,580.6	1, 851, 962	5, 126, 690	37, 207	46, 504
1953	490, 375	1, 576.8	1, 805, 788	5, 754, 927	42, 816	49, 795
1954	544, 742	1, 866.4	1, 598, 250	5, 837, 251	46, 888	54, 398
1955	626, 026	1, 902.6	1, 622, 706	8, 243, 136	50, 198	55, 165
1956	653, 829	2, 053.6	1, 760, 689	8, 671, 490	48, 335	55, 549
1957	720, 282	1, 996.5	1, 486, 521	9, 740, 150	50, 884	31, 376
1958	746, 617	1, 985.5	1, 629, 487	11, 107, 087	54, 014	40, 793
1959	862, 515	2, 224.9	1, 862, 759	12, 066, 084	59, 644	37, 507
1960	895, 707	2, 441.0	1, 845, 465	13, 373, 973	59, 190	35, 803
1961	903, 709	3, 660.1	1, 870, 515	15, 506, 988	51, 280	39, 474
1962	954, 942	4, 206.4	2, 030, 587	19, 439, 469	51, 972	41, 661
1963	1, 053, 354	4, 201.5	2, 012, 878	22, 326, 745	53, 800	48, 883
1964	1, 240, 019	4, 651.5	2, 318, 254	27, 161, 173	55, 066	52, 397
1965	1, 466, 004	5, 558.7	2, 610, 685	31, 621, 218	57, 384	57, 776
1966	1, 623, 678	5, 838.9	2, 794, 725	32, 214, 858	59, 722	76, 894

(1) Figures not available

* Estimates

Air Carriers at Portland International Airport: The Flying Tiger Line, Northwest Orient Airlines, Pacific Air Lines, Pan American World Airways, West Coast Airlines, Western Airlines, United Air Lines, Eastern Airlines, Braniff Airlines and Continental Airlines.

[1/] Data furnished by the Port of Portland.

TOTAL AIR ACTIVITY AT MC NARY FIELD, SALEM, OREGON, 1966[1/]

	PASSENGERS			AIR MAIL (Pounds)		AIR EXPRESS (Pounds)		AIR FREIGHT (Pounds)		
1966	ON	OFF	TOTAL	ON	OFF	ON	OFF	ON	OFF	TOTAL
January	368	421	789	3246	5161	2105	3619	16, 135	16, 263	46, 529
February	436	450	886	3219	6902	2086	2983	7, 786	10, 914	33, 890
March	504	522	1026	3782	8519	2758	3418	15, 823	16, 655	50, 955
April	554	594	1148	3998	7312	3323	4032	12, 804	20, 344	51, 813
May	677	609	1286	4225	7173	2966	3858	13, 548	20, 298	52, 068
June	707	737	1444	4185	4263	3364	3689	18, 001	18, 590	52, 092
July	360	292	652	2231	1001	3145	2528	4, 928	7, 205	21, 038
August	362	334	696	2427	2549	3425	3720	14, 169	8, 160	34, 450
September	591	572	1163	4012	6264	3046	3676	13, 685	18, 469	45, 152
October	536	580	1116	4442	8394	1872	3169	13, 404	20, 669	51, 920
November	501	464	965	3952	7940	1759	3332	14, 144	15, 790	46, 917
December	580	518	1098	7215	7717	2005	4636	13, 821	21, 782	57, 176
TOTAL	6176	6093	12, 269	46, 934	73, 465	31, 854	42, 660	158, 248	195, 139	548, 300

Note - Lower figures in July and August reflect strike against United Air Lines which began 7-8-66, terminated 8-29-66.

[1/] Data furnished by air carriers operating out of Salem, Oregon.

TOTAL AIR ACTIVITY AT THE CORVALLIS MUNICIPAL AIRPORT, CORVALLIS, OREGON, 1966[1/]

1966	PASSENGERS			AIR MAIL (Pounds)		AIR EXPRESS (Pounds)		AIR FREIGHT (Pounds)		
	ON	OFF	TOTAL	ON	OFF	ON	OFF	ON	OFF	TOTAL
January	258	342	600	1953	----	904	935	1749	9209	14,750
February	311	315	626	1558	----	788	2270	1426	7012	13,054
March	334	489	823	2049	----	824	2578	4012	7094	16,557
April	307	379	686	2310	----	941	2485	2503	7049	15,288
May	423	430	853	2349	----	1160	2585	3622	7846	17,562
June	541	611	1152*	1798	----	1176	3856	6315	6332	19,477
July	285	264	549	1562	----	467	2229	3320	2465	10,043
August	305	298	603	1569	----	778	2157	1891	4410	10,805
September	327	503	830	1733	----	973	2717	2958	9644	18,025
October	275	281	556	1807	----	1516	3250	2336	9421	18,330
November	370	321	691	2497	----	1665	2341	2968	6810	16,281
December	338	287	619	6055	----	1036	3441	1781	9598	21,911
TOTAL	4074	4514	8588	27,240	----	12,228	30,844	34,881	86,890	192,083

Note - Cargo both ways in and out averages 95% to/from Portland, 5% to/from San Francisco.

* 20 year record figure.

1/ Data furnished by West Coast Airlines, Corvallis, Oregon.

TOTAL AIR ACTIVITY AT MAHLON SWEET FIELD, EUGENE, OREGON, 1966[1/]

	Passengers			Air Mail (Pounds)		Air Express (Pounds)		Air Freight (Pounds)		Air Cargo (Pounds)		
1966	On	Off	Total	On	Off	On	Off	On	Off	On	Off	Total Pounds
January	3,451	3,580	7,031	21,174	12,982	3,692	7,085	23,720	31,865	48,586	51,932	198,036
February	3,559	3,541	7,099	21,199	15,679	3,212	6,275	22,416	31,535	46,927	53,489	200,732
March	4,076	4,034	8,110	18,877	17,008	2,771	6,744	29,711	45,564	51,359	69,316	241,350
April	3,804	3,734	7,538	22,747	17,144	8,236	5,948	40,974	39,240	71,777	62,332	268,398
May	4,447	4,492	8,939	23,049	16,555	4,845	7,205	56,627	40,832	84,521	64,592	298,226
June	4,937	4,822	9,759	21,731	16,559	5,360	9,206	51,966	48,127	79,057	73,892	305,898
July	2,899	2,792	5,691	21,170	9,041	2,866	5,144	23,385	15,275	47,241	29,460	153,582
August	3,256	3,576	6,831	21,828	12,397	4,686	7,986	20,582	25,876	47,096	46,259	186,710
September	4,198	4,448	8,646	23,944	23,524	3,907	10,909	29,756	53,385	57,607	87,818	290,850
October	4,368	4,222	8,590	21,398	17,118	6,024	8,598	38,924	38,287	66,346	64,003	260,698
November	4,261	4,567	8,828	25,544	18,558	4,112	7,646	30,029	39,430	59,685	65,634	250,638
December	4,599	5,000	9,599	38,613	30,990	4,350	12,325	39,470	42,013	82,433	85,328	335,522
TOTAL	47,855	48,807	96,662	281,374	207,555	54,061	95,071	407,380	451,429	742,815	754,055	2,993,740

[1/] Data furnished by City of Eugene, Airport Department, Mahlon Sweet Field.

APPENDIX III

CARRIER FURNISHED INFORMATION ABOUT RAILROAD SERVICE IN THE WILLAMETTE VALLEY

Due to the difficulties involved in measuring short segments of a total transportation system each rail carrier providing direct service to the Willamette Basin was asked to contribute a statement on the service provided the Willamette Basin. These statements follow:

1. Information about the Southern Pacific and Service to Willamette Valley; Mr. Henry M. Ortiz, Public Relations Manager- N.W., Southern Pacific Company, Portland, Ore.

2. Information about the Portland Terminal Railroad Company, Portland, Oregon; Mr. J.H. Jones, Manager Portland Terminal Railroad Company, Portland, Ore.

3. Union Pacific Railroad Service in the Willamette Valley; Mr. George Skorney, Union Pacific Railroad Public Relations Department, Portland, Oregon.

4. Information about the Oregon Electric Railway and its Service to the Willamette Valley; Spokane, Portland and Seattle Railway Company; Mr. R. A. Lawrence, Traffic Manager, SP and S Railway, Portland, Oregon.

INFORMATION ABOUT SOUTHERN PACIFIC AND SERVICE TO WILLAMETTE VALLEY

Rail Lines

" Portland is northernmost terminal of the SP system covering 14,000 miles in 12 states and extending from the Pacific Coast to St. Louis and New Orleans.

The main SP line from Portland to California and transcontinental points runs through the heart of the Willamette Valley via Oregon City, Salem, Albany, Eugene, Springfield and on to Oakridge and Klamath Falls.

Lines also extend from Portland, via Milwaukie and Lake Oswego, to Beaverton, Hillsboro, Forest Grove and Tillamook and the west side of the valley to Newberg, McMinnville, Corvallis and Albany.

East valley lines from Woodburn serve Molalla, Silverton, Stayton and Lebanon.

The Coos Bay line and the Siskiyou line serve outlying Eugene, including Cottage Grove.

There are approximately 600 miles of SP track serving the valley commerce, industry and agriculture.

Southern Pacific Objectives

To provide the best possible transportation service at lowest possible cost to enable Oregon agriculture and industry to compete with producers who by geographical advantage are so much closer to the major population centers and markets of the East and Midwest.

Since 1957, as a result of capital improvements in Oregon and the rest of the system, SP has helped produce rate savings to Oregon shippers totaling $108,440,000. While consumer items increased 9 percent in costs from 1956 to 1965, the cost of Southern Pacific rail freight service to Oregon users declined 11.3 percent.

Rail Service

SP offers daily service to all shippers and receivers in the Willamette Valley and other parts of Oregon. Local freight trains in branch and main line service distribute inbound freight and empty cars and pickup products for placement in long distance trains moving out of Portland or Eugene in proper blocks for destination within 24 hours after release by shippers.

Eugene Yard

Nearly all traffic moving via SP lines to and from the Pacific Northwest moves through SP's modern classification yard at Eugene,

where shipments are sorted by electronic and computer controls according to destination.

Ten years ago, as common practice at nearly all rail terminals, cars were sorted by large numbers of switch engines, a costly and time consuming process. When 75 or so cars for the same general direction were accumulated they would go out in a train for subsequent sorting at intermediate points.

Today cars are sorted automatically. Pushed to a crest, they roll by gravity toward 32 separate classification tracks. Track retarders, controlled by a radar-computer system, govern the rolling speed of the cars so they couple at proper speed with other cars on the makeup track.

Cars are blocked for distant destinations to minimize further handling and permit trains to bypass other major terminals. Trains from Oregon move, in many cases, in such fashion to points such as Los Angeles and to terminals on connecting railroads well beyond interchange points.

Freight Schedules

The Southern Pacific operates numerous trains to/from the Willamette Valley daily, including identified trains listed, plus extra sections and others as traffic fluctuates.

SB	PSSE (Portland-Sunset Eagle)	To Roseville - SW
	PNL (Pacific NW - Los Angeles)	To Los Angeles
	SMW (Shasta Manifest - West)	To Roseville-No. Calif.
	SSMW (Stockton Shasta Manifest West)	To Roseville-San Joaquin Vly.
	BAS (Bay Area Special)	To San Francisco and Coast
	OS (Oregon Special)	To Ogden
	377-PCW (Pacific Coast Expediter)	Piggy-back manifest to Oakland
	TFC Special	Piggy-back manifest to Los Angeles

NB	OPS (Oakland - Portland Special)	From Oakland
	NCP (North Coast Perishable)	From San Joaquin Valley
	NWS (Northwest Special)	From Ogden
	378-PCE (Pacific Coast Expediter)	From Oakland
	376 (Starpacer)	From Los Angeles
	366 (Advanced Starpacer)	From Los Angeles

Also as needed X-Mugs - Special trains of empties (box and flats) for Oregon to augment empties sent on other trains or which develop empty after unloading in Oregon.

Piggyback Ramps

Portland)
Salem) Provides pickup and delivery piggyback service
Albany) to all points in the Willamette Basin
Eugene)

(Other Ramps: Coos Bay, Roseburg, Medford, Klamath Falls)

Switching - Local Service

SP operates 70-80 road switch engines to meet local service requirements in the valley. These are based mainly at Portland, Eugene, Oregon City, Canby, Woodburn, Salem, Lake Oswego, Beaverton, Forest Grove, Dallas, Albany, Corvallis, Lebanon.

Southern Pacific Employment

Portland - 1200
Eugene - 1500
Albany - 70

Lesser numbers of employees at other points. Willamette Valley is estimated at about 3,000. "

INFORMATION ABOUT THE PORTLAND TERMINAL RAILROAD COMPANY, PORTLAND, OREGON

"The Terminal Company is a switching company and owns no freight or passenger cars and operates no main line trains of its own.

It has approximately 90 miles of trackage located in the Northwest area of Portland and offers daily switching service to approximately 250 industries located on 180 industry spur tracks. To perform this work requires an average of 30 switching crews on a 24 hour daily basis.

The Union Station is operated by the Portland Terminal Railroad Company (formerly the Northern Pacific Terminal Company) a company which was incorporated August 22, 1882, under the laws of the State of Oregon. In addition to operating the Union Station, the Company maintains the Station Building, receives all passenger trains that operate into Portland, transferring baggage and mail to trains for movement beyond Portland, unloads and delivers baggage to passengers terminating at Portland, unloads and delivers mail to the United States Post Office Department, mail terminating at Portland for post office distribution to Portland and vicinity. Also, the same handling is applied to shipments by REA Express Agency.

The Union Station is a city within itself. It has a restaurant, cocktail lounge, police station, barber shop, shoe shine stand, news stand, ticket office and reservation bureau, U.S. Post Office Annex,

telegraph office, steam generating plant, the only electric interlocking plant on Portland's west side, and in addition, many railroad offices for various departments on the second and third floor of the station.

The Terminal Company also cleans, services, inspects and makes necessary repairs to all but two of the passenger trains that operate in and out of Portland.

Material and supplies required by this company amounts to over $725,000 per year, 65 percent of which is purchased on the local markets.

Baggage handled in one year amounts to approximately 700,000 pieces. U.S. Mail handled in one year amounts to approximately 6,000,000 pieces.

The Terminal Company also handles over 750,000 freight cars per year that terminate in Portland, originate in Portland, and for points in all of the continental United States, Canada, and Mexico. It has an average payroll of 800 employees who receive an annual gross payroll of about $6,000,000, the bulk of which is spent in Portland and the immediate vicinity."

UNION PACIFIC RAILROAD SERVICE IN THE WILLAMETTE VALLEY

"The Union Pacific Railroad serves 13 states west of the Mississippi with 10,057 miles of mainline track, a steel highway that provides the most direct transportation route from the West Coast to the Midwest.

Portland is the headquarters of the Union Pacific's Northwestern District, which consists of all the trackage in Oregon, Washington, Idaho and Montana, a branchline to Wells, Nevada, and the mainline as far east as Granger, Wyoming.

The Union pacific has approximately 3600 employees in Oregon, 1880 of them in the Portland area. The railroad's annual payroll in the state is over $26 million and it pays $1.7 million in property and state taxes each year.

In the Northwestern District, the Union Pacific serves Butte, Montana; all the major cities of Southern Idaho; all of Northern Idaho, connecting with the Canadian Pacific through the UP's subsidiary line, the Spokane International; all of Eastern Washington, including Walla Walla and Spokane; Central Washington to Yakima; all the cities in Northern Oregon from Huntington to Portland; Southwestern Oregon from Ontario to Burns; Central Oregon from The Dalles to Bend; north from Portland to Tacoma and Seattle, and west from Centralia, Washington to Grays Harbor.

In Portland, the Union Pacific has freight connections with four major rail lines: Northern Pacific, Great Northern, Southern Pacific and Spokane, Portland and Seattle. Union Pacific is a joint owner with the Southern Pacific in the operation of the Portland Traction Company, a 52-mile freight line which serves industries in Portland and Gresham in East Multnomah County. Union Pacific is also part owner with the Northern Pacific and Southern Pacific of the Portland Terminal Railroad Co., which operates industrial rail lines in the city and Union Station.

Albina Yard, on the east side of the Willamette River in Portland, is the Union Pacific's largest freight terminal in the Northwest. Approximately 3000 freight cars are handled daily through the yard. Trains are assembled here for through movement to the UP's huge hump yard at North Platte, Nebraska, where they are reclassified for movement to connecting lines in the Middle West, South or East.

In addition to Albina Yard itself, UP has 25 miles of terminal trackage to industries on the east side of the Willamette River. UP serves the three tidewater grain elevators, Albina Dock, Swan Island Industrial Park, Municipal Terminal No. 4 and Rivergate Industrial District. Along N. Swift Blvd., near Rivergate, UP is developing its Barnes Industrial District. The area has been graded and 50 acres will be available for purchase by industry after streets and lead tracks are built.

The Rockwood Industrial District, which the Union Pacific owns and is developing at NE 181st Ave. and Interstate 80N, is outside the Portland terminal area. UP has 90 acres of developed land available for industry and 100 more acres set aside for future use. Nine large firms have bought land and built warehouses at Rockwood. The district adjoins the UP mainline.

Freight Schedules

SPX (Seattle-Portland Expedite). Daily, Portland to Council Bluffs and Kansas City.

East local, daily, Portland to The Dalles.

Advance SPX, one to four sections, daily, Portland to Council Bluffs and Kansas City.

Advance 126. Daily, Portland to Pocatello to connect with Salt Lake City and Los Angeles.

No. 126. Monday through Friday, Portland to Pocatello.

Washy. Daily, Portland to Spokane, Wallace, Kellogg and Milwaukee interchange.

Farley turn. Daily except Sunday, from Portland along Kenton line to Troutdale.

North Local. Daily except Sunday, Portland to Centralia.

Rocky Point turn. Daily except Monday, Portland to Kelso and Longview.

No. 681. Daily except Sunday, Portland to Tacoma and Seattle.

No. 683. Daily, Portland to Olympia, Tacoma and Seattle.

No. 691. Daily cleanup train, Portland for Longview Junction, Centralia, East Olympia, Tacoma, Black River Junction and Seattle.

No. 684. Daily except Sunday, Seattle to Portland.

No. 690. Daily, Seattle to Portland.

No. 692. Daily, Seattle to Portland.

South Local. Daily except Sunday, Centralia to Portland.

Three or four forwarder trains arrive in Portland daily from Pocatello where they were assembled with freight cars arriving from Council Bluffs, Kansas City. Los Angeles and Salt Lake territories.

Two or three drags arrive in Portland daily from Eastern Oregon and Eastern Washington points with mostly wheat, miscellaneous commodities and empty cars."

INFORMATION ABOUT THE OREGON ELECTRIC RAILWAY AND ITS SERVICE TO THE WILLAMETTE VALLEY

Rail Lines

"The Oregon Electric Railway is an integral part of the Spokane, Portland and Seattle Railway System. It extends from Portland to Eugene, operating via Beaverton, Salem, Albany and Junction City. Branch lines also extend from Forest Grove Junction to Hillsboro and Forest Grove, from Albany to Lebanon and Sweet Home and from Bowers Junction to Vernonia. There are approximately 210 miles of track serving the Willamette Valley industry and agriculture.

The Spokane, Portland and Seattle Railway System is owned jointly by the Great Northern and Northern Pacific Railway Companies, who in turn own 97 percent of the Burlington Lines. Recently the Interstate Commerce Commission approved the merger of these lines into a 27,000 mile railway system which, if it is consumated, will place this new line in a position to give its patrons better service, rates and car supply.

Rail Service

Oregon Electric rail service is geared to the needs of our shippers and receivers of freight in the Willamette Valley. These freight trains distribute inbound freight and empty cars and pickup commodities for the North and East.

Freight Schedules

All trains are operated as extra trains and originate as follows:

Portland to Albany	No. 325
Portland to Eugene	No. 231
Albany to Portland	No. 326
Albany-Sweet Home Turnaround	Local
Albany-Enid Turnaround	Local
Eugene to Portland	No. 230
Sweet Home-Lebanon Turnaround	Local
Portland-Hillsboro-Forest Grove-Vernonia Turnaround	Local

T. O. F. C. Ramps

Portland
Salem
Eugene

Substitute service is also provided from Portland to:

Beaverton
Tigard
Albany
Cornelius
Forest Grove
Hillsboro

Switching Service

Oregon Electric Railway maintains switch engines at Salem, Albany, Sweet Home and Eugene to meet local service requirements.

Oregon Electric Railway has interchange and switching arrangements with the Southern Pacific at Salem Albany, Lebanon and Eugene.

Employment

Oregon Electric employs approximately 200 persons in the Willamette Valley Area.

Industrial Development

On our own Oregon Electric Railway since 1939 we have purchased over 1,230 acres of property at a cost in the neighborhood of 2 million for industrial developmwnt. This includes about 280 acres at Beaverton which we are going to develop into an industrial partk. This will only be accomplished after we have completed a comprehensive engineering study of the property, which will include a proper sanitation system, a water system with sufficient pressure for sprinkling systems, underground utilities, paved street dedications and trackage. Our Declaration of Restrictions under its performance standards will call for the proper type of construction, set-backs, ample off-street parking and landscaping. With this type of planning and restrictions, we will add to the Portland metropolitan area and the State of Oregon an industrial park that will be second to none in the Pacific Northwest. Our over-all cost of development and improvements will be in the neighborhood of $3 million.

This 1,230 acres also includes about 350 acres at Eugene, 75+ acres each at Salem and Albany, and 66 acres at Junction City.

In addition, adjacent to Portland in Washington County, we have a total of 378 acres, namely 141 acres at Tualatin, 132 acres at Bendemeer, and 105 acres at Orenco. On some of these properties are some of the major industries of the Willamette Valley with each contributing substantially through payrolls and taxes to the economy of our State.

We are also now serving the new American Can plant at American, Oregon, which is near Halsey, Oregon. This plant also will eventually be served by the Southern Pacific.

The Spokane, Portland and Seattle Railway Co. is very much interested in industrial development, and in order to accomplish this has a strong Industrial Department and has made these substantial expenditures to secure and develop the land for this purpose. "

APPENDIX IV

RIVER TRANSPORT IN THE WILLAMETTE BASIN[21]

Logs and Log Products

Logs

Rafted logs are only one of the commodities shipped on the upper Willamette River. There are many sources and destinations, but approximately 65 percent of the total logs moved through the locks come from the Canby log dump. Crown Zellerbach ships many fir logs from Molalla to a storage area called "pulp siding" about three miles above the locks. Crown Zellerbach also ships spruce and hemlock from a log dump at Dundee to pulp siding. Spruce and hemlock logs come by truck and rail to the Dundee dump from areas in the Coastal Range. Weyerhauser ships logs from Molalla through the locks enroute to Longview. Logs are shored along the Willamette River in many places and moved as needed. The exact flow of logs or the use of the river as a storage ares is hard to determine; however, there is a strong decrease in log traffic as shown in the following table.

	Willamette River	Willamette Falls	WR-WF
1950	2.69*	1.39	1.30
1955	2.34	1.08	1.27
1960	1.83	.76	1.07
1964	1.75	.67	1.08

* Figures are shown in million short tons.

[21] All tonnages obtained from Corps of Engineers via Waterborne Commerce of the United States (11).

Pulpwood

The decrease in logs may be a result of an increasing use of pulpwood. Pulpwood is small blocks of wood ground in the forest which can be shipped to the mills for use in making paper. It is highly conceivable that the pulpwood could be shipped by barge to the mills. As of present, pulpwood comes to pulp siding by rail, then changes to barges for a three mile trip to the paper mills at the locks. There were no pulpwood shipments in 1960 or prior to that date. A rapid increase is seen in pulpwood movements as shown in the following table.

	Willamette River	Willamette Falls	WR - WF
1962	37 *	37	0
1963	59	54	5
1964	74	74	0

* Figures are shown in thousand tons.

Paper and Kindred Products

All paper products shipped on the river come from the Crown Zellerbach plant at Oregon City. Shipments may go downstream for reloading at Portland or upstream to a railroad dock at the pulp siding location. There appears to be no shipments prior to 1950. 267,000 tons were shipped in 1964, but the tonnages appear to be decreasing.

Waste Materials

Since 1955 there has been an increase of tonnages of waste materials. A very small fraction, 5 percent or less, passes through the locks. Although waste materials are not sub-classified, this commodity is composed almost entirely of paper mill waste matter from Publishers Paper Co. Barges are loaded on the lower side of the falls and then moved to areas in Portland. From 1960 to 1964 the movement averaged about 250,000 tons.

Other

Other wood products, shipped on the Willamette River, include posts, poles, piling, and wood pulp. The posts, poles and piling are usually rafted and moved in this manner. Tonnages have fluctuated a great amount but rarely exceeded 4,000 tons. The shipment of these items is an exception rather than a continuous practice. Approximately 8,000 tons of barged wood pulp pass through the locks, which includes movement in both directions. The upstream movement, however, is terminated at pulp siding.

Ores, Minerals and Products

Limestone

A small amount of limestone (9,000 tons) is being shipped on

the Willamette, but the length of travel on the river is only three miles from pulp siding to the Crown Zellerbach mills. The limestone, as well as clay used in paper production, is quarried in the Southern United States and shipped by rail to the barge loading stations at pulp siding. Research has been made to find local sources of the raw materials, but to this date, poor quality of limestone has been a limiting factor.

The cement plant at Lake Oswego, one of three in the state, was at one time shipping limestone from a quarry near Dallas to its plant in Lake Oswego. Although the shipments were not by water, the possibilities of shipments by water were present. Portland Cement Co. now receives barges of crushed limestone from British Columbia because of a more favorable price.

Sand, Gravel, Crushed Rock

The use of the river in this case is more important as a source, rather than as a means of transportation. The gravel and sand in most cases is dredged near either loading facilities for trucks or operational facilities such as Dayton Sand and Gravel or concrete plants along the river. There are no restrictions as to how much sand and gravel can be removed except in the area around Salem where regulations have been initiated. The Corps of Engineers will make restrictions only where a threat to navigation is seen. Dredging

and hauling of gravel on the upper Willamette and probably the Yamhill River also is done almost exclusively by Bernert Towing Co. Inc., the base of operations being at Wilsonville.

The tonnages on the upper Willamette River are increasing quite rapidly, but since the distance hauled seldom exceeds 1/2 mile, only the resources available are significant. The sand and gravel resources available on the lower Willamette River and on the adjacent Columbia River are large enough that it is highly unlikely that a market would arise which would necessitate gravel shipments from the upper Willamette River to the Portland area via the river.

Building Cement

All cement shipments originate at the Oregon Cement Co. at Lake Oswego. The shipments by river are very fluctuating but may rise as high as 80,000 tons. Present shipments do not pass through the locks and thus have no movement above the falls.

About one percent of all production of cement is shipped by water, trucks being the principal method of transport. Most cement is shipped bulk as opposed to being bagged. The ratio of bulk to bagged is 8: 1 and 7: 1 in 1963 and 1964 respectively. Most shipments were made within the state. The main destination of Portland Cement, as represented by 1964 figures is as follows: 67 percent ready mixed concrete companies; 14 percent concrete product manufacturers;

8 percent general contractors; 8 percent building materials dealers; 3 percent miscellaneous.

Clays and Earths

As previously mentioned, clays and earths are shipped by rail to pulp siding where they are bagged and sent to the Crown Zellerbach mills and to various brick and earthenware manufacturers. There has been a steady increase in shipments, probably in correlation to growth of manufacturing firms rather than a change of type of transportation used.

Year	Willamette River
1950	15 *
1955	25
1960	29
1964	31

* Figures are shown in Thousand Tons.

Note: In 1964 about 8000 tons did not pass through the locks and could be significant of movement on the upper river.

Sulfur

Approximately 10,000 tons of dry sulfur is shipped on the Willamette, the shipments being made to the Crown Zellerbach mills. Publishers Paper also receives sulfur for operations but since most

of the sulfur must be shipped by rail anyway, Publishers Paper does not barge sulfur. The location of Crown Zellerbach necessitates the use of barges from rail terminals to the mill. Shipments at present are short and do not include the upper regions of the Willamette River.

Other

This category includes brick and tile and non-metallic minerals not classified elsewhere. Brick and tile are being shipped through the locks but sources and destinations are not known. The annual shipment is generally between 30 and 70 tons. The minerals being shipped may often reach rather large tonnages; the amount shipped in 1962 was 4800 tons. Very little of this is being sent through the locks, usually about 500 tons annually. The small amounts traveling through the locks are probably sent to Crown Zellerbach. Most likely, the larger tonnages are destined for chemical companies on the lower sections of the Willamette River.

Finished Products

Although these commodities are highly varied in their nature, the total tonnage contributed by them is almost insignificant in comparison to the total river tonnages. The total tonnage may reach 15,000 tons, but even this is less than 0.5 percent of the total

movement on the river. Because the commodities are so varied and the shipments irregular it is unlikely that an exact analysis can be made. Much of the total passes through the locks, but since detailed source-destination records are not kept by the locks, the ton-miles cannot be secured. The shipments, however, are generally short and pass through the locks in both directions. A short analysis follows:

Rolled and finished steel products - very fluctuating, as high as 6000 tons. Usually 30-40 tons, through locks.

Metal manufacturers and parts - 200-300 tons passing through locks.

Earth working and construction machinery - 300-1200 tons passing through locks.

Industrial machinery, pumps, office equipment - 200-800 tons passing through locks.

Chemical specialties - 100 ton passing through locks.

Industrial chemicals - 2500 tons passing through locks.

Pigments, paints, varnishes - about 400 tons mostly passing through locks.

Miscellaneous commodities - 2000-4000 tons.

Appendix Table 1. Changes Over Time In Various River Basins As A Time Use Base Period 1954 Through 1956.

	OHIO RIVER			ILLINOIS RIVER			MISSOURI RIVER			COLUMBIA RIVER		WILLAMETTE RIVER	
	Total Tons	$T - \bar{x}$	T % of $\bar{x}$	Total Tons	$T - \bar{x}$	T % of $\bar{x}$	Total Tons	$T - \bar{x}$	T % of $\bar{x}$	Total Tons	T % of $\bar{x}$	Total Tons	T % of $\bar{x}$
1954	55, 076, 677	12, 561, 485	81.43	15, 354, 052	2, 106, 280	87.94	1, 245, 135	214, 743	85.29	17, 751, 099	88.80	4, 108, 782	93.06
1955	71, 461, 178	3, 823, 016	105.65	17, 390, 360	69, 972	99.60	1, 277, 632	182, 246	87.52	19, 826, 068	99.18	4, 289, 722	97.16
1956	76, 376, 633	8, 738, 471	112.92	19, 636, 585	2, 176, 253	112.46	1, 856, 868	396, 990	127.19	22, 390, 661	112.01	4, 847, 620	109.79
1957	81, 567, 152	13, 928, 990	120.59	20, 229, 707	2, 769, 375	115.86	1, 863, 180		127.63	21, 532, 158	107.72	3, 578, 110	81.04
1958	73, 476, 894	5, 838, 732	115.46	20, 562, 464	3, 102, 132	116.05	2, 581, 271		176.81	18, 469, 720	92.40	3, 373, 754	76.41
1959	80, 801, 017	13, 162, 855	119.51	22, 116, 641	4, 656, 309	126.67	3, 955, 166		270.92	20, 630, 693	103.21	3, 723, 645	84.34
1960	79, 477, 596	11, 839, 434	117.50	22, 807, 633	5, 347, 301	130.63	4, 034, 472		276.36	21, 866, 626	109.39	4, 064, 710	92.06
1961	80, 137, 815	12, 499, 653	118.48	23, 353, 572	5, 893, 240	133.75	4, 342, 221		297.44	22, 860, 532	114.36	4, 172, 970	94.51
1962	85, 306, 058	17, 667, 896	126.12	25, 358, 514	7, 898, 182	145.24	5, 595, 751		383.30	22, 257, 842	111.35	3, 822, 134	86.57
1963	88, 828, 291	21, 190, 129	131.33	23, 613, 308	6, 152, 976	135.24	5, 129, 090		351.34	25, 926, 798	129.70	4, 604, 270	104.28
1964										26, 272, 787	131.43	4, 957, 915	112.28
Average 1954-5-6	67, 638, 162			17, 460, 332			1, 459, 878			19, 989, 276		4, 415, 189	

Appendix Table 2. Movement of Selected Commodities by River Systems, 1962-1963.

Special Selected Commodities*	1962 Ohio River	Missouri River	Illinois River	Columbia R.	Willamette R.	Will. Fls. (W)-(WF)
Animal Product, inedible	1,000	29,965	30,216	2,175	203	203
Corn	2,061,861	19,670	3,587,309	3		
Barley and Rye	18,704	41,282	27,748	1,040,750		
Wheat	386,648	1,453,824	577,466	3,109,821		
Grain Sorghums	6,349	11,340		157,745		
Other Flour & Grain Preparation	1,213		10,598	1,308		
Animal Feeds NEC **	51,445	70,088	701	48,347		
Vegetables & Preparations, except canned, fresh, or frozen				86,973	310	310
Rubber, crude & allied gums				611	72	72
Naval Stores, Gums & Resins	29,385		4,585	307	31	31
Soybeans	648,365	97,894	747,499			
Molasses, inedible	141,779	63,195	84,726	55,242		
Vegetable Products, inedible NEC**				9,524	1,927	1,927
Cotton, manufactured				502	25	25
Logs				349,377		
Rafted Logs	12,974	3,178	1,229	4,001,334	1,409,386	700,107 709,279
Posts, Piles, & Pilings	90			28,893	537	537
Lumber & Shingles			9,809	685,260		
Wood Manufactures, NEC**				7,990	1	1
Pulpwood				88,726	37,436	37,436
Wood Pulp	4,822			125,166	8,995	8,995
Paper & Kindred Products, NEC**	14,562		74,235	1,078,600	406,274	406,274
Bituminous Coal & Lignite	41,638,105	8,962	7,813,012			
Gasoline	8,101,805	90,893	2,461,476	2,553,389	7,029	7,029
Gas Oil & Distillate Fuel Oil	1,864,510	15,381	1,282,393	2,029,823		
Petroleum, crude	4,078,023		40,400	216,480		
Building Cement	228,925	40,958	44,610	195,186	8,448	8,448
Clays and Earths				7,757	20,233	20,233
Brick and Tile	8,478			2,161	29	29
Sulphur, dry	197,005		151,329	33,350	8,926	8,926
Limestone, crushed	2,458,938		24,063	106,257	90,772	9,228 81,544
Sand, Gravel & Crushed Rock	9,254,771	1,343,484	2,095,283	2,017,298	1,580,261	1,580,261
Non-metallic Minerals, NEC**	774,114	51,173	355,847	12,986	4,861	621 4,240
Iron Ore & Concentrates	18,790		554,750			
Iron & Steel Pipes, Tubes, Tubing	709,602	72,090	115,629	26,557		
Rolled & Finished Steel Products	1,355,120	49,108	780,269	106,006	8	8
Metal Manufactures & Parts NEC**	155,216	4,196	18,008	4,048	498	373 125
Earth Working & Construction Mach.	463		158	10,060	995	440 555
Industrial Mach., Pumps, Office, etc.	2,089	776	2,331	1,380	155	155
Merchant Vessels & Parts	24,575		708	169,365	7	7
Industrial Chemicals, NEC**	2,398,451	2,098	380,232	111,655	2,679	2,679
Chemical Specialties NEC**	123,624	4,642	65,620	8,981	76	76
Pigments, Paints & Varnishes	51,974	5,742	4,894	3,400	274	274
Commodities, NEC**	20,308	400	100	8,226	4,202	4,202
Waste Materials NEC**				310,800	196,900	196,900
Waterway Improvement Material	862,312	2,042,409				
Stone and Manufactures. NEC**						
Non-Fer. Ores. Mtls., Scraps NEC**						
Residual Fuel Oil	1,483,491		770,558	1,065,119	30,584	30,004 580
Petroleum Asphalt & Products	905,921		116,193	213,189		
Total Shipping in Short Tons						

* Included in specific commodity list are the first 10 commodities of each river and all commodities on the Willamette River.

** NEC = not elsewhere classified; see "Waterborn Commerce of the United States" for fuller explanation of each commodity.

Appendix Table 2. (Continued) Movement of Selected Commodities by River Systems. 1962-1963.

	1963						
Special Selected Commodities *	Ohio River	Missouri River	Illinois River	Columbia R.	Willamette R.	Will. Fls.	(W)-(WF)
Animal Product, inedible		24, 692	32, 206	4, 246	165	165	
Corn	1, 621, 606	82, 666	3, 367, 003	8, 707			
Barley and Rye	28, 668	11, 724	55, 945	722, 853			
Wheat	504, 695	1, 362, 758	762, 943	5, 157, 685			
Grain Sorghums	10, 992	84, 006	5, 777	4, 618			
Other Flour & Grain Preparation		1, 793	2, 247	793			
Animal Feeds NEC	70, 031	81, 232	4, 427	68, 743			
Vegetables & Preparations, except canned, fresh, or frozen				84, 049			
Rubber, crude & allied gums				500			
Naval Stores, Gums & Resins	25, 898		991	1, 833			
Soybeans	513, 611	138, 333	806, 238				
Molasses, inedible	103, 712	52, 705	72, 334	33, 764			
Vegetable Products, inedible NEC**				12, 125	3, 030	3, 030	
Cotton, manufactured				27			
Logs				819, 401			
Rafted logs	10, 873	1, 068		4, 897, 340	1, 393, 435	699, 122	694, 313
Posts, Piles, & Pilings				21, 303	250		250
Lumber & Shingles			17, 119	735, 015			
Wood Manufactures, NEC**	2			18, 719			
Pulp Wood				411, 901	59, 028	53, 589	5, 439
Wood Pulp				181, 466	7, 834	7, 834	
Paper & Kindred Products, NEC**	18, 518	600	65, 535	1, 244, 885	351, 651	351, 651	
Bituminous Coal & Lignite	42, 348, 090	39, 597	7, 504, 480				
Gasoline	8, 665, 185	77, 496	1, 971, 453	2, 565, 782			
Gas Oil & Distillate Fuel Oil	1, 502, 043	13, 885	804, 017	2, 004, 435			
Petroleum, crude	4, 373, 437			246, 072			
Building Cement	348, 151	71, 318	120, 431	237, 772	35, 239		35, 239
Clays and Earths				9, 117	25, 848	25, 848	
Brick and Tile	9, 900			2, 662			
Sulphur, dry	139, 270		14, 787	30, 325	9, 273	9, 273	
Limestone, crushed	3, 233, 151		35, 844	329, 422	292, 857	9, 545	283, 312
Sand, Gravel & Crushed Rock	9, 405, 584	1, 207, 315	1, 384, 143	2, 222, 184	2, 144, 527	675	2, 143, 852
Non-metallic Minerals, NEC**	1, 048, 574	94, 390	394, 327	23, 222	652	652	
Iron Ore & Concentrates	11, 842		321, 638				
Iron & Steel Pipes, Tubes, Tubing	706, 203	45, 549	95, 702	31, 792	200	200	
Rolled & Finished Steel Products	1, 349, 710	39, 961	787, 435	136, 200	6, 868	30	6, 838
Metal Manufactures & Parts NEC	61, 276	200	12, 543	3, 918	390	381	9
Earth Working & Construction Mach.	4, 225		2, 572	17, 034	1, 248	928	320
Industrial Mach, . Pumps, Office, etc.	1, 713		1, 202	3, 570	370	370	
Merchant Vessels & Parts	20, 634		70	245, 406	13	5	8
Industrial Chemicals, NEC**	2, 783, 042		363, 680	17, 083	2, 514	2, 514	
Chemical Specialties, NEC**	124, 062	4, 291	40, 341	16, 019	177	177	
Pigments, Paints & Varnishes	17, 179	2, 263	2, 400	2, 798	808	808	
Commodities, NEC	46, 134	942	164	3, 444	2, 833	2, 833	
Waste Materials NEC				255, 000	246, 690	450	246, 240
Waterway Improvement Material	1, 207, 826	1, 604, 641					
Stone and Manufactures, NEC**					4, 200		4, 200
Non-Fer. Ores, Mtls., Scraps NEC**					25	25	
Residual Fuel Oil	1, 768, 015		1, 108, 895	1, 047, 263	14, 145	14, 145	
Petroleum Asphalt & Products	1, 012, 481		136, 325	154, 821			
Total Shipping in Short Tons	88, 825, 013	5, 129, 090	23, 613, 308	25, 926, 798	4, 604, 270	1, 184, 250	3, 420, 000