



REVIEW OF
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CONDITIONS

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Alaska's Unique Transportation System

INTRODUCTION

General

Alaska's transportation needs are unique compared to those of the contiguous states. This uniqueness results from a small population being scattered across a vast, rugged area, mostly in urban coastal centers. These centers either have no highway connections to the outside or can be served by overland transportation only at considerable expense. Consequently, the dominant modes of transport in Alaska are air and marine, precisely those that play the smallest role in the domestic commerce of the contiguous states. It is only in Alaska's railbelt corridor that a variety of transport modes compete for the market.

Except for the region surrounding Fairbanks, all significant population centers in Alaska have access to marine transport, with most of the Interior having access to seasonal river transportation. Thus, this is the mode used to transport most goods into and out of the state. The pervasive nature of marine transport in Alaska is reflected in Table 1, which shows types and

frequency of marine services provided selected Alaska ports. Historical trends in marine traffic through selected Alaska ports are shown in Table 2.

Because of the long distances between urban areas and the lack of direct surface transport over many shorter distances, air travel dominates in moving passengers throughout the state. It provides the only year-round access to many of the more remote areas and takes the traditional place of trucking as the primary mover of high-value items into many of these locations.

The Regional Approach

For purposes of describing Alaska's transport system, we have divided the state into three major regions: (1) the Southeastern (2) the Southcentral/Interior, and (3) the Western/Arctic. Each of these regions has, for a variety of reasons, developed a transport system whose structure is closely identified with its particular population and resource requirements. The Southeast network is primarily concerned with the forest products industry, the Western/Arctic is

The information on which this article is based was gathered for a study being performed by the Institute of Social and Economic Research for the United States Department of Transportation. Entitled "the Alaska Transportation Systems Study," the project interconnects computer simulation models of Alaska's economic and transportation systems. It uses these interconnected models to evaluate impacts of alternative transportation policies on both the operation of the state's transportation system and the patterns of state and regional development. By creating a method for systematically analyzing the interaction between economic development and transportation, ISER

hopes that this study will provide a basis for informed and objective policy decisions in the transportation sphere.

To fully appreciate the need for systemwide planning for the Alaska transportation system, one must first understand the economic and geographic influences that make the system and its problems unique among the states. Thus, the purpose of this *Review* is to provide a basis for such understanding by briefly examining the Alaska transportation network and its interrelationships with the population, geography, and the economy of the state. A fuller description of the Alaska Transportation Systems Study and its results will be presented in a future issue of the *Review*.

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FEATURE

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Alaska's Unique Transportation System

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(Continued from page 1)

oriented toward fisheries, while the Southcentral/Interior is somewhat more typical of a developed economy, with a wider variety of factors influencing demand for transport. The structure that has evolved in each region is a function of both the geographic and demand constraints of the particular area.

This *Review* will look at each of the regions separately, examining within each the transportation network and the different types of transport available. It will explain how these interact with regional economic influences. Finally, it will describe which carriers and types of transport technology have been adapted to Alaska's special requirements.

First, we will look at the dominant mode of transport: marine, including carriers and ports of call. Then, we will examine other modes of transport, as appropriate. Following the discussion of the regional transport systems, we will examine the petroleum distribution system in Alaska. It deserves special treatment not only because of the importance of fuel movements to the state's economy, but also its influence on the overall structure of the transport system.

THE SOUTHEAST

Marine Transport

The predominate influence on the Southeastern marine transport system in Alaska has been the recovery, processing, and exploring of forest products. The region has several population centers of modest

size, none of which is connected to any of the others by overland transport. Seven ports in the region—Ketchikan, Wrangell, Metlakatla, Juneau, Sitka, Haines, and Skagway—each normally have annual traffic volumes in excess of 100,000 tons (Table 2). Of these, only two, Juneau and Skagway, are not dominated by forest products (see Figures 1, 2, and 3, pages 6, 7, and 10).

Ketchikan

Ketchikan is the largest of the region's ports, annually handling a volume of 1.5 to 2.2 million tons. Of this amount, about 75 percent is logs, wood chips, lumber, or pulp; and about 15 percent is petroleum products, as the port is the primary fuel distribution center for the Southeast region. The remaining 10 percent consists of miscellaneous items.

Inbound shipments of commodities are transported by three major means, tankers, barges, and log rafts. Bulk petroleum comes from the U.S. West Coast and Alaska refineries in tankers of the 15,000-to-40,000-ton range. Consumer goods generally move through the port in containers brought north from Seattle by container barges. Foss Alaska Line provides this service on a weekly basis while Boyer Alaska Barge Line provides biweekly service. Both carriers use 20-foot and 24-foot containers on barges that carry about 350 units. These are transferred between barge and dock by use of forklifts. Both carry deck cargo not suitable for container movement.

Table 1
Principal Scheduled Common Carrier Marine Services to Selected Alaska Ports

Between		Carrier	Service	
Ketchikan	Seattle	F.A.L.	Weekly container barge	
		B.A.B.L.	Twice monthly barge	
		A.M.H.S.	Twice weekly	
Sitka	Prince Rupert	A.M.H.S.	Twice weekly (October—May)	
		A.M.H.S.	Four times weekly (June—September)	
Sitka	Seattle	F.A.L.	Weekly container barge	
		A.M.H.S.	Weekly	
Skagway	Prince Rupert	A.M.H.S.	Weekly	
	Seattle	A.M.H.S.	Twice weekly	
	Prince Rupert	A.M.H.S.	Twice weekly (October—May)	
Whittier	Vancouver	W.P.Y.	Weekly container ship	
		Seattle	A.H.T.	Weekly Rail Barge
		Prince Rupert	C.N.R.	Rail barge every two weeks (September—April)
				Rail barge every ten days (May—August)
Anchorage	Valdez	A.M.H.S.	Five times weekly (mid-May—mid-September)	
		Seattle	S.L.S.	Twice weekly container ship
			T.O.T.E.	Twice weekly Roll-on-Roll-off ship
			P.W.L.	Barge every two weeks (mid-March—mid-November)
			C.B.L.	Barge monthly (April—November)
Kodiak	Seattle (via Anchorage)	S.L.S.	Weekly container ship	
		Cordova	S.L.S.	Monthly container ship (October—April)
	Seward/Valdez/Cordova		Twice monthly container ship (May—September)	
		Homer/Seldovia	A.M.H.S.	Weekly
Unalaska	Kodiak	A.M.H.S.	Twice weekly (May—September)	
			Weekly (October—April)	
		S.L.S.	Twice monthly container ship	
Dillingham	Adak	S.L.S.	Twice monthly container ship	
			Container barge every three weeks	
		F.A.L.	Container barge every three weeks	
Bethel	Seattle (via Sitka)	F.A.L.	Barge; four sailings (April—August)	
		Seattle	P.A.L.W.	Barge; three sailings (May—August)
Nome	Seattle	F.A.L.	Barge; three sailings (May—August)	
			P.A.L.W.	Barge; three sailings (May—August)
Yokohama	Kodiak	F.A.L.	Barge; three sailings (May—August)	
			P.A.L.W.	Barge; two sailings (May—August)
	Unalaska	S.L.S.	Container ship every three weeks	
			A.P.L.	Container ship monthly
	S.L.S.	Container ship every three weeks		
		A.P.L.	Container ship weekly	

Abbreviations

F.A.L.	Foss Alaska Line
B.A.B.L.	Boyer Alaska Barge Line
A.M.H.S.	Alaska Marine Highway System
W.P.Y.	White Pass & Yukon
A.H.T.	Alaska Hydro-Train (Crowley Maritime)
C.N.R.	Canadian National Railway
S.L.S.	Sea-Land Service
T.O.T.E.	Totem Ocean Trailer Express
P.W.L.	Pacific Western Lines
C.B.L.	Coastal Barge Line
A.P.L.	American President Lines
P.A.L.W.	Pacific Alaska Line, West (Crowley Maritime)

Source: Published schedules and carrier representatives.

Industrial chemicals and minerals used in pulp manufacture are brought to this area primarily in railcars which are brought by barge from Seattle, Bellingham, and Vancouver, B.C. Crowley Maritime provides this service weekly, using barges that carry 35 to 40 railcars.

Most logs move in log-rafts and most woodchips by barge to Ketchikan from points in Southeast Alaska and Northern British Columbia.

Petroleum products are distributed from Ketchikan by barges to most points in Southeast Alaska. Processed fish is an important outbound product and is moved by container barge to Seattle either for domestic consumption or export shipment. Wood pulp leaves the area by three means: railcars to U.S. destinations, containers to Seattle for foreign shipments, or directly to the Far East by breakbulk ships.¹ Logs and lumber generally move directly to the Far East via breakbulk ships.

Sitka

Sitka, like Ketchikan, is the location of a major pulp-processing facility. It also receives industrial chemicals and minerals by railcar barge from western locations and ships pulp to the lower U.S. by the

¹A ship (or barge) of conventional design used for transport of non-containerized general cargo below or above deck.

same means. The railbarge carrier, Washington Tug and Barge, uses barges with a capacity of 25 to 30 railcars. Logs are moved to Sitka in rafts while woodchips normally arrive in barges. Both are moved by a number of independent operators. Most pulp shipped out of Sitka is destined for Japan and moves via breakbulk shipping.

Foss, with its weekly container barges, is the principal carrier for other inbound consumer and construction goods. Petroleum products, mostly from Ketchikan, are shipped via fuel barges.

Sitka also serves as a transshipment facility for cargo moving between Seattle and the Aleutians. Foss provides this service every three weeks.

Outbound goods, principally seafood, usually go to Seattle by Foss container barge. Total annual throughput averages 750,000 to 1 million tons.

Wrangell, Metlakatla, and Haines

Wrangell, Metlakatla, and Haines are timber ports. The only significant quantities of any commodities passing through these three ports are inbound rafted logs and outbound logs and lumber. Export of these products is almost entirely to the Far East via breakbulk shipping. All three ports receive petroleum principally by barge from Ketchikan. For consumer and construction-type commodities, Wrangell is

Table 2

Total Traffic for Selected Alaska Ports:

Historical Trends
(in thousands of short tons)

Ports	1977	1976	1974	1972	1970	1968	1966
Ketchikan	2,168	1,559	2,162	2,186	1,868	1,881	1,542
Metlakatla	224	174	318	291	117	70	15
Wrangell	656	827	1,023	1,169	1,181	755	502
Petersburg	67	56	205	157	294	134	114
Sitka	553	998	970	1,243	916	1,009	1,072
Juneau	152	167	154	201	119	126	133
Skagway	1,026	833	1,514	1,388	1,273	575	297
Valdez	10,667	507	357	254	478	182	188
Cordova	36	66	35	42	34	44	57
Seward	115	237	72	62	29	117	49
Homer	126	31	12	170	190	17	14
Whittier	414	457	662	646	349	312	N/A
Anchorage	2,220	2,932	2,340	2,058	1,937	1,311	1,009
Kodiak	501	388	217	193	124	109	213
Unalaska	325	350	157	190	252	121	171
Bethel	96	110	41	N/A	N/A	N/A	N/A
Nome	64	30	32	43	21	41	47
Bristol Bay	71	59	12	34	169	26	61

Source: U.S. Army, Corps of Engineers, Waterborne Commerce of the United States, Part 4.

served weekly by Foss container barges. Containers bound for Haines and Metlakatla are transferred to the State Marine Highway System ferries at Juneau and Ketchikan, respectively.

Juneau

Juneau is one of the two ports in the Southeast not involved in the movement of forest products. Since the city has no industry, the port's only purpose is to provide products for local consumption. Petroleum arrives via small tankers and barges from the U.S. West Coast and Alaska distributors, while most other commodities are brought north by the Foss container barge service. As the port is presently the northern terminus for this operation, it also serves as a transshipment point for products bound for Haines and Skagway via the Marine Highway.

Skagway

Skagway is influenced by factors which make it unique in Alaska. As the primary port for the Yukon Territory, the demands for its service have almost no relationship to Alaska conditions. Further, most of its facilities are privately owned by White Pass and Yukon Limited, a multimodal Canadian transport firm. WP&Y operates two small container ships, *Frank H. Brown* and *Klondike*, between Vancouver, B.C. and Skagway.² A narrow-gauge railroad and a pipeline are operated between Skagway and Whitehorse, Yukon Territory. Extensive trucking services are also provided in the Yukon and northern British Columbia. In addition to its container transfer facilities in Skagway, the company also operates a bulk ore terminal.

Skagway itself generates little demand for shipping. However, the total throughput of the port is in the range of 800,000 to 1,500,000 tons annually. Of this, about 50 percent will generally be copper, lead, and zinc concentrates destined for the Far East, and 20 percent will be bulk materials handled in containers for movement south to Vancouver. Of the remainder, about two-thirds represents inbound petroleum products from Vancouver distributors and one-third is inbound containerized general cargo.

Skagway's local consumption needs are primarily satisfied by containers brought from Juneau by the state Marine Highway System and by petroleum barges from Ketchikan.

Petersburg

Petersburg is an important smaller port. It is the largest seafood processing center in the region and produces considerable tonnages of this high-value commodity for movement via Foss container barge to

²WP&Y also operated the world's first cellular container ship, *Clifford J. Rogers*, which entered service in 1955 and was retired in 1966.

Seattle. The port also ships a limited amount of lumber and some logs in rafts from the surrounding area to Southeastern mills. When the local timber harvesting operations are working at full capacity, Petersburg will usually move considerably more than 100,000 tons.

There are numerous smaller ports in the region, primarily engaged in shipments of logs or fish. Most are served by feeder barges from the larger centers, although occasionally a mainline container barge will call at one of them for a major shipment. Collectively, they have an annual throughput of about 1.0 to 1.5 million tons, with log movements constituting 90 percent of this amount.

The Marine Highway

The Alaska Marine Highway system ties together the entire Southeastern region. The mainline vessels of the state's fleet serve Ketchikan, Wrangell, Petersburg, Sitka, Juneau, Haines, and Skagway. The mainland routes also extend south to Prince Rupert, B.C. and Seattle. In addition, Metlakatla, Hollis, Kake, Angoon, Tenakee, Pelican, Hoonah, and Glacier Bay are connected to the mainland routes by feeder services. Traffic on the system is primarily passenger and private vehicle; it is highly seasonal, with tourist traffic crowding the vessels in the summer.

Some freight is moved from Seattle and Prince Rupert to various Southeast locations. As was noted earlier, freight traffic is particularly important on the routes north of Juneau and between Ketchikan and Metlakatla. Mainline service frequency calls for twice-weekly departures from each of the southern terminals during the winter, with summer traffic increasing the Prince Rupert departures to four per week. Most feeder service is once or twice per week, depending upon the season. During 1977, the system carried 195,000 passengers and 50,000 vehicles, while the volumes for 1978 were 222,000 passengers and 54,000 vehicles. The most heavily patronized route segments were Wrangell-Petersburg and Juneau-Haines. The busiest ports were Juneau, Haines, and Prince Rupert in both years (Table 3).

There were four mainline vessels serving the Marine Highway System: *Columbia*, *Matanuska*, *Malaspina*, and *Taku*. The largest and newest of these is *Columbia*, which usually operates out of Seattle. Two older rebuilt vessels, *Matanuska* and *Malaspina*, run either from Seattle or Prince Rupert while the smallest of the four, *Taku*, operates almost exclusively from Prince Rupert. Of the three smaller feeder vessels, *Chilcat* operates between Ketchikan, Metlakatla, and Hollis, while *Le Conte* and *Aurora* serve the towns of Petersburg, Kake, Juneau, Sitka, Angoon, Tenekee, Hoonah, Pelican, Haines, and Skagway, with *Aurora* also scheduled into Ketchikan, Hollis, and Prince Rupert.

Figure 1
Major Inbound Commodity Flows
1977

- 1 Ketchikan
- 2 Wrangell
- 3 Petersburg
- 4 Sitka
- 5 Juneau
- 6 Haimes
- 7 Skagway
- 8 Yakutat
- 9 Cordova
- 10 Valdez
- 11 Whittier
- 12 Seward
- 13 Homer
- 14 Kenai
- 15 Anchorage
- 16 Kodiak
- 17 Unalaska
- 18 Dillingham
- 19 Bethel
- 20 Nome
- 21 Kotzebue
- 22 Barrow
- 23 Prudhoe Bay
- 24 Healy
- 25 Fairbanks

Annual Tons in Thousands

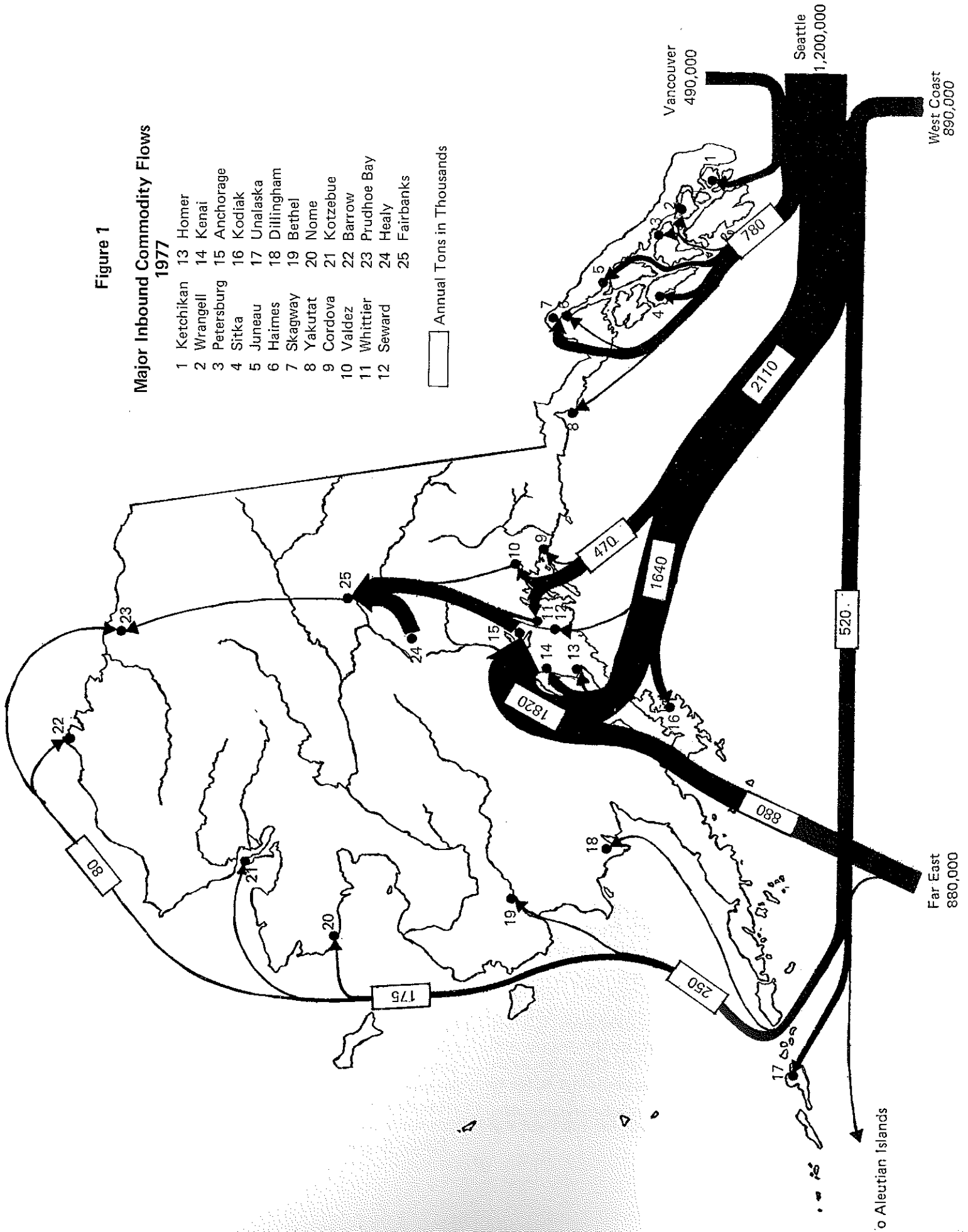


Figure 2
Major Outbound Commodity Flows
1977

- 1 Ketchikan
- 2 Wrangell
- 3 Sitka
- 4 Haines
- 5 Skagway
- 6 Valdez
- 7 Whittier
- 9 Homer
- 10 Kenai
- 11 Anchorage
- 12 Kodiak
- 13 Prudhoe Bay

□ Annual Tons in Millions

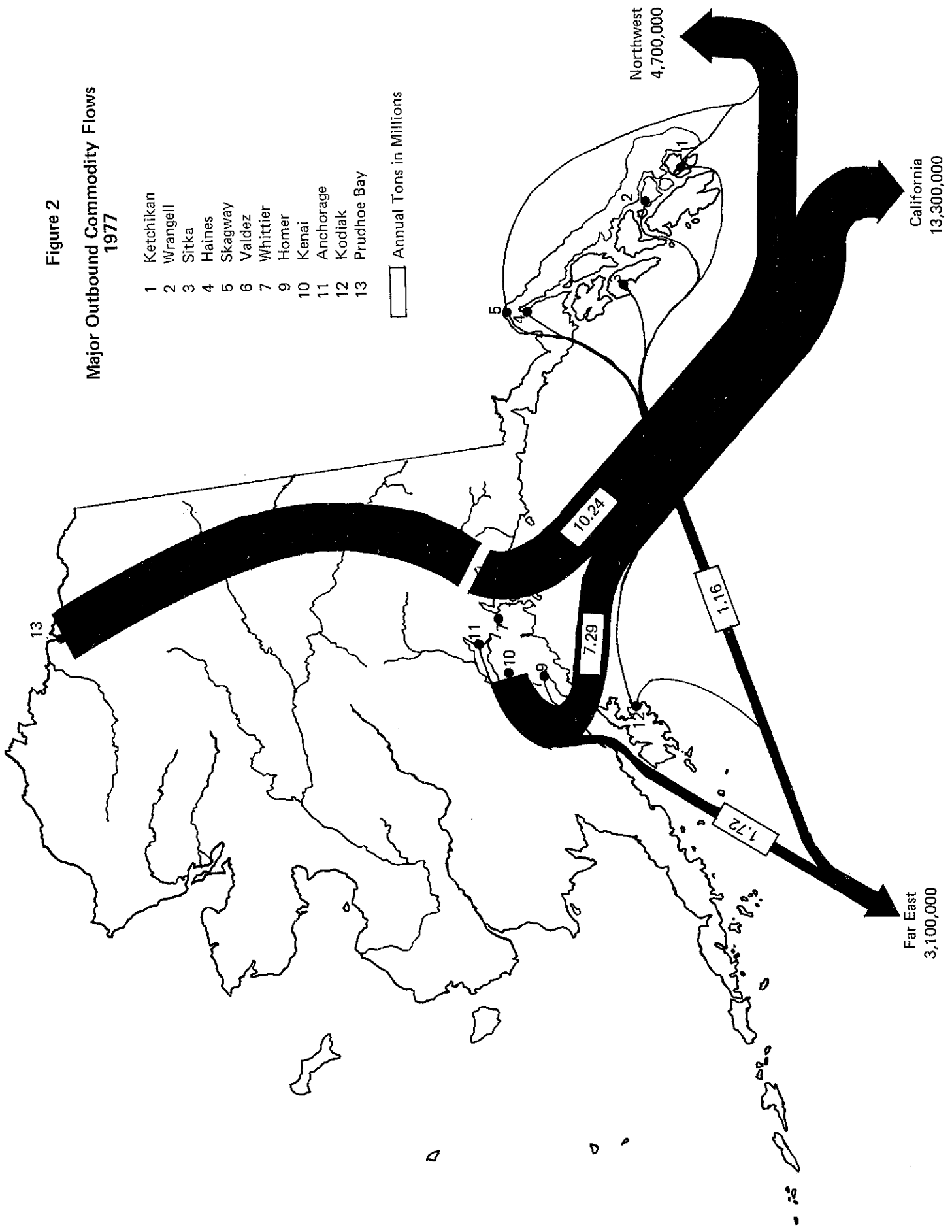


Table 3
Marine Highway System

1978 Southeast Passenger Origins and Destinations

Origins

Destina- tions	Seattle	Prince Rupert	Metla- katla	Ketchikan	Hollis	Wrangell	Peters- burg	Kake	Sitka	Angoon	Tenakee	Hoonah	Juneau	Haines	Skagway	Glacier Bay	Pelican
Seattle	10	41		2,063	162	434	710		997				3,373	5,187	2,330		
P. Rupert				8,067		772	1,136		454				3,872	7,839	3,108		
Metlakatla				6,483													
Ketchikan	3,483	8,991	7,277	4,108	4,150	2,039	2,123	54	655	23		1	2,803	952	552		
Hollis		161		4,108		162	64	2	17	36		7	5				
Wrangell	476	714		2,697	33		1,770	18	404				1,007	350	106		
Petersburg	848	1,074		2,366	35	2,171		1,694	1,094	40	3	23	2,878	745	225		
Kake				57	1	18	1,625		322	215	4	60	154	9	4		
Sitka	156	714		603	9	357	1,172	394	881	881	111	635	3,439	1,146	800		
Angoon				53	36	1	18	124	932		9	203	782	31	2		
Tenakee						3	7	4	88	5		4	640	1			
Hoonah				1	4	1	29	42	662	159	6		2,556	167	27	45	49
Juneau	4,023	4,528		3,209	31	1,111	3,200	176	2,940	743	619	2,263		12,124	5,949	516	363
Haines	5,838	6,020		977	3	344	649	46	659	65	9	64	11,694		6,192		5
Skagway	5,750	2815		799		129	235	19	368	15		21	6,492	6,226			1
Glacier B.												45	516				
Pelican												57	376				

1978 Southeast Vehicle Origins and Destinations

Origins

Destina- tions	Seattle	Prince Rupert	Metla- katla	Ketchikan	Hollis	Wrangell	Peters- burg	Kake	Sitka	Angoon	Tenakee	Hoonah	Juneau	Haines	Skagway	Glacier Bay	Pelican
Seattle	15	25		795	62	261	238		457				946	1,979	151		
P. Rupert				2,180		244	317		93				1,053	2,852	290		
Metlakatla				1,423													
Ketchikan	1,043	2,503	1,372	1,340	1,295	376	297	2	165	1		3	428	293	28		
Hollis		59		531	8	13	13		6				6		1		
Wrangell	218	261		357	12	517	464	3	60	4		7	139	72	10		
Petersburg	269	350		7	1	2	212	182	291	4		8	569	213	21		
Kake				125	3	54	336	94	85	10		59	40	2			
Sitka	85	234		2	2	2	4	2	100	96	1	28	672	331	392		
Angoon													135	4			
Tenakee				1	2	1	3	2	54	10			401	43	4		
Hoonah				478	15	195	610	45	623	130		356		3,702	776		16
Juneau	1,506	1276		287	71	22	161	4	160	6		16	3,532	1,009			
Haines	2,450	2,301		289	1		24		37				958	1,057			
Skagway	467	293															
Glacier B.																	
Pelican																	

Source: Alaska Marine Highway System; Annual Traffic Volume Report-1978.

Roads and Highways

Roads and highways in the region are very limited in scope, mostly being only local service or logging roads. Two exceptions to this are the Haines Highway which runs 154 miles north to join the Alaska Highway in the Yukon Territory and the newly completed Skagway-to-Whitehorse highway paralleling the White Pass and Yukon Railway between these points.

Paralleling the Haines Highway is an out-of-service military petroleum products pipeline which runs through Canada to Fairbanks. Another highway important to the Southeast is Canadian Highway 16 from Prince Rupert eastward to Prince George and Edmonton. At Prince George it connects with Highway 97 to Vancouver and Seattle (Figure 4, page 20).

Air

Air service is the primary means of connecting the region to the remainder of the state and nation for passenger travel (Figure 5, page 24). For this mode, Juneau with its significant population and concentration of government offices is the center. Airports capable of handling jet aircraft up to the size of a Boeing 720 or 727 are located in Yakutat, Gustavus, Juneau, Sitka, Petersburg, Wrangell, and Ketchikan. Extensive commuter service is operated from Juneau to smaller towns in the northern part of the area, with a more limited number of commuter routes radiating from Ketchikan to the southern panhandle.

Alaska Airlines, the largest carrier in the region, serves all of the airports noted above with Boeing 727 aircraft. Gustavus receives only summer service from Juneau—mostly for tourist traffic. Frequency of service to most locations varies by season but is usually three or four flights per day between Juneau and Anchorage; one to two daily to Sitka; three or four daily between Ketchikan, Juneau, and Seattle; and once daily to other towns.

Wien Air Alaska, the second major airline in the region, connects Juneau and Ketchikan to Anchorage, Whitehorse, and Seattle. Wien's schedules also vary seasonally, but generally include one or two daily flights on all routes except Juneau-Whitehorse, which receives twice-weekly service. The most heavily traveled commuter routes in the region are those between Juneau, Haines, and Skagway. During the summer almost hourly service is provided, while winter schedules are three to four flights daily.

THE WESTERN/ARCTIC

Geographically the largest and demographically the smallest of the state's transport regions, the Western/Arctic is like the Southeast in that a single resource commodity has been the principal influence

shaping its transport structure. In the Western/Arctic, the catching, processing, and exporting of seafood has evolved the transportation network. Like the Southeast, this region is not served by any overland modes of transport except for a few local access roads. Distances between the few small population centers that do exist are greater than for any other part of the state.

Marine Transport

Only two ports in this area, Kodiak and Unalaska, have traffic volumes normally exceeding 100,000 tons (Table 2). Other areas with significant activity include the Bristol Bay basin, Bethel, Nome, Kotzebue, and Barrow. Each of these has a service area of considerable geographic size. In addition, there are many ports, mostly seasonal, usually established to support either fishing or the import of subsistence goods for local residents.

Kodiak

Kodiak is the largest of the region's ports, handling an annual volume of 200,000 to 600,000 tons. Of this amount, about 30 percent is petroleum products for local consumption, received by tanker and barge from both West Coast and Alaska points. The port is also the home of one of the nation's largest fishing fleets. The port's largest single commodity category is seafood products, with inbound unprocessed fish comprising about 15 percent and outbound processed products comprising about 25 percent of the total volume. The port serves as the major transshipment point for goods bound for Southwestern Alaska, and thus, the remaining 30 percent represents a considerable volume of general cargo.

Sea-Land Service calls at Kodiak weekly with container ships from Seattle via Anchorage. Cargo is transferred from this mainline service to a small ship, *Aleutian Developer*, which can carry ninety of Sea-Land's 35- or 40-foot containers. This ship operates on a biweekly schedule between Kodiak and Cordova, Unalaska, Adak, and many smaller ports along the Alaska Peninsula.

Seafood exports to Japan are transported by container ships operated by Sea-Land and American President Lines. Sea-Land has constructed a new ship, *Boxer Captain Cook*, with a capacity of 280 containers, designed specifically for this trade. Schedule frequency is every three weeks. American President Lines provides monthly cargo pickup at Kodiak, using its ships from the Seattle-Japan route. For this service, APL uses "Pacesetter Class," ships with a capacity of 590 40-foot containers.

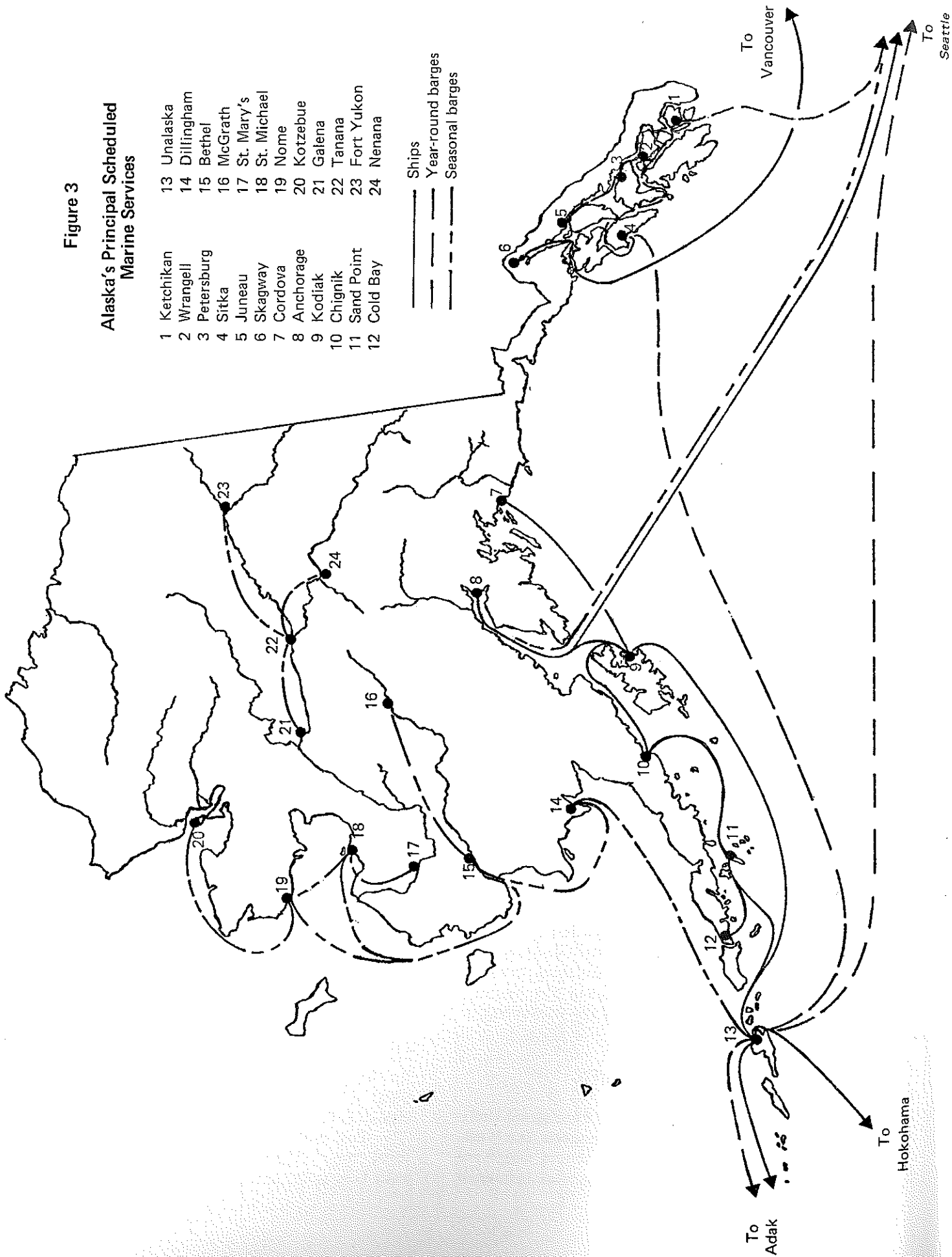
Tug and barge operators from Kodiak provide local cargo transport service to Kodiak Island, the Alaska Peninsula, Bristol Bay, and the Aleutians. Some

Figure 3

Alaska's Principal Scheduled Marine Services

- 1 Ketchikan
- 2 Wrangell
- 3 Petersburg
- 4 Sitka
- 5 Juneau
- 6 Skagway
- 7 Cordova
- 8 Anchorage
- 9 Kodiak
- 10 Chignik
- 11 Sand Point
- 12 Cold Bay
- 13 Unalaska
- 14 Dillingham
- 15 Bethel
- 16 McGrath
- 17 St. Mary's
- 18 St. Michael
- 19 Nome
- 20 Kotzebue
- 21 Galena
- 22 Tanana
- 23 Fort Yukon
- 24 Nenana

— Ships
 --- Year-round barges
 - - - Seasonal barges



logging is done in the area and export of logs and lumber to Japan takes place mostly by foreign breakbulk shipping.

Unalaska

Unalaska is the largest port in the Aleutian Islands and handles about half the volume of Kodiak. It is the principal petroleum distribution point in the region and, as such, now has a throughput of about 275,000 tons of petroleum products per year. These are generally received from West Coast and Alaska refineries directly by small tankers. Like Kodiak, its other significant commodity is seafood. It has become an increasingly important seafood processing center and is presently almost equivalent to Kodiak in value of cargo, although somewhat lower in total tonnage.

The port does a limited amount of transshipment work. Most of this is related to seafood traffic, particularly that involving transfers to *Aleutian Developer* from barges operating in Bristol Bay and Kuskokwim Bay. Crowley Maritime is particularly active in this trade, operating a service called the "Salmon Barge" into Bristol Bay in conjunction with Sea-Land. Foss Alaska Lines also serves Unalaska, using container barges which connect with their Southeast service at Sitka. Direct export service for seafood to Japan is offered weekly by American President Lines and every three weeks by Sea-Land.

Adak and Shemya

Adak and Shemya are the most active ports in the western part of the Aleutian Island system. Both are primarily used to service adjacent military installations (U.S. Naval and Air Force Stations, respectively), although Adak is becoming an increasingly important center for the shipment of seafood. Each port has an annual throughput of about 25,000 tons, with the largest component part for each being fuel. Adak is served every other week by Sea-Land's *Aleutian Developer* and every three weeks by Foss container barges. Service to these ports and others in the islands is also provided by barges under contract to the military. Crowley Maritime is currently responsible for this operation.

Bristol Bay

The aggregate traffic in Bristol Bay is fairly high; however, no single port dominates the area. Two have significant volumes: Naknek and Dillingham. Most of their traffic is related to the seafood industry, although Naknek also serves as the port for the King Salmon Air Force Station. Outbound seafood is mostly taken to Kodiak or Unalaska for processing, although the value of some species has made air movement to Anchorage for processing and transshipment increasingly attractive. Petroleum is received by

barge, primarily from distributors in Unalaska, with lesser amounts coming directly from the West Coast.

Almost all movements in Bristol Bay are by barge. Foss Alaska Lines provides four sailings yearly from Seattle to Dillingham. The first of these, in mid-April, brings mostly cannery supplies. Crowley Maritime provides thrice-yearly service to the area as part of their Pacific Alaska Lines-Westward system. Considerable contract barge service is also available, mostly related to the seafood industry or the military.

Bethel

Bethel is the only Alaska river port capable of receiving ocean-going barges. In fact, one of the primary reasons for the town's existence is its location at the head of deep draft navigation on the Kuskokwim River, which makes it a distribution center for the Lower Kuskokwim and a transshipment point for the traffic moving upriver. Total annual tonnage is between 75,000 and 100,000, with about 50 percent of this being petroleum products. Most of this is received by barge from Unalaska, with about one-third transshipped for movement to various points up the river, principally McGrath at the head of river navigation. The major outbound commodity is fish, which is moved by barge to processing points in Alaska and further south. Both Crowley and Foss have three yearly trips scheduled into Bethel, while additional contract service is available from both of these carriers and other operators. Transport on the Kuskokwim River is provided by United Transportation using shallow-draft general cargo and fuel barges of 300-to-500-ton capacity.

Kotzebue and St. Michael

Kotzebue and St. Michael are two other West Coast ports providing transfer service between ocean and river carriers. Kotzebue handles about half the total cargo volume of Bethel and is the transshipment point for goods moving up the Kobuk. Its principal commodities are inbound petroleum products by barge from Unalaska and outbound fish to various processing points. Crowley Maritime usually provides two scheduled trips per year from Seattle. Additional service is usually on a contractual basis. St. Michael is the transshipment location for freight moving into the lower Yukon River area. About 7,500 tons are transferred annually for shipment to points on the lower Yukon, with the St. Mary's area being the principal destination. Petroleum traffic represents the majority of the business. Crowley makes two annual scheduled calls at St. Michael while Foss will stop to make deliveries from their three Bering Sea sailings if cargo is available. The river carrier operating from St. Michael is Black Navigation.

Nome

Nome is the principal port of the Norton Sound area. Handling about 75,000 tons per year, it is the distribution center for the area and has significant volumes of most commodities. However, like most other ports in the region, its largest item is petroleum products, which comprise about two-thirds of the total throughput. Formerly having very little outbound traffic, Nome is becoming a fairly important summer fishing port with the expansion of domestic Bering Sea Fisheries. Crowley makes two scheduled trips annually into Nome, while Foss makes three.

Barrow

Barrow is the nation's northernmost port. It is a small port with almost no outbound cargo. Inbound items are entirely for the subsistence of the residents. Of this, almost 80 percent is petroleum products. Barrow is served by Crowley, with a frequency of only once or twice yearly, due to ice conditions in the Arctic Ocean.

Other Small Ports

Like the Southeast, the Western/Arctic region has a large number of small ports scattered along the coast. In this region they are generally smaller and further apart. Their commodity volume distribution tends to be much like that of the larger centers. The total for all the smaller ports is about 100,000 tons with 65 percent being petroleum products and 20 percent being seafood. Much of the cargo destined to the smaller communities around Norton Sound and the Chuckchi Sea is delivered by Arctic Lighterage Service. This service operates from bases in Nome and Kotzebue, where it makes connection with the main-line carriers. These smaller ports as well as many larger ones are served by two operations unique to this area.

"Cool Barge" is a service operated by Crowley Maritime under contract to the Department of Defense. Its original purpose was to provide summer barge service to isolated military stations along the Alaska coast. It gradually expanded to include other federal and state activities in remote areas and later to all communities in the Western Coastal Region. Service is provided both "over the beach" and to fixed facilities, and includes both petroleum products and general cargo. During the 1979 season "cool barge" called at eighty-three locations, with its largest customer being the Native Health Service.

Another unusual service is that offered by the Bureau of Indian Affairs. A modified 1945 "victory" ship, *North Star III*, makes two trips a year from Seattle to the western coastal villages of Alaska. On the first trip, the *North Star III* moves freight as far north as Norton Sound; on the second trip it

transports cargo from Seattle to ports north of Norton Sound to Barrow. The ship can carry 5,000 tons of general cargo and 4,000 tons of bulk petroleum products. It also carries four landing craft, each having a 35-ton capacity (with one modified to handle bulk petroleum) for lighterage to village beaches. The longer-term expectations for this service are somewhat clouded, as the ship has expended most of its useful life. Whether it will ultimately be continued using another vessel or converted to a contract tug and barge operation similar to "cool barge" is undetermined at this time.

A major influence on traffic patterns in much of this region is the seasonal nature of marine access. North of the Alaska Peninsula, most ports are closed by ice during part of the year. This period ranges from 3 to 4 months in the lower Bristol Bay to 10 to 11 months at Barrow. In addition, most of the regional ports do not have fixed loading and unloading facilities available. This requires that cargo for these points be lightered ashore in small lots for beach transfer. This is true even at larger locations such as Barrow. The fixed facilities at Nome and Kotzebue can accommodate only the smallest vessels. The net effect of these constraints is to make marine transport much more costly in this region than it is in more settled and accessible areas.

Air

Because of the long distances involved, air travel is much more dominant in this region than in the Southeast. Major locations having the capability to handle jet aircraft include Kodiak, Cold Bay, Unalaska, Adak, Amchitka, Shemya, King Salmon, Dillingham, Bethel, Aniak, McGrath, St. Marys, Unalakleet, Nome, Kotzebue, Barrow, and Galena. Cold Bay is the center for Alaska Peninsula-Aleutian Islands service, while Bethel, Nome, and Kotzebue are hubs for widespread local commuter service. Three major carriers and a number of smaller carriers serve the region. Air route connections from this area to the remainder of the state take place through Anchorage for Kodiak, Bristol Bay, the Aleutians, and Bethel and via Fairbanks and Anchorage for Nome, Kotzebue, and Barrow.

Due to the sparseness of the regional population, a relatively high percentage of freight flows both into and out of the area by air. In many of the more remote villages, even though they are on the coast, considerably more than half of all goods consumed therein may arrive by air. At points where the marine alternative is not available or can be considered only briefly in a short season, all items may well arrive by air. Depending on the origin and destination of shipments and the value of goods, air tariffs may well

be competitive with marine.³ This has proved to be particularly true for the high-value seafood species originating in areas north of the Alaska Peninsula. For this part of the region, access by direct shipping to the Far East or West Coast may take 10 to 20 days. In such cases, where freshness of the product is a prime determinant of market value, it is frequently more economical to use air freight directly to Anchorage.

Wien Air Alaska, the largest carrier in the region, is based in Anchorage, the center of most of the company's service. From this base, Wien provides once or twice daily service to Bethel, Dillingham, King Salmon, Kodiak, Kotzebue, and Nome, with thrice weekly scheduled flights to Aniak, Galena, McGrath, St. Marys, and Unalakleet. There is daily air service from Fairbanks to Barrow and Kotzebue and once or twice weekly to Barter Island, Galena, McGrath, and Nome. There is only limited demand for movement between towns in the region, and thus the only intraregional mainline service is incidental to the Anchorage or Fairbanks routes provided by Wien. Most flights use Boeing 737 aircraft, often with only limited seating in order to accommodate greater quantities of freight than would be the case in more populated areas. In addition to the intrastate routes, Wien has recently begun direct, four-times-weekly service between Kodiak and Seattle.

Besides the mainline routes, Wien also maintains a network of bush commuter routes with actual service usually contracted to local operators. These are centered in Barrow, St. Marys, Nome, Kotzebue, Bethel, and Galena and have service frequencies of one to five times weekly. For many of the communities served, particularly in the interior locations, these flights often represent the only contact with the outside world and are the source of all goods consumed by the local residents. Wien is a major freight carrier to remote areas. During 1978 the airline moved 33,000 tons of freight out of Anchorage International Airport, most of it to the bush.

The two other major airlines serving the region are Reeve Aleutian Airways and Great Northern Airlines. As the name would imply, Reeve provides service to Cold Bay and all major locations in the Aleutian Islands and Alaska Peninsula with its fleet of Lockheed Electras. It provides once- or twice-daily flights between Anchorage and Cold Bay and Unalaska with less frequent flights from Cold Bay to the other island locations. Reeve also flies between Cold Bay and Seattle two or three times weekly. In 1978, the airline moved 2,500 tons of freight out of Anchorage

to the Aleutians and brought back 1,100 tons, mostly fish. Great Northern is a major carrier that moves freight into and out of the region, particularly to and from Nome, Kotzebue, and Unalakleet. In 1978, it moved 28,000 tons of freight from Anchorage to all areas of the state, but mostly to the western and northern areas. It brought back 6,000 tons, primarily seafood, mostly from Bristol Bay. This company also uses Lockheed Electra aircraft. In early 1980 the company announced plans to merge with Alaska International Airlines, a Fairbanks-to-Prudhoe Bay carrier, to form Alaska's largest intrastate airline.

The Marine Highway

The only other transport mode important to the area is the State Marine Highway System which connects Kodiak with the Southcentral ports of Homer and Seward. Frequency is once per week to each and it is used primarily by passengers with vehicles, especially for recreational purposes. The vessel used on this run is *Tustemena*. Twice in the spring and fall of each year she also makes runs down the Alaska Peninsula to Sand Point and King Cove.

THE SOUTHCENTRAL/INTERIOR

This region contains the majority of the state's population and economic activity. Accordingly, it has the most diverse transportation system and is the only area of the state where overland modes play a significant role. This is the region which most closely approximates the contiguous states in the manner in which its network has evolved. The economy is diverse, with many more sectors having a significant impact than is the case in either the southeast or Western/Arctic. In addition, this area has sufficient population to support rudimentary service sectors, which make for a more diverse commodity flow—much more so than elsewhere in the state. It has five major seaports, three significant lesser ones, a river port, a rail and highway network, and extensive air service tying together all principal population centers.

Marine Transport

Valdez

Valdez is the state's largest port in terms of total annual tonnage (Table 2). As the southern terminal of the Trans-Alaska Pipeline, and the nation's only superport, it is capable of handling most American-registered tankers presently afloat. Annual throughput is presently about 60 million tons, with 99 percent of this being crude petroleum en route to the West Coast or Alaska refineries, or for transshipment to the U.S. East Coast via the Panama Canal. Most of the petroleum is moved in tankers operated

³This competitive condition frequently results from a large portion of goods being shipped into remote areas by air as parcel post rather than under normal airfreight tariffs.

by the North Slope oil companies. Typical of the ships used in this service are *Arco Juneau*, 121,000 tons; *B.P. Alaska*, 189,000 tons; and *Arco Sag River*, 70,000 tons. In addition to the crude oil, about 400,000 tons of petroleum products move to or through the Valdez port, which is a major distribution point for two companies transshipping the commodity to both coastal and inland points throughout Southcentral and Southeast Alaska. Little else presently moves through the port; however, the city expects to begin construction of a container terminal in 1980. The port also has facilities for movement of rail cars from barges to local destinations. However, these have not been used since completion of the pipeline terminal. During the construction period, this service was provided from Whittier by Crowley Maritime. In early 1980, Pacific Western Lines announced that they would inaugurate monthly barge service between Valdez and Seattle in April 1980, giving the port its first scheduled service since the 1964 earthquake.

Kenai

The Kenai area has the second largest port complex in the state. Like Valdez, outbound crude petroleum is its principal commodity. However, since the area is also a refining and petrochemical center, it is not so dominated by crude oil as is Valdez.⁴ Kenai has a total annual throughput volume of about 10 million tons, of which almost 70 percent is crude oil. Unlike Valdez, more than 400,000 tons of this commodity is imported, mostly from the Far East, to be processed into chemicals for re-export to the Orient. Of the remaining total tonnage, about 5 percent is outbound chemical fertilizer and 25 percent is outbound petroleum products. The latter are shipped to points throughout Alaska, to the West Coast, and, in the form of liquefied petroleum gas, to the Far East. The fertilizer is shipped by Crowley Maritime's Pacific Alaska Lines, which uses two custom-built 12,000-ton barges to transport the material from Nikiski to Portland, Stockton, and Sacramento, making a minimum of twenty trips per year. A large component of the outbound marine petroleum products movement, that going to Anchorage, ceased in late 1977 with the completion of a 10-inch pipeline between the two points. In addition to petroleum, the port handles about 75,000 tons of general cargo, mostly related to off-shore oil exploration and operations. The only carriers serving the port are contractors serving the oil or petrochemical industries. No

scheduled operations call at the port.

Anchorage

Anchorage is Alaska's largest general cargo port. Annual freight volume is currently at about the 2-million-ton level. Of this, about 40 to 45 percent is petroleum products inbound from the West Coast and Far East. However, the volume of petroleum is declining both as a percentage of the total and as an absolute amount as the state becomes increasingly self-sufficient in its fuel requirements and a greater proportion of the total demand is supplied by the Nikiski Pipeline. Conversely, general cargo movements should continue to increase in volume, both absolutely and proportionately. About 90 percent of the general cargo is inbound and most of this is brought to the port on container or roll-on-roll-off ships operated from Seattle or Tacoma. Sea-Land provides twice weekly service using three ships, each with a capacity of 360 containers. These are *Portland*, *Philadelphia*, and *Newark*. Totem Ocean Trailer Express provides twice weekly service with two roll-on-roll-off ships, *Great Land* and *Westward Venture*, each with a 410-trailer capacity. The remaining freight generally consists of bulk construction material brought from Seattle by barge. This is transported by Pacific Western Lines, which provides biweekly summer service, and by Coastal Barge Lines which sails monthly during the construction season. Of the general cargo, consumer merchandise represents about 35 percent and food products about 25 percent. The remainder is composed of a variety of construction and consumer items. Outbound materials are similarly diverse.

Of the products moving into the Anchorage port, about 60 percent are destined for Anchorage with the remainder having destinations throughout the region. The city-owned port is a modern, highly efficient facility with two container/roll-on-roll-off berths, with one berth used for general cargo, petroleum, or bulk. In addition, there are several privately owned facilities.

While not ice free in the winter, Anchorage harbor is navigable by non-ice strengthened, self-propelled shipping year round, due to tidal action which keeps the ice broken throughout the winter season. The port has one other physical problem: the channel must be dredged annually to maintain sufficient depth for ocean-going shipping. Despite the dredging, most larger ships must wait 3 hours into the rising tide before they have sufficient depth to enter the harbor.

Whittier

Whittier is operated principally by the Alaska Railroad and is the point at which railcar barges from Seattle and Prince Rupert, B.C. are loaded and un-

⁴The principal outbound crude terminal is not actually in Kenai but is directly across Cook Inlet at the mouth of Drift River, while the petrochemical port is 7 miles to the north at Nikiski. Within the city itself there is only a small docking facility on the Kenai River.

loaded. In addition, the military maintains a petroleum products terminal at the port, which is connected by an 8-inch pipeline to the Air Force and Army installations in Anchorage. Annual throughput varies between 300,000 and 500,000 tons, with no single commodity being particularly dominant. The railcars arriving at Whittier are usually loaded outside the immediate Seattle area and carry consumer goods not wholesaled in that area and other items such as chemicals, vehicles, machinery, lumber, and metal products which are customarily moved by rail in the continental U.S. and Canada. Alaska destinations are: Anchorage, 60 percent; the Interior, 25 percent; with the remainder going to other areas. Crowley Maritime's Alaska Hydro-Train division presently provides weekly service from Seattle to Whittier using barges with a capacity of 50 to 60 railcars (depending on car length). Frequently, two barges will be towed on each run. Canadian National Railway provides service from Prince Rupert, B.C. every ten days, using a barge with a 20-to-30-car capacity. Washington Tug and Barge provides the actual towing capability for Canadian National Railway.

Seward

Seward can presently be best characterized as a port in waiting. Before 1964, most of the petroleum and general cargo destined for Anchorage and the Interior moved via the Seward docks. However, most of the port's facilities were destroyed in the 1964 earthquake, and since being rebuilt in 1966 it has primarily been a general cargo port handling about 50,000 to 150,000 tons per year. In early 1979, the last scheduled service, biweekly Pacific Alaska Lines barges from Portland, ceased calling at this port. Since then, the primary activity has been as a shipping point for log and wood chip exports to Japan at the rate of about 40,000 tons annually. Future activity will likely center around the seafood and logging industries and offshore petroleum developments.

The last major movements through the port took place during 1974 through 1977, and were related to pipeline construction and offshore oil exploration. The principal commercial dock at Seward is owned by the Alaska Railroad.

Homer

Of the three lesser ports in the region, Homer is the most important. Its primary function is as a seafood processing center and as a base for an extensive fishing fleet. However, it does not handle large quantities of outbound seafood products. These are generally moved by truck to Anchorage for shipment to Seattle in order to make use of the larger port's more frequent sailings. The largest local export is lumber; the limited amount of logging in the area provides some lumber for shipment to the Far East. The major import tonnages are petroleum products. No sched-

uled carriers call at Homer.

Cordova

Cordova is the other significant southcentral coast port. It is a fishing port whose principal imports are petroleum products and exports are seafood products. It is the only port in the region without overland transport connections. Service to the town is via fuel barge from Valdez and by Sea-Land's *Aleutian Developer* every two weeks from Kodiak.

Prudhoe Bay

The remaining ocean port in the region is the privately owned facility at Prudhoe Bay. (This arctic coast port is included here with a more southerly region because the economic and overland transport ties of this oil-producing area are with the Southcentral and Interior areas.) This port is usually open only 4 to 6 weeks per year and in some years may not open at all because of ice conditions. Volume of throughput fluctuates considerably, depending on the types of oil-field development which may be under way at a particular time. Annual volumes have ranged from a high of 187,000 tons during 1970, to 153,000 tons in 1975, down to the present 20 to 40 thousand tons. The present low throughput results from the increasing use being made of the North Slope haul road as a year-round supply facility for the Prudhoe Bay area. Because of the seasonal nature of marine transport, items delivered by water may require storage for up to 12 months. It is this inventory and storage cost which appear to make the haul road an economically feasible alternative. Prudhoe Bay has the only permanent terminal facilities on the northern coast of the state.

Nenana

The one major river port in the Interior is the Nenana, located at the confluence of the Tanana and Nenana rivers and about 200 miles above the point where the Tanana empties into the Yukon. It is a seasonal port, operating from late May through early October of each year. Throughput is usually between 30 and 40 thousand tons, with 99 percent of this being outbound. Of this, about 80 percent is petroleum products, with general subsistence and construction goods making up the remainder. Destinations may include all points on the lower Tanana, Koyukuk, and the Yukon River, all the way from the Canadian border to St. Marys. However, Yukon traffic south of the mouth of the Koyukuk is usually handled via St. Michaels. Nenana is a primary transfer point for supplies to the Air Force stations at Fort Yukon and Galena. The Alaska Railroad owns and operates the port of Nenana. Most barge traffic on the river system is handled by Yutana Barge Lines. The Yukon, Nenana, Tanana, and other major navigable rivers in Alaska are described in Table 4.

Table 4

Major Navigable Alaska Inland Waterways

River	Restrictions
Yukon	Navigable by shallow-draft, flat-bottom river boats from the mouth to near the head of Lake Bennett. It cannot be entered or navigated by ocean-going vessels. Controlling depths are 7 feet to Stevens Village and 3 to 5 feet thereon to Fort Yukon.
Koyukuk	Navigable by vessels drawing up to 3 feet to Allakaket during normally high river flow and to Bettles during occasional higher flows.
Tanana	Navigable by shallow-draft (4-foot), flat-bottom vessels and barges from the mouth to Nenana and by smaller river craft to the Chena River 201 miles above the mouth. Craft of 4-foot draft can navigate to Chena River on high water to University Avenue Bridge in Fairbanks.
Porcupine	Navigable to Old Crow, Yukon Territory, by vessels drawing 3 feet during spring runoff and fall rain floods.
Kuskokwim	Navigable by 18-foot draft ocean-going vessels from mouth upriver 65 miles to Bethel. Shallow-draft (4-foot) vessels can ascend river to Mile 465. McGrath at Mile 400.
Stikine	Navigable (May 1 – Oct. 15) from mouth 165 miles to Telegraph Creek, B.C., by shallow-draft, flat-bottom river boats.
Susitna	Not navigable by ocean-going vessels. Stern wheelers and shallow-draft, flat-bottom river-boats can navigate to confluence of Talkeetna River, 75 miles upstream but cannot cross bars at mouth of river.
Nushagak	The river is navigable by small vessels of 2½-foot draft to Nunachuak about 100 miles above the mouth. Shallow-draft ocean-going vessels can navigate to mouth of Wood River, mile 84.
Noatak	Shallow-draft barges can ascend Noatak River to a point about 18 miles below Noatak village. Shallow-draft vessels can continue on to Noatak.
Kobuk	Controlling channel depth is about 5 feet through Hotham Inlet, 3 feet to Ambler and 2 feet to Kobuk Village, about 210 river miles.
Kvichak	The river is navigable for vessels of 10-foot draft to Alaganak River, 22 miles above the mouth of Kvichak River. Remainder of river (28 miles) navigable by craft drawing 2-4 feet depending on stage of river. Drains Lake Iliamna which is navigable an additional 70 miles.
Naknek	Navigable for vessels of 12-foot draft for 12 miles with adequate tide. Vessels with 3-foot draft can continue an additional 7.5 miles.
Chilkat	Navigable by shallow-draft vessels to village of Klukwan, 25 miles above mouth.

Source: U.S. Army, Corps of Engineers.

The Marine Highway

The state's Marine Highway System operates to the ports of Homer, Seldovia, Seward, Cordova, Valdez, and Whittier and connects these to Kodiak. Service is year-round for all except the Whittier-Valdez route, which is operated only during the summer. Traffic consists almost entirely of passengers and their vehicles, except for occasional freight movements on the Cordova and Homer-Kodiak routes. Frequency is once or twice a week on most links, with three-times weekly service available between Homer and Seldovia and five times weekly between Valdez and Whittier during the summer. Summer schedules require two vessels, *Tustemena* and *Bartlett*. *Tustemena*, the only ocean-going ship in the state's fleet, is assigned to all traffic between the mainland and Kodiak, while *Bartlett* handles business along the coastline. Generally, only one of the ships is

operated in winter. Total traffic on this system during 1978 was 47,000 passengers and 13,000 vehicles (Table 5). Comparable figures in 1977 were 40,000 and 13,000. The busiest ports were Valdez, Whittier, and Homer, while the most heavily traveled routes were Valdez-Whittier and Valdez-Cordova.

Roads and Highways

Most points in the Southcentral/Interior region are linked by a system of highways. The network is predominantly two-lane, asphalt-surfaced roads. Exceptions to this include several major gravel highways and some four-lane and freeway-class highways in the immediate vicinity of Anchorage and Fairbanks. Even though roads exist in this region, they do not form a dense network; the entire area of about 175,000 square miles has only seven major highways, five minor ones, and a few access roads. Between the coastal

Table 5
Marine Highway System

1978 Southcentral Passenger Origins and Destinations

Destinations	Origins								
	Cordova	Ellamar	Valdez	Whittier	Seward	Kodiak	Port Lions	Seldovia	Homer
Cordova		38	2,691	28	1,542	1			
Ellamar	42		14						
Valdez	2,445	10		9,957	711	3			
Whittier	224		11,219						
Seward	1,480		610				4	7	51
Kodiak	47		30		2,244	1,630	237	97	3,158
Pt. Lions					46	227			
Seldovia	1				9	38			2,254
Homer	7		2		48	3,017	95	2,168	

1978 Southcentral Vehicle Origins and Destinations

Destinations	Origins								
	Cordova	Ellamar	Valdez	Whittier	Seward	Kodiak	Port Lions	Seldovia	Homer
Cordova			1,072	7	303	4			
Ellamar									
Valdez	844			2,043	204				
Whittier	45	30	2,277						
Seward	262		165			637			9
Kodiak	14		12		827		95	34	1,209
Pt. Lions					26	99			
Seldovia						38			859
Homer					17	1,200	14	757	

Source: Alaska Marine Highway System; Annual Traffic Volume Report-1978.

areas and Fairbanks, the entire on-highway population does not exceed 10,000. Average daily traffic volume for Alaska highways is shown in Table 6. As can be seen, traffic volumes are not heavy except near urban areas and on the Kenai Peninsula.

The Richardson Highway

The Richardson Highway is the state's oldest road, extending 370 miles from Valdez to Fairbanks. It crosses the coast mountains in the first fifty miles from Valdez, with the remainder of the route traversing rolling hills and high plateaus. Heavily used during

construction of the trans-Alaska pipeline, which parallels the road, it has since been only partially reconstructed, with the center segment between Gulkana and Delta Junction being in particularly poor condition. The main commodities carried over the road are petroleum products trucked from Valdez to interior towns and pipeline pump stations and general goods hauled into Valdez from Anchorage and from Fairbanks to Eielson Air Force Base, Fort Greely, and Delta Junction. The highway is four-lane from Fairbanks to Eielson and two-lane the remainder of its length.

Table 6
Average Daily Traffic Volume
Selected Alaska Highway Segments
(Vehicles per day)

Highway Segment	1978	1975	1970	1965	1960
Sterling					
Soldotna-Seward Highway Jct.	2,537	1,723	1,165	690	565
Soldotna-Homer	1,698	1,179	679	440	N/A
Seward					
Seward-Sterling Highway Jct.	768	693	550	429	N/A
Girdwood-Sterling Highway Jct.	1,719	1,594	924	499	N/A
Potter-Girdwood	3,508	2,985	1,929	1,217	889
in South Anchorage	37,791	27,649	16,094	12,907	7,267
Parks					
Glenn Highway Jct.-Willow	1,158	943	381	150	N/A
Willow-Mt. McKinley Park	468	516	—	—	—
Mt. McKinley Park-Nenana	991	791	—	—	—
Nenana-Fairbanks	820	1,136	364	260	N/A
Glenn					
Anchorage-Eagle River	17,566	11,373	7,150	4,105	2,982
Eagle River-Palmer	7,910	5,351	3,322	1,964	N/A
Palmer-Glennallen	501	607	N/A	N/A	N/A
Tok Cut-off, Alaska					
Tok-Canadian Border	235	292	176	208	N/A
Glennallen-Tok	497	451	333	258	N/A
Richardson					
Valdez-Glennallen	275	696	164	101	N/A
Gulkana-Delta Junction	207	552	367	269	N/A
Delta Junction-Eielson AFB	730	643	575	550	N/A
Eielson AFB-Fairbanks	11,022	10,150	5,647	4,695	4,419
Other					
Palmer-Wasilla	2,233	1,736	1,249	1,425	1,197
Ketchikan-Ward's Cove	4,231	N/A	N/A	1,979	N/A
Haines-Canadian Border	632	603	613	330	N/A
Fairbanks-Fox	1,769	2,753	1,433	886	489
Juneau-Auke Bay	12,771	9,538	6,146	4,262	2,224

Source: Alaska Department of Transportation and Public Facilities; Alaska Highways Annual Traffic Volume Report-1978.

The Alaska Highway

Alaska's principal overland connection to Canada and the United States is the Alaska Highway. Built as an emergency measure in World War II, the road extends southeastward 200 miles from its connection with the Richardson Highway at Delta Junction to the Canadian border. From that point, it reaches 1,200 miles through Whitehorse to its connection with the Canadian transcontinental system at Dawson Creek. Two hundred miles east of the Alaska-Yukon border, at Haines Junction, the Alaska Highway connects with the highway that originates at Haines, Alaska in the Southeast. Freight traffic on the Alaska Highway enjoyed a brief boom during the 1975-1977 pipeline construction years, with about 40,000 tons of general cargo coming into the state in 1977. However, since that period, freight movements have decreased to much lower levels, reflecting that little more than local supplies, mail, and a few household goods are being moved. Passenger (principally tourist) traffic continued its steady postwar increase until 1979, when it slackened due to gasoline shortages in the U.S. Tourist use now represents the most important use of the facility. The Alaska portion of the highway is paved, as are several hundred miles in Canada in segments near Whitehorse, Watson Lake, Fort Nelson, and Dawson Creek. However, most of the Canadian route remains gravel. The entire 1,400-mile route is through rolling hill country.

The Glenn Highway

Connecting Anchorage to the Richardson and Alaska highways is the Glenn Highway, which extends 325 miles from Tok on the Alaska Highway through Glennallen on the Richardson Highway to the Matanuska-Susitna Valley and Anchorage. Freight traffic on the route includes petroleum products from Anchorage destined for points along the Glenn, Richardson, and Alaska highways and general goods destined for Valdez and areas of the eastern interior. The first 20 miles east of Anchorage are four lane, while the remaining 20 miles to Palmer are two lane, all through flat coastal terrain. East of Palmer the next 75 miles traverse mountainous areas, while the remaining segments to Glennallen and Tok are across the rolling interior plateau.

The Parks Highway

The remaining major road of the Interior system is also the newest and most heavily used. This is the Parks Highway which provides direct road access from the south (near Anchorage) to Fairbanks. It is 325 miles from its junction with the Glenn Highway near Palmer to the northern interior city. Important intermediate points include several towns in the Lower Susitna Valley, the Healy River coal mining

area, Mt. McKinley National Park, and the river port of Nenana. Commodities moved are in all classes, including about 75,000 tons for local delivery along the highway and about 150,000 tons of items bound for Fairbanks and points north. This highway has also become a principal artery for passenger travel within the state. Most of the route is through rolling country, although some stretches are mountainous. The entire highway is two lane.

The Seward and Sterling Highways

South of Anchorage, two highways, the Seward and the Sterling, serve most significant communities on the Kenai Peninsula. The Seward Highway goes south for 125 miles from Anchorage to Seward. Its principal freight use is for transporting consumer goods from Anchorage to Seward and for moving seafood products northward for forwarding through the Anchorage port. Most of the route is across mountainous terrain while all but the 8 miles closest to Anchorage is two lane. The Sterling Highway extends from its origin at mile 39 of the Seward Highway 135 miles west and south to the cities of Soldotna and Homer, with a major spur to the petrochemical and fish processing area around the Kenai. This is one of the most heavily used highways in the state. Total commodity traffic is estimated at about 225,000 tons annually, comprised mostly of inbound consumer goods and outbound processed seafood from Homer and Kenai. In addition, there are significant movements of petroleum products throughout the area and logs along the Homer-Kenai segment. The highway is two lanes throughout its length, and except for the easternmost 20 miles, is through rolling country. Passenger traffic is heavy on all Kenai Peninsula highways, particularly weekend recreational traffic from Anchorage.

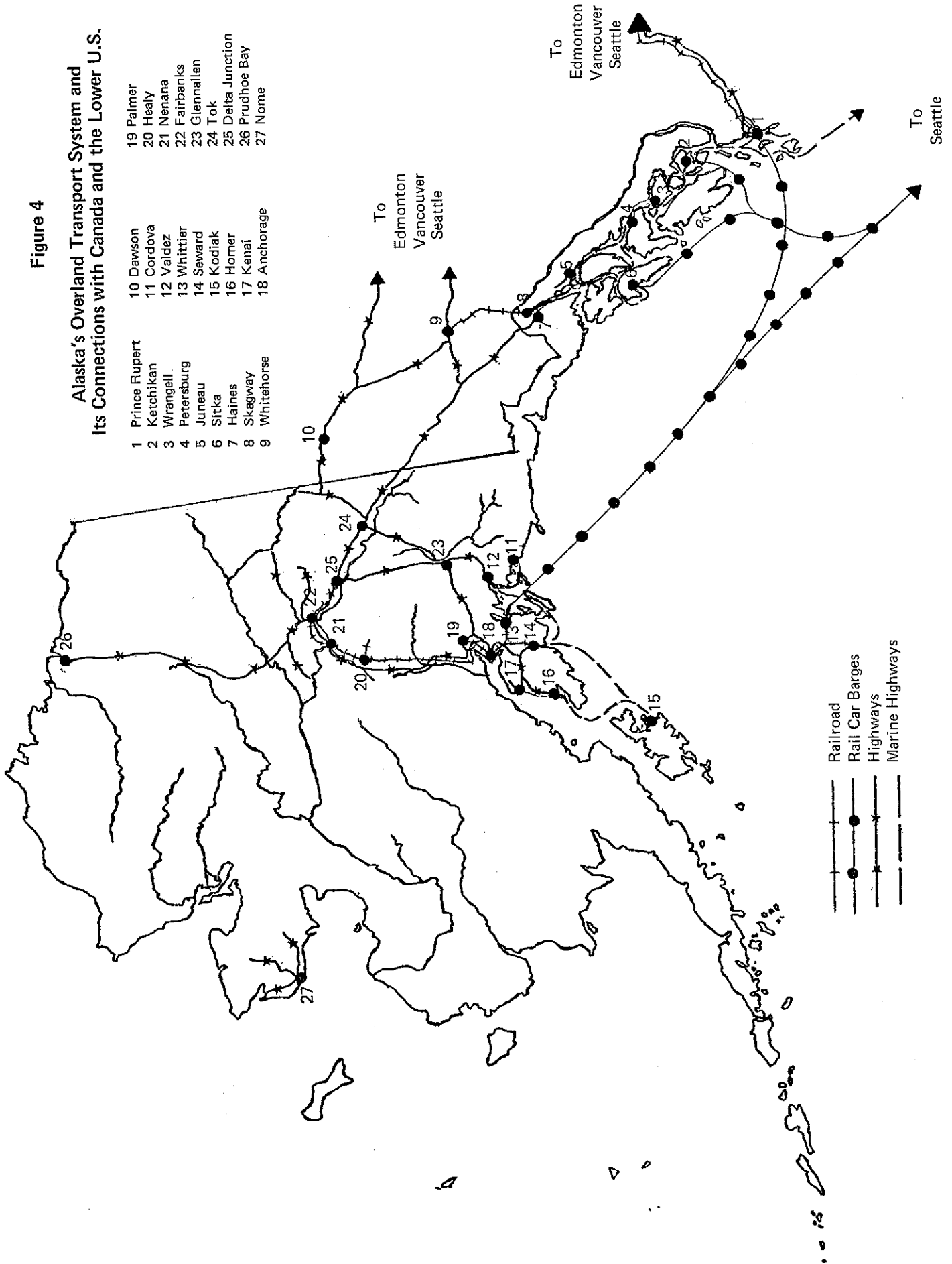
The Prudhoe Bay Highway

The Prudhoe Bay Highway is the last major artery in this region. It is actually composed of two roads, the first being the southernmost 75 miles of the Elliot Highway, north of Fairbanks (from Fox to Livengood), with the remainder being the 420-mile North Slope Haul Road constructed by Alyeska Pipeline Service Company during the building of the trans-Alaska pipeline. The highway is open to public use as far north as the Yukon River, with access restricted beyond that point to firms with special state permits. The highway is mostly used by North Slope oil producers or companies supplying goods for their consumption. Current freight traffic is almost entirely northbound and is mainly heavy oil field supplies. Both segments of the road are gravel except for about 20 miles of pavement on the Elliot Highway near Fairbanks.

Figure 4

Alaska's Overland Transport System and Its Connections with Canada and the Lower U.S.

- | | | |
|-----------------|--------------|-------------------|
| 1 Prince Rupert | 10 Dawson | 19 Palmer |
| 2 Ketchikan | 11 Cordova | 20 Healy |
| 3 Wrangell | 12 Valdez | 21 Nenana |
| 4 Petersburg | 13 Whittier | 22 Fairbanks |
| 5 Juneau | 14 Seward | 23 Glennallen |
| 6 Sitka | 15 Kodiak | 24 Tok |
| 7 Haines | 16 Homer | 25 Delta Junction |
| 8 Skagway | 17 Kenai | 26 Prudhoe Bay |
| 9 Whitehorse | 18 Anchorage | 27 Nome |



Principal Secondary Roads

The principal secondary roads in the region primarily serve local community requirements or provide recreational access. All five of those mentioned here are maintained only during the summer:

- The Steese Highway provides access from Fairbanks to Circle on the Upper Yukon River, 160 miles westward from the river's junction with the Prudhoe Bay Highway.
- The Elliot Highway is a 156-mile gravel road that extends from the Steese Highway (at Fox) to Livengood and Manley Hot Springs on the Lower Tolovana River.
- The Taylor Highway runs from the Alaska Highway at Tetlin Junction, twelve miles east of Tok, for 160 miles to Eagle on the Upper Yukon near the Canadian border. Fifty miles south of the river it forms a junction with the Canadian Klondike Highway to Dawson and Whitehorse.
- The Denali Highway is 160 miles long and provides access to Mt. McKinley National Park from the Richardson Highway at Paxson.
- The Edgerton Highway extends 95 miles from the Richardson Highway near Tonsina to McCarthy in the Wrangell Mountains.

Motor Transport Carriers

There are about 200 motor transport common carriers in the state, of which about twenty-five to thirty usually have annual operating revenues of \$1 million dollars or more. Of these, about one-third are operated by household goods moving and storage companies. Of the remaining operators, the most important are Lynden Transport, Sea-Land Freight Service, Mukluk Freight Lines, K&W Trucking, Mammoth, Sourdough Express, KAPS Transport, and Kodiak Oil Field Haulers. The remaining large common carriers generally provide local delivery services of one product exclusively (usually bulk petroleum). The small common carriers are mainly towing and wrecking firms and local delivery services. In addition, there are almost 200 contract motor carriers in Alaska, only about five of whom have over \$1 million dollars operating revenue annually. About 85 percent of the contract carriers are limited to hauling of dry bulk construction goods (sand, gravel, cement) usually as part of a parent construction company. Of the remainder, about one-third are log carriers, half are house movers, and the rest haul mostly petroleum products or general cargo. In addition to the freight carriers, there are about thirty-five firms licensed to carry passengers. Of these, about half are taxi or limousine services and most of the remainder operate only charter, tour, or sightseeing services. Only three

provide scheduled intercity routes.

The Alaska Railroad

The Alaska Railroad is the state's principal rail facility, extending 470 miles north from the ports of Seward and Whittier, through Anchorage, Healy, and Nenana to Fairbanks. Owned and operated by the U.S. Department of Transportation, it has a single main track throughout and is operated without a train control signal system. Although traffic volumes are not heavy (see Table 7), the physical plant is well maintained and is capable of handling all types of equipment between Whittier and Anchorage, as well as cars up to 90 tons capacity elsewhere. A major upgrading of track and structures during the 1975-1977 period accounts for the current excellent condition. The purchase of fifteen new locomotives together with the rebuilding of ten others has also given the line a reliable, modern motive power fleet. Annual traffic volume varies between 1.8 and 2.3 million tons, with 75 percent of this consisting of gravel and coal. Gravel, moved to Anchorage from Palmer in summer-operated unit trains, accounts for about half of the total volume, while coal movements from Healy to Fairbanks and Eielson Air Force Base equal 500,000 to 600,000 tons. Movement of petroleum products, mostly gasoline, from Anchorage to Fairbanks amounts to 200,000 tons, while Anchorage-to-Fairbanks container and trailer traffic reaches 100,000 tons a year. The remainder is accounted for primarily by interline movements received via the rail car barges at Whittier (about 220,000 tons) and by cement transported from Anchorage to Fairbanks. Frequency of freight service is three times weekly between Anchorage and Fairbanks, with overnight delivery to Fairbanks of goods arriving in Anchorage by ship. Twice weekly coal trains operate from Healy to Fairbanks; service is once or twice weekly from Anchorage to meet barges in Whittier, once weekly to Seward, mostly for log movements, and five or six times weekly for summer gravel trains from Palmer to Anchorage. The railroad also delivers fuel to both Anchorage and Fairbanks international airports. Daily Anchorage-Fairbanks and Anchorage-Whittier passenger service is provided during the summer with the schedules being reduced to twice and three times weekly, respectively, in the winter. The summer trains to Whittier provide an auto shuttle service to connect with the Marine Highway vessels to Valdez, while the winter passenger trains to Fairbanks also handle high-priority container and trailer traffic. The principal yard, repairshops, and headquarters are located in Anchorage, while other smaller yards and shops are at Seward, Healy, Fairbanks, Whittier, Palmer, Suntrana, Nenana, and at the four military installations served by the railroad.

Table 7

Alaska Railroad Traffic Profile

Commodity	Freight Traffic Revenue Tons (in Thousands)									
	1971	1972	1973	1974	1975	1976	1977	1978	1979	
Sand and Gravel	3	3	2	1	1	104	700	727	637	
Coal	600	607	565	563	584	607	550	593	524	
Bulk Petroleum	248	406	363	414	557	624	532	374	220	
TOFC/COFC (Piggyback)	49	35	48	57	95	114	100	100	89	
Forest Products	43	51	49	56	120	124	82	68	55	
Machinery and Machines	16	16	15	21	60	31	47	47	24	
Cement	16	12	15	14	25	32	42	33	33	
Iron and Steel Pipe and Fittings	29	68	11	15	107	174	16	28	33	
Manufactured and Misc. Products not otherwise specified	32	43	32	34	44	29	17	13	25	
Manufactured Iron and Steel	20	21	18	37	60	89	19	12	12	
Agricultural Products	11	22	18	15	13	9	12	8	7	
Animal Products	6	19	8	5	3	3	4	2	0	
Other	148	303	187	145	193	248	184	173	149	
TOTAL	1,221	1,606	1,331	1,377	1,862	2,188	2,305	2,178	1,808	

Revenue Passengers
(in Thousands)

Passengers	94	102	74	85	81	84	118	126	151
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Note: All quantities are for federal fiscal rather than calendar years.

Source: Alaska Railroad, Office of Policy and Plans.

Air

Air service in the region is comprehensive. Most passenger traffic moves by air, although because of highway and rail alternatives, it is not as dominant as in the other regions. Areas with scheduled jet services include Anchorage, Fairbanks, Prudhoe Bay, Kenai, Homer, and Cordova, with those at Anchorage and Fairbanks being international class facilities around which most service in the region revolves.

International Air Service

Anchorage is the hub not only of the region and the state, but also of the Northern Pacific Rim. It has direct passenger and freight flights to most of the major hubs of Western Europe and Southeast Asia in addition to frequent service to U.S. points and Alaska locations. Northwest Orient, Flying Tiger, Japan Air Lines, Lufthansa, British Airways, Sabena, KLM Royal Dutch, and Scandinavian Airlines all provide passenger or cargo service from Anchorage to Japan and other Far East points while all but the first two also fly from Anchorage to Europe.

Interstate Air Service

Interstate service from Anchorage is provided by

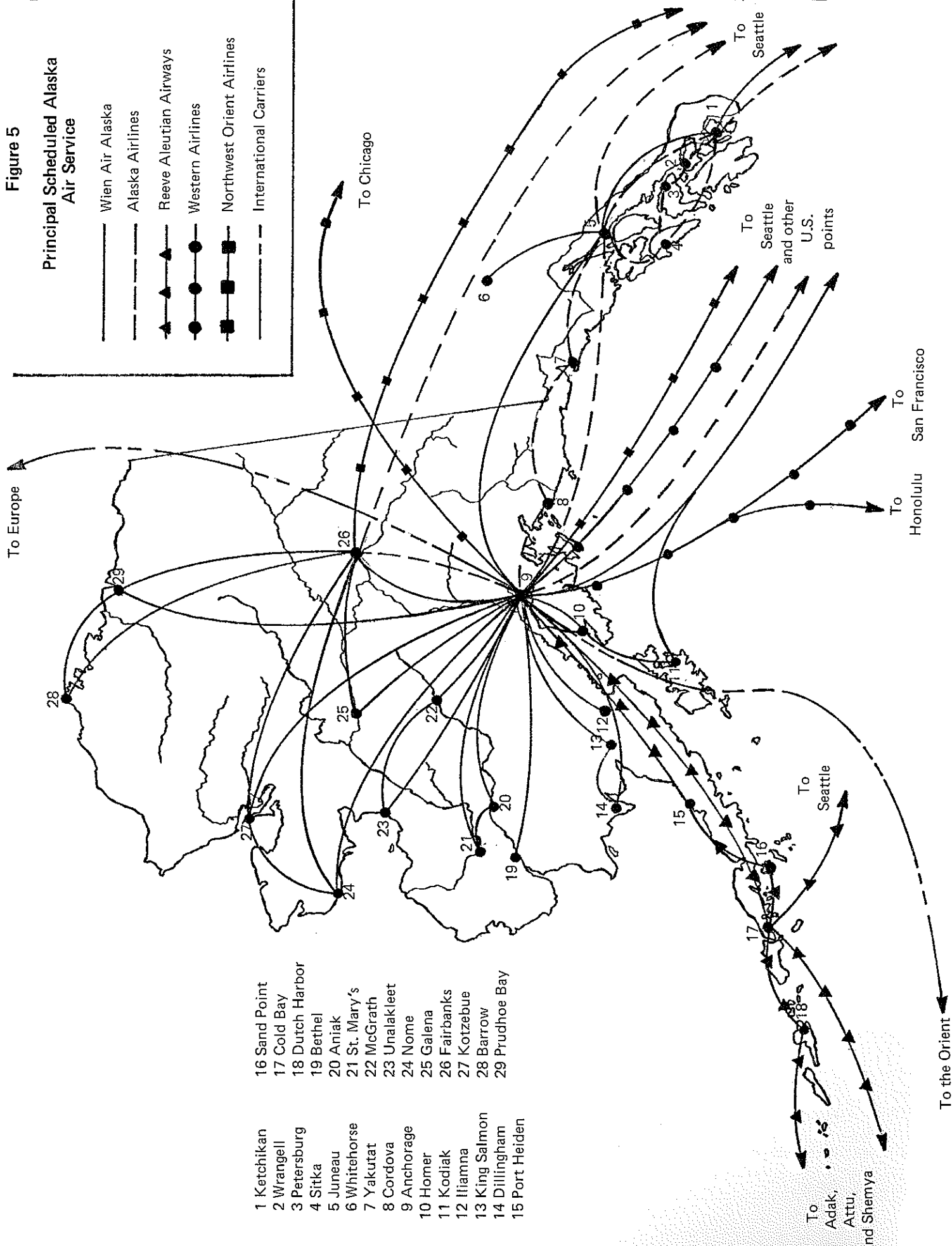
Alaska Airlines, Wien Air Alaska, Western Airlines, Flying Tiger, and Northwest Orient Airlines as follows:

- Alaska Airlines provides four to six daily flights to Seattle (two of which continue to San Francisco), one to Portland, and one to Dallas and Houston on a through-plane agreement with Braniff.
- Wien provides two or three daily flights from Anchorage to Seattle, and during the summer, three weekly flights from Kenai to Seattle
- Western Airlines also flies between Anchorage and Seattle four to six times daily, with four flights continuing to either San Francisco, Los Angeles, San Diego, Phoenix, Denver, Dallas, Houston, or New Orleans, with the latter four cities served via a through-plane agreement with Continental Airlines. Western also has daily direct service to San Francisco and three to six weekly flights to Honolulu.
- Northwest Orient has two or three daily flights to Seattle, with continuing service to Los Angeles, Tampa, Chicago, Cleveland, and

Figure 5

Principal Scheduled Alaska Air Service

- Wien Air Alaska
- - - Alaska Airlines
- ▲ Reeve Aleutian Airways
- Western Airlines
- Northwest Orient Airlines
- - - International Carriers



- 1 Ketchikan
- 2 Wrangell
- 3 Petersburg
- 4 Sitka
- 5 Juneau
- 6 Whitehorse
- 7 Yakutat
- 8 Cordova
- 9 Anchorage
- 10 Homer
- 11 Kodiak
- 12 Iliamna
- 13 King Salmon
- 14 Dillingham
- 15 Port Heiden
- 16 Sand Point
- 17 Cold Bay
- 18 Dutch Harbor
- 19 Bethel
- 20 Aniak
- 21 St. Mary's
- 22 McGrath
- 23 Unalakleet
- 24 Nome
- 25 Galena
- 26 Fairbanks
- 27 Kotzebue
- 28 Barrow
- 29 Prudhoe Bay

Atlanta. Direct daily Anchorage-to-Chicago service is also offered with this flight continuing to Miami.

- Flying Tiger also provides direct daily cargo service to New York, Chicago, Seattle, and Los Angeles.

Aircraft used by companies on these routes include the Boeing 720, 727, 737, 747, and McDonnell-Douglas DC8s and DC10s.

Intra-regional Air Service

Much of the inter-regional service linking Anchorage with other regions of the state has been previously mentioned. However, there is also considerable air transport activity within the Southcentral/Interior area. The two largest carriers are Alaska Airlines and Wien Air Alaska. Alaska flies to Cordova once daily and to Fairbanks five times daily. Wien flies to Fairbanks four or five times daily. Two or three of these flights continue to Barrow and Prudhoe Bay, while direct Anchorage-to-Prudhoe Bay service is offered several days a week. Twice weekly service to Homer is available.

Anchorage is also the center of considerable intra-regional commuter operations, with the two largest firms being Alaska Aeronautical Industries (AAI) and Polar Airlines. AAI offers 145 to 250 flights per week between Anchorage and Kenai and 45 to 60 scheduled weekly flights to Homer. Service is also available to Seward, Cordova, and Valdez. Polar has 35 to 50 flights weekly to Kenai and 25 to 35 flights weekly to Valdez. Also available is a weekly

service to Glennallen, Tok, and Delta Junction. Total traffic at Anchorage is shown in Table 8 for 1977 and 1978.

Fairbanks also has both international and domestic traffic, although not to the levels of Anchorage. However, the recent availability of locally refined jet fuel has made Fairbanks increasingly attractive to international cargo flights. In addition to service to Seattle via Anchorage on Alaska Airlines, Fairbanks also has daily direct flights to Seattle continuing to San Francisco on both Northwest Orient and Alaska. As mentioned earlier, it also has direct service to many locations in northern and western Alaska. In particular, Wien serves Prudhoe Bay from Fairbanks twice daily. Fairbanks also serves as a staging area for the transport of high-value goods to the North Slope, after they have been brought to this interior city by a variety of modes. Alaska International Airlines, using the Lockheed Hercules, is the largest carrier in this market.

THE ALASKA PETROLEUM DISTRIBUTION SYSTEM

Clearly, much of the total state demand for transport results from the need to move a wide variety of petroleum products. For this reason and due to the critical nature of this commodity for most communities, petroleum products distribution deserves a somewhat detailed treatment here. The subject is also of particular interest because petroleum products produced in Alaska represent a significant

Table 8
Anchorage International Airport Traffic

	Passengers Inbound (in thousands)		Passengers Outbound (in thousands)		Passengers in Transit (in thousands)		Total Passengers (in thousands)	
	1977	1978	1977	1978	1977	1978	1977	1978
International	31.8	30.5	32.0	28.9	880.4	988.7	944.2	1,048.1
Domestic	572.3	579.7	590.3	597.2	86.0	76.8	1,248.6	1,253.7
Intrastate	340.7	372.1	343.2	375.7	1.5	0.2	685.4	748.0
Total	944.8	982.3	965.5	1,001.8	967.9	1,065.7	2,878.2	3,049.8
	Cargo Inbound (tons)		Cargo Outbound (tons)		Total Cargo (tons)			
	1977	1978	1977	1978	1977	1978		
International	492.1	484.7	1,272.2	2,116.4	1,764.3	2,601.1		
Domestic	32,807.7	30,474.4	12,263.9	10,302.9	45,071.6	40,777.3		
Intrastate	16,158.7	21,227.1	69,202.9	65,413.5	85,361.6	86,530.6		
Total	49,458.5	52,076.2	82,739.0	77,832.8	132,197.5	129,909.0		

part of the intrastate as well as interstate and foreign commerce. Six oil companies are involved in this distribution system and they employ both in-house transport resources and those of common and contract carriers. This section will detail the operations of each of these companies.

Chevron, U.S.A.

The most extensive operations in Alaska are those of Chevron. The company operates four principal distribution centers and has other smaller facilities at numerous locations throughout the state. The principal bulk plant for the Southeast is in Ketchikan. It is mainly supplied by company-operated tankers from California refineries and by contract barge from a Puget Sound refinery. Some products are also supplied from Chevron's small refinery in Nikiski. From Ketchikan, products are moved to points throughout the Southeast by contract fuel barges. The major smaller bulk plants are located in Wrangell, Petersburg, Juneau, Sitka, Haines, and Skagway. Chevron's current contractor in the Southeast is Foss Launch and Tug.

Unalaska is the center for operations in the Western-Arctic region. Chevron is the only firm conducting business in this part of the state. The Unalaska terminal receives products from California refineries by tanker. These are then moved to points north and west in contract fuel barges. Local bulk plants are located at Naknek, Dillingham, Bethel, St. Michael, Nome, and Kotzebue. The facility at St. Michael is used mostly as a point for transfer from ocean to river barges. In addition to serving significant local markets, the operations at Bethel and Kotzebue are also transshipment points for distribution to Kuskokwim and Kobuk River locations, respectively. The mainline barge contractor for Chevron in this region is Crowley Maritime, while the Yukon River traffic is handled by Black Navigation. Distribution on the Kuskokwim River is through the services of United Transportation. Seasonal constraints require that all annual petroleum requirements of this region, except those of Unalaska and the Aleutians, be imported between May and October.

The third Chevron distribution point is in Valdez. Products are transported to this location by barge from Kenai and Puget Sound refineries and by company-owned tankers from California refineries. From Valdez, deliveries are made to smaller bulk plants in Yakutat, Cordova, Seward, Homer, Kodiak, and to various fishing stations along the southerly side of the Alaska Peninsula. The Valdez distribution center also supplies Southeast Alaska, particularly Juneau, with Kenai-processed fuel. The method used for many of the local marine deliveries is rather unique. Chevron uses a 2,700-ton tanker, *Alaska Standard*, for service to the outlying ports. The small

size of this vessel both gives it the capability of calling at many points having only limited facilities and closely matches it to the product demand and storage capabilities of these locations. In addition to the marine distribution, products are also moved from the Valdez plant by highway to points in the Interior, generally only as far north as Glennallen or Gulkana but occasionally to more distant locations.

Of the four principal plants, the Anchorage distribution terminal moves the largest volume of products. It is the principal supply location for both local needs and those of the Interior. Products arrive at the Anchorage terminal from two principal sources. The first is by company tanker from California refineries, while the second is by pipeline from the Nikiski refineries. From Anchorage, truck transport supplies local area needs and those of local points along the Glenn Highway, the Parks Highway south of Nenana, the Richardson Highway between Glennallen and Delta Junction, and some areas of the Kenai Peninsula. Other points on the Peninsula are supplied by truck directly from the Nikiski terminal.

Rail transport is used for petroleum products going to the Nenana and Fairbanks bulk plants. These plants also receive products from the Earth Resources Refinery in North Pole. From Fairbanks, distribution is made by highway to northern Interior points, while Nenana is used primarily as a rail-barge interchange point for products destined for towns along the upper Yukon and lower Tanana rivers. This service is provided by Yutana Barge Lines.

Union Oil Company of California

The Union Oil Company maintains the second largest distribution network in the state. It has a somewhat more limited area of operations than Chevron and the structure of its system differs to some extent. It serves both the Southeast and Southcentral/Interior regions.

The Southeast is served from the West Coast refineries by two large terminals located at Juneau and Ketchikan. The Juneau facility provides products only for local consumption. The Ketchikan facility, however, fulfills a much broader role, distributing its products via contract barge to smaller bulk plants throughout the Southeast. Locations of these plants are at Metlakatla, Noyes, Hoonah, Chatham, Petersburg, Wrangell, Sitka, Tenakee, and Haines. Union also provides considerable quantities of fuel to logging camps throughout the region. The present barge contractor for this system is Foss Launch and Tug.

Further west, Union has a somewhat more complex system, with major terminals in Kodiak, Anchorage, and Fairbanks. Kodiak receives products both from the company's West Coast refineries and from the Tesoro Refinery in Nikiski. Service from the West Coast is by company-owned tanker, while the intra-

state distribution is by a local barge contractor. The Kodiak terminal supplies products for local consumption only.

The largest of Union's Alaska facilities is at Anchorage. Most of its products are received by pipeline from the Tesoro Refinery in Nikiski; however, aviation fuel and asphalt feedstock are brought from the West Coast by company-owned tankers. The latter material is refined into commercial asphalt in the firm's Anchorage plant. From the Anchorage terminal, products are distributed by highway both to the local area and to smaller bulk plants in Palmer, Talkeetna, Glennallen, Tok, and to some points on the Kenai Peninsula. The peninsula is also served by highway direct from Nikiski for some products. From Anchorage, some products, principally gasoline and aviation fuel, move by truck or rail to Healy and Nenana and by rail to Fairbanks.

The main terminal in the Interior is at Fairbanks. As mentioned, it receives some products from Anchorage while the remainder, mostly diesel and heating oil, are purchased from the refinery at North Pole. These items are then distributed throughout the Interior by both highway and rail to the Nenana and Healy facilities.

Texaco

Texaco has only a single major distribution point in the state, at Anchorage, which receives products by company tankers from their West Coast refineries and by pipeline from Tesoro's Nikiski Refinery. From Anchorage, products are moved by rail to both Fairbanks and Seward and by highway to all points on the Glenn and Alaska highways, the Parks Highway south of Nenana, and the Richardson Highway south of Delta Junction. The western portion of the Kenai Peninsula is served by highway from a small terminal in Nikiski.

Tesoro-Alaska

Tesoro has extensive facilities throughout the Southcentral-Interior region. The basic component in its operation is its refinery in Nikiski and its ten-inch pipeline from there to Anchorage. As noted previously, these facilities provide service to a number of companies besides Tesoro. However, their primary function is to ensure adequate supplies for the company's own operations. Tesoro maintains three major terminals in the state, at Anchorage, Valdez, and Fairbanks.

The Valdez facility receives products by contract barge from the Nikiski refinery. From this point they are distributed by truck to southern Interior highway points.

The Anchorage terminal receives products by pipeline from Nikiski. These are then distributed by highway to the local area and to points on the west-

ern Glenn and southern Parks highways and by rail to the Fairbanks terminal. From Fairbanks, distribution to the northern Interior takes place via highway transport. The Kenai Peninsula is served by highway directly from the Nikiski terminal.

Other Systems

Three other operations distribute petroleum in the state. The first of these, Mobil Oil Company, has a bulk terminal in Ketchikan from which it distributes products to logging camps in the southern part of the southeast region. The second, Shell Oil, maintains a terminal in Anchorage that primarily supplies aviation and jet fuel for several airlines operating from Anchorage International Airport. This facility receives most of its products from refineries in Singapore.

The third and most extensive system is that maintained by the Department of Defense to service its operations in the state. The Military Sealift Command provides in-house and charter tanker service to its principal terminals in the state (Whittier, Unalaska, Kodiak) while making extensive use of charter fuel barges to serve more remote locations. Currently, Crowley Maritime provides this service. The Whittier terminal is connected to an Anchorage terminal by an eight-inch pipeline. From there, gasoline and aviation fuel is shipped by rail to Fort Wainwright and Eielson Air Force Base. From Ft. Wainwright it is shipped by highway to Ft. Greely. The military purchases diesel and jet fuel for these installations from North Pole Refinery when it is available. Yutana Barge Lines also provides petroleum transport capability between Nenana and Galena and Ft. Yukon Air Force stations. The military also has a terminal with tanker facilities in Haines and an inland terminal at Tok. These are connected to each other and to Ft. Wainwright by an eight-inch pipeline. However, because of pipeline deterioration, this system is now out of service.

General Observations

Petroleum-Products Transport

The transport equipment used in the Alaska market consists of mostly smaller units tailored to the limited demands of the market. Other than the *Alaska Standard* mentioned earlier, tankers are in the range of 15,000 to 50,000 tons. Representative of these are *Chevron Washington*, 40,000 tons, and Union Oil's *Lompoc*, 17,000 tons, both of which visit Alaska frequently. Ocean-going fuel barges are predominantly of a size similar to the Foss Launch and Tug 286 class with a capacity of 38,000 barrels (5,300 tons), although Crowley does have one of its largest barges converted to fuel service with a capacity of 105,000 barrels (14,500 tons). Smaller units are used in Western Alaska for lighterage to shore as well as for river movement. These are usually in the

range of 2,200 to 3,600 barrels (300 to 500 tons). Highway and rail equipment used in Alaska is similar to that used throughout North America.

Major Events Impacting the System

Over the past two decades, certain events have had considerable impact on the shape of the petroleum products distribution system. The first of these was the 1964 earthquake. Prior to that time, Chevron and Texaco had their principal import terminal facilities located in Seward, while Union's main base was in Whittier. The destruction of all of these facilities⁵ occurred shortly after the installation of petroleum transfer capability at the Anchorage port, which was not harmed by the earthquake. This resulted in the main operations for all three companies being shifted to Anchorage. These facility shifts simply represented a reorientation of the external supply system to changes in Alaska geographic conditions.

The second event (or combination of events) is more recent and is in fact still evolving. These consist of the production startup of the Earth Resources Refinery at North Pole, the Tesoro Refinery at Nikiski, and the connection of the latter by pipeline to Anchorage. These developments are much more profound in their long-term impact than the immediate destructive results of the earthquake. This is particularly true in the area of transportation, where the changes formed the basis for an intrastate petroleum production and distribution system. While the effect has been greatest in the railbelt area, all parts of the state have been influenced to some degree. Most locations in the state are now using at least some Alaska fuel. These trends toward self-sufficiency received considerable encouragement from summer fuel shortages on the U.S. West Coast and can be expected to accelerate if recently announced plans for expansion of the Tesoro refinery and construction of the Alaska Petrochemical Refinery at Valdez are carried through. Even without these developments, an increasing proportion of all fuel consumed in the state will be locally produced.

CONCLUSIONS

In this discussion, we have viewed the state's transport system on a regional basis. Within each of these areas, intra-regional trade and movements to points outside the state are more important than interactions with the other regions. Often, only the most basic inter-regional ties exist. Several overall characteristics of the system are immediately obvious and carry important implications for future transportation planning. These include the dominance of marine transport, the economic-transportation system

interactions, the sparseness of Alaska's transportation network, and the various types of flow imbalances.

With only three major exceptions (rail haulage of coal and gravel and Nikiski-Anchorage pipeline movements), all significant commodity flows in the state have a marine component. Because so much of Alaska's activity is coastal, the marine element may be the only transport activity involved in the shipment, other than local delivery. This situation indicates the importance of analysing the structure of maritime operations, port systems, and the method of integrating inland transport into the marine system. It has generally been port location and technology that have controlled the transport component of resource production and the characteristics of the logistics systems developed to satisfy consumer goods demand.

The interaction of transport with its economic environment is another clear characteristic of the Alaska system. The evidence provided by the state's development history indicates that successful transport endeavors have followed the creation of an economic demand (mining, petroleum, timber, defense, fisheries, and Government service delivery). Thus, real or potential economic activities which have required transport services have also caused the development of facilities and operations to satisfy their demands. Examples of this might include the Kenai Peninsula Highway System that was developed in response to petroleum, fisheries, and recreational demand; the Port of Anchorage, which was developed in response to consumer demand; and the port of Kodiak, which was developed in response to requirements of the fishing industry.

Facilities that were constructed without regard to economic demand have met with little success. Examples of the latter include the reconstruction of the Seward Port following the 1964 earthquake and the Interior highway system. In neither case has the construction of transport facilities, without prior economic demand, been sufficient to cause subsequent economic activity, even though both are located in areas of considerable resource potential.

This is not to say that a transport facility, once it is in place, does not contribute to the development of secondary economic activity. This has occurred several times, including the Healy River coal fields, Matanuska Valley gravel mining and Anchorage wholesaling activity. However, each of these activities, which were partially made economically attractive by the existence of transport capability, were also insufficient by themselves to support the initial capital investment required by the transportation facility. Effectively, these economic developments were also responding to the same economic stimuli which created the transport system. Thus, it appears that the Alaska situation requires the existence of a poten-

⁵Including Seward's inland rail connection.

tial or actual economic development before transport development.

The sparseness of the network even in relatively developed regions makes it obvious that any facility additions or changes or any flow pattern or volume changes may impact major portions of the system. This is particularly true if such a change were to lead to a substantial flow across regional boundaries. The relatively small traffic volumes and primitive facilities make the term "major change" refer to projects or commodity quantities which would be regarded as incremental improvements or flow diversions in more highly developed parts of the nation. Thus, a system-wide model that takes the whole network into account would likely be the most appropriate tool for assisting the planning and decision-making process in the transport sector.

Another characteristic that has determined the state's pattern of transport development is the flow imbalance which results in low back-haul rates. Even though the state's imports and exports are somewhat

balanced in terms of total quantities, the mix of commodity types (export of bulk resource materials versus imports of manufactured goods and food) is such that one type of vehicle cannot be used for both export and import. In any case, the import commodity flows have to be broken down into relatively small shipment sizes because of the small markets and long distances. This has prevented the development of a modern efficient transport infrastructure in most areas. In most of the state, only the most rudimentary cargo handling facilities are available due to the limited volumes which are being moved. This severely limits the types of vehicles that can be used in a particular service, a problem made even more serious by the limited number of transport modes available.

In this article we have outlined the structure and constraints of the Alaska transport system. Subsequent *Reviews* will define the procedure designed to replicate and simulate this system in a computer model and detail findings regarding the interrelationship of transportation and various kinds of development.

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