

ALASKA LEGISLATURE COMMITTEE FILES 1987 - 1988 8672

5129 HTRA COMM. MTGS: AK. MARINE HWY. (FILE 2)

701

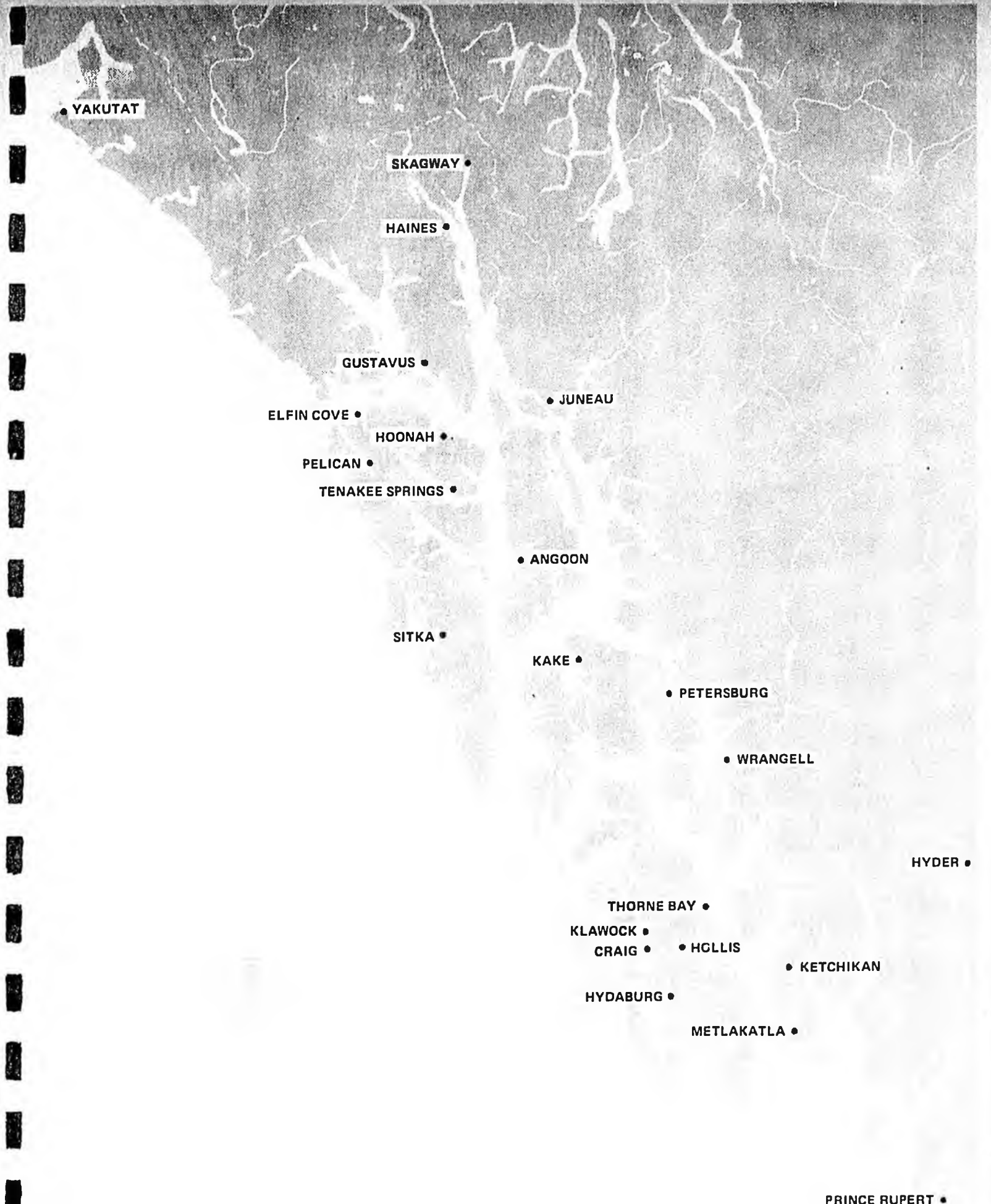


Figure 1
SOUTHEAST ALASKA REGION

the options which were considered as short-term system alternatives and presents the findings of the short-term evaluations, while Section 5 deals with long-term system options in the same manner. Section 6 presents a summary of findings as well as conclusions and recommendations based on the analysis. In addition, two appendixes are provided which describe, in greater detail, some of the evaluation concepts.

2 - REGIONAL PLANNING CONTEXT

2 - REGIONAL PLANNING CONTEXT

2.1 - General

In the years since the previous Transportation Plan was developed, a number of changes have occurred in the Southeast Alaska Region. Some of the changes have been generated internally but many have been generated by outside forces which have impacted on the needs and opportunities within the area.

The intervening years have seen a marked decline, for example, in the resource markets on which a substantial portion of the Alaskan economy is based. Falling oil prices have placed downward pressure on government revenues, while poor markets for forest products and minerals have led to curtailment or deferral of projects which were originally planned for the early 1980s. These factors have led to an increasing reliance on the tourist market, which has remained strong in spite of generally poor economic conditions.

Within the region, shifts in population and income have altered the demand pattern for transportation services. In addition, system changes made as a result of the 1980 Plan have provided new information regarding the interactions between demand and services and have highlighted new areas of service shortfalls.

These factors have combined to create a new context in terms of transportation demand within the Region. At the same time, some significant changes have occurred in the supply side of the equation as new transportation technologies and new types of services have evolved as practical options.

As a result, an initial step in the definition and assessment of system options was to reevaluate the transportation planning framework in terms of

- expected changes in the demand for service,

- the base or existing transportation system, and
- the technological changes which may be available for future integration into the transportation network of the Region.

2.2 - Population and Tourism Growth

The key factors contributing to changing demand for transportation services in Southeast Alaska are the growth in regional population and the growth in tourist traffic into the area. In a survey carried out in 1983, almost 40% of the Marine Highway users were Alaska residents. In addition, on the Marine Highway, almost 50% of the travelers (and over 70% of summer travelers) were tourists. These two markets clearly account for the major portion of surface transportation demand in the Region, and the future growth in these markets will play a key role in defining the need for transportation services.

In the past, population growth in the Southeast Alaska region has generally remained fairly stable and relatively strong. Since the late 1960s, the population of the Region has grown at a fairly consistent rate of 2.5% to 3.0% per year, somewhat lower than the State average of 3.5% but without the marked swings seen in statewide population figures. Similarly, employment opportunity in the Region has shown a fairly stable and strong growth rate, increasing at an average rate of 4.0% per year. (See Table 2.1.)

In the late seventies it was expected that, provided the State capital was not moved from Juneau, the long-term population growth rate could be maintained at around 2.8%, increasing to over 100 000 persons by the year 2000. More recent forecasts, however, have been more pessimistic (see Figure 2). In part because of the Region's dependence on State government employment and the expected need to reduce State spending, forecasts have generally predicted a decline in the long-term annual growth rate. A Delphi forecast prepared in 1983 projected regional population growth of less than 2.5% per year to 1990, declining to below 2% from 1990 to 2000 and less than 1.5% thereafter. The Alaska Institute for Social and Economic Research, using

TABLE 2.1

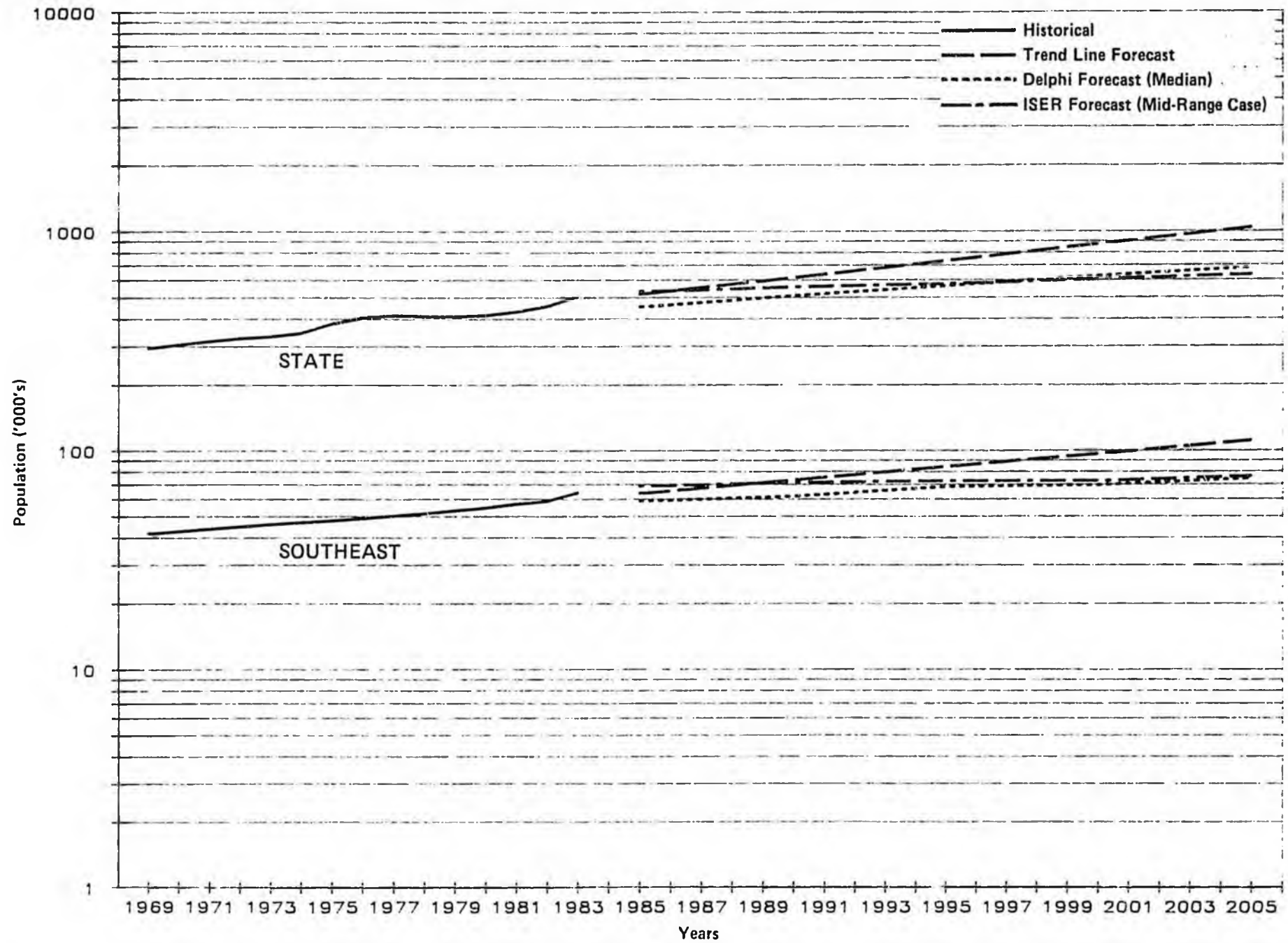
POPULATION AND EMPLOYMENT OPPORTUNITY - SOUTHEAST ALASKA

<u>Population*</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Haines	1,400	1,400	1,400	1,500	1,500	1,500	1,500	1,600	1,600	1,700	1,700	1,700	1,800	1,900	1,800	1,800
Juneau	13,000	13,000	14,600	15,200	15,700	16,100	16,400	17,000	17,500	18,000	18,900	19,800	21,100	22,000	23,000	23,700
Ketchikan Gateway	10,200	10,200	10,200	10,300	10,500	10,700	10,900	11,200	11,400	11,600	11,800	12,000	12,200	12,400	12,600	12,700
Prince of Wales	3,400	3,700	4,000	4,000	4,100	4,200	4,300	4,100	4,100	4,100	4,200	4,300	4,400	4,400	4,600	4,700
Sitka	6,300	3,700	6,100	6,300	6,500	6,700	6,900	7,100	7,400	7,600	7,700	7,800	8,000	8,200	7,700	7,600
Skagway-Yakutat-Angoon	2,700	2,800	2,900	2,900	2,900	2,900	2,900	3,000	3,100	3,200	3,300	3,400	3,500	3,600	3,800	3,700
Wrangell-Petersburg	5,000	5,000	5,000	5,100	5,200	5,300	5,400	5,500	5,700	5,900	6,100	6,300	6,500	6,700	6,700	6,600
Total Southeast	42,000	43,100	44,200	45,300	46,400	47,400	48,300	49,500	50,800	52,100	53,700	55,300	57,500	59,200	60,200	60,800
Total Alaska	297,400	308,500	319,600	329,800	336,400	348,100	354,100	409,800	418,000	411,600	413,700	419,700	435,200	460,800	510,600	
<u>Employment Opportunity</u>																
Total Southeast	15,667	16,710	17,393	19,415	20,423	22,150	21,950	22,300	23,050	24,750	25,000	25,750	27,100	27,750	28,550	29,000
Total Alaska	86,565	92,467	97,584	104,243	109,851	128,179	161,689	171,714	161,071	166,900	166,600	171,600	186,500	200,400	212,900	217,800

*By Census Borough.

Source: Alaska Department of Labour.

Figure 2
ALASKA POPULATION FORECASTS



the detailed State Economic Model, has projected even lower growth rates for Southeast population ranging from a low of less than 0.5% per year in their pessimistic case, up to an average of less than 1% in their optimistic scenario.

In light of these forecasts and the generally weak long-term prospects for the Region, it was decided, for planning purposes, to project that regional population could maintain its long-term growth rate (2.7%) through to the end of the 1980s but that growth thereafter was likely to decline and stabilize at a rate of 1% per year. Regional population was forecast to increase from 60 800 in 1984 to 73 900 by 1990 and 85 800 by 2005.

The second key market for transportation services is tourist traffic. Relatively little data are available on the growth in this market, but indications are that visitor volumes have grown at an average annual rate of 4.5% in recent years. The long-term prospects for this market are strong as increasing proportions of the population find themselves with the leisure time and financial means to indulge their desire for travel.

It is too early to tell whether Alaska can sustain its share of this growing market, just as it is difficult to predict the portion of these visitors who will make use of State-operated transportation services (airports, roads and the Marine Highway). For planning purposes, however, it was assumed that tourist demand for transportation services into and within the Region would continue to grow at 4.5% per year to 1990 and would taper off to 2.5% per year growth thereafter.

2.3 - Existing Surface Transportation System

The surface transportation system currently in place in Southeast Alaska has also changed somewhat since the introduction of the 1980 Transportation Plan. The system has two key components - the marine service system and the road network.

2.3.1 - Marine System

The main factor in existing the marine transportation system is the Alaska Marine Highway. This operation provides surface links for passengers and vehicles both to, from and within the Southeast Region.

Seven vessels operate in the Southeast area. The four mainline vessels, Columbia, Matanuska, Malaspina and Taku, provide service between the southern road systems at Prince Rupert and Seattle and the northern road connections out of Haines and Skagway. They provide a link for the through movement of traffic as well as for passengers and vehicles moving to and from the Region and internally between a number of ports. All mainline vessels offer overnight accommodation for long-distance passengers.

During the peak season, one of these vessels, the Columbia, operates a weekly service between Seattle and Skagway. The other three vessels offer twice-weekly service out of Prince Rupert, making one three-day trip to Skagway via Clarence Straits and Stephens Passage, and one four-day trip when they travel via Chatham Strait and call at Sitka (see Figure 3). Vehicle capacities range from 90 (for the Taku) to 155 (for the Columbia) while passenger capacities range from 500 to 750.

The three remaining vessels, the Aurora, LeConte and Chilkat, provide mainly internal feeder services carrying passengers and vehicles between the smaller communities and the mainline ports. The smaller of these, the Chilkat, operates between Ketchikan and Metlakatla and occasionally to Prince of Wales Island. The Aurora and LeConte, with 40-vehicle, 250-passenger capacity, provide connections between Prince of Wales Island and the Prince Rupert-Ketchikan-Petersburg corridor, and between communities in the Juneau-Sitka-Petersburg triangle (including Hoonah, Pelican, Tenakee Springs, Angoon and Kake) (see Figure 4).

The Marine Highway also acts as an important link for freight movements, providing substantial capacity for truck movements into and within the Southeast Region. This service supplements the activities of various

• YAKUTAT

• SKAGWAY

• HAINES

• GUSTAVUS

• ELFIN COVE

• HOONAH

• PELICAN

• TENAKEE SPRINGS

• JUNEAU

• ANGOON

• SITKA

• KAKE

• PETERSBURG

• WRANGELL

• HYDRUS

• THORNE BAY

• KLAWOCK

• CRAIG

• HYDABURG

• HOLLIS

• KETCHIKAN

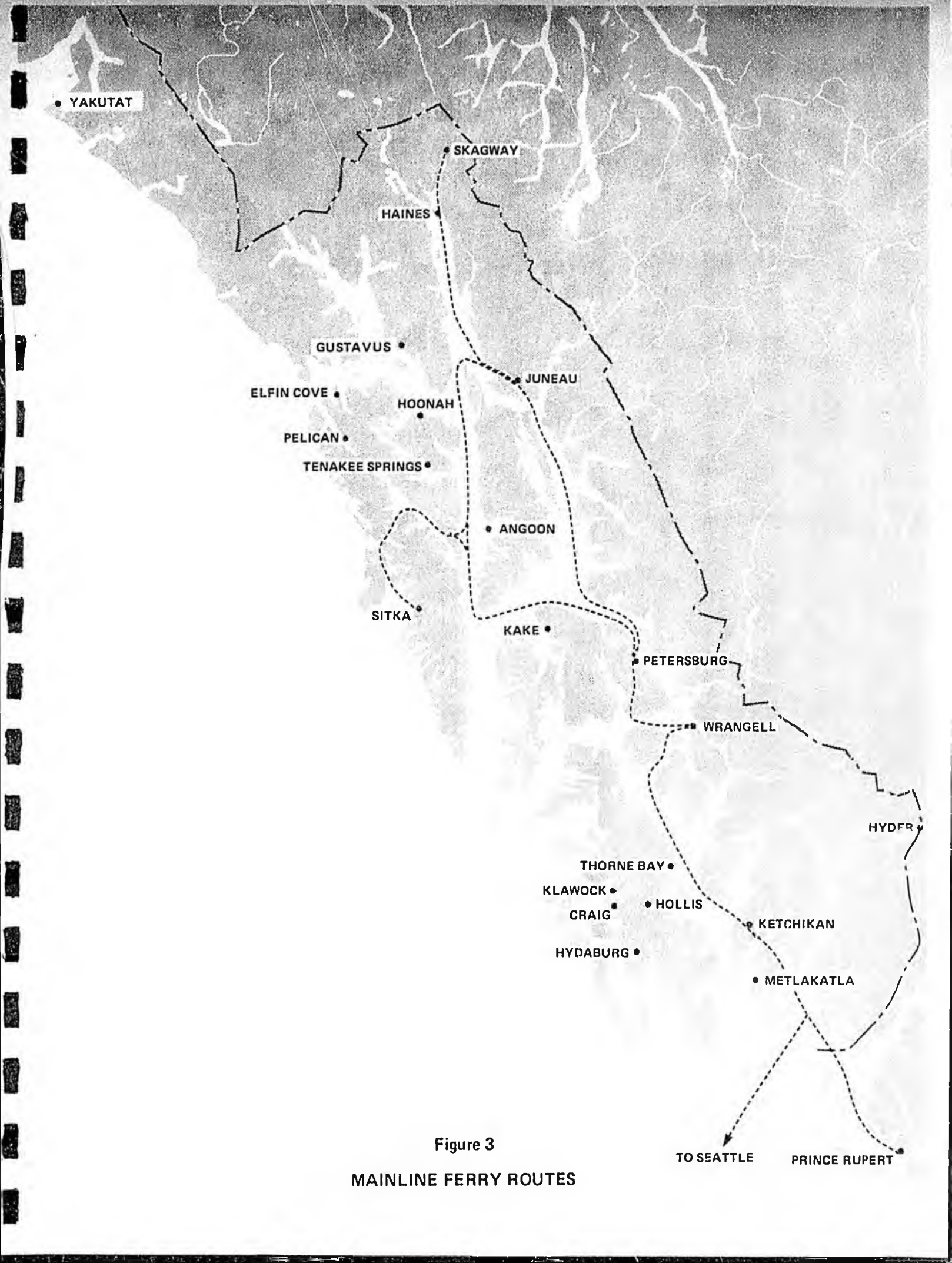
• METLAKATLA

Figure 3

MAINLINE FERRY ROUTES

TO SEATTLE

PRINCE RUPERT



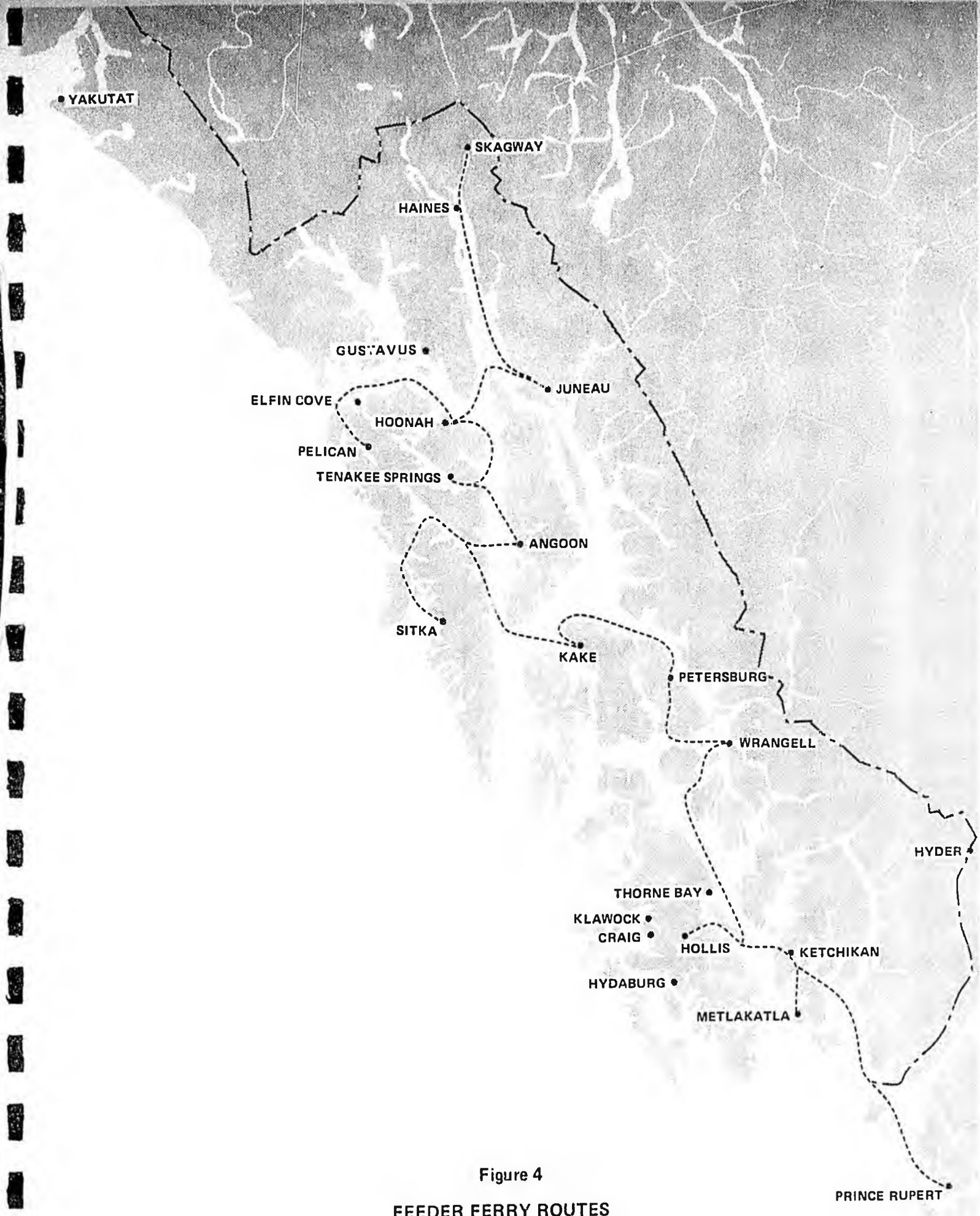


Figure 4
FEEDER FERRY ROUTES

tug-and-barge operators who carry the remaining freight, generally from Seattle, and distribute it to regional communities.

The Region has a range of port facilities to serve the Marine Highway and tug-and-barge operations. Seven communities have ferry terminals capable of handling the mainline vessels (Ketchikan, Wrangell, Petersburg, Sitka, Juneau, Haines and Skagway), while others can accommodate only the Aurora/LeConte class vessels (Hoonah, Tenakee Springs, Angoon, Pelican, Kake, and Hollis/Clark Bay). Two ports are also presently designed to handle the Chilkat (Hollis and Metlakatla) although renovations at Metlakatla will shortly be completed to accommodate the Aurora rather than the Chilkat. In addition, terminal facilities are planned at Hyder and Elfin Cove to allow ferry operations into those communities.

Terminal facilities for tug-and-barge operations vary widely among the communities from sophisticated container-handling terminals at Juneau to break-bulk, manual loading operations at smaller ports.

2.3.2 - Roads System

The roads system in Southeast Alaska is sharply constrained by the geography of the Region. Steep coastlines, multiple fjords and generally mountainous terrain make roads a costly option to construct and maintain. While there are some potential road corridors within the area, only a limited number have been developed (see Figure 5).

Access to the continental road system is provided at three points in the Region: Haines and Skagway in the north and Hyder in the south, but residents in other communities must use the Marine Highway to connect either with these roads or with the road system out of Prince Rupert.

Within the region, a substantial network of roads is operated and maintained to provide access between adjacent communities and links to nearby recreation areas. In addition, the US Forest Service has developed an extensive road network which, while not meeting State standards, provides some travel opportunity as well as a foundation for future road development.

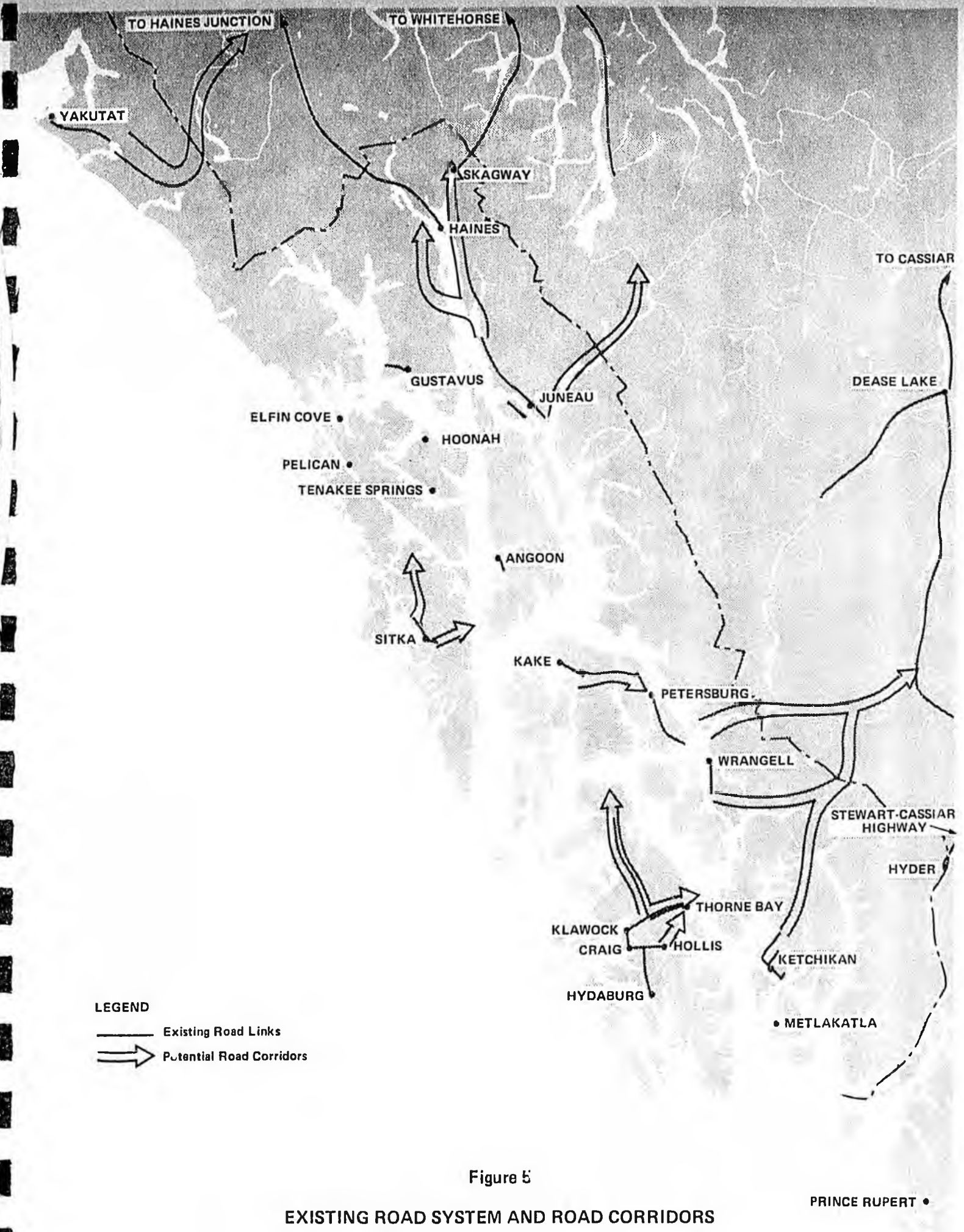


Figure 5

EXISTING ROAD SYSTEM AND ROAD CORRIDORS

PRINCE RUPERT •

In general, however, with the exception of Prince of Wales Island communities, links between major towns within the Region are provided by air and by ferry.

2.4 - Projected Developments in Technology

In terms of new opportunities for the provision of transportation services, the consultants reviewed current and likely future technological developments in marine and road transportation that might impact Southeast Alaska. The detailed review is contained in a separate report ("Technology Evaluation", Sept. 1985) but is summarized below.

2.4.1 - Marine Technology

There were two main areas of technology development in the marine environment that were expected to have impacts on Southeast Alaska transportation. The more immediate was the possible introduction of high-speed craft to provide rapid surface transport between communities.

Air-supported craft, foil-supported craft and conventional displacement planing craft were all reviewed (see Tables 2.2 and 2.3) and two representative types, shown in Figures 6 and 7, were selected as appropriate for use in Southeast Alaska. One type is a conventional catamaran vessel with a capability of moving a small number of vehicles and passengers at speeds up to 30 mi/h. The other is a much larger surface-effect ship (which also has a catamaran hull form) capable of speeds up to 46 mi/h.

Such high-speed craft should not however be looked on as total replacements for existing vessels. While they would enable better utilization of present vessels to be achieved during the summer and, if required, shoulder seasons, the performance of the smaller craft in the winter, except on sheltered routes, is unknown. The larger craft considered appropriate for Southeast Alaska has the capability to operate year-round but, like all high-performance vessels, has limitations relative to payload. For example, automobiles, campers, coaches, and lightly-loaded trucks and vans could be

TABLE 2.2

HIGH SPEED CRAFT
TYPES EVALUATED

		<u>Passenger and Vehicle</u>	<u>Cost</u>	<u>Seakeeping</u>	<u>Comfort</u>	<u>Susceptibility to Strikes</u>	<u>Speed to Load</u>	<u>Comments</u>
Air Supported	SRN4 MK2/3	yes	very high	moderate	fair	nil	fair	
	AP1-88	no	low	poor	good	nil	fair	
	Hovermarine	no	medium	poor-mod.	good	some	good	
	Bell Halter	yes	medium	mod.-good	fair	some	good	
Foil Supported	Jetfoil	no	high	mod.-good	excellent	high	poor	Production dis-continued.
	Hydrofoil	no	medium	poor-mod.	fair	high	poor	
Displacement	Monohull	yes	high	moderate	fair	low	fair	
	Catamaran	yes	low-med.	mod.-good	fair-good	low-fair	fair	
	SWATH	yes	low-high	mod.-good	excellent	low-fair	good	Small Water Plane Area Twin Hull
Planing and other		no	low-med.	poor-mod.	poor-fair	low-fair	poor	

Types Excluded from Further Analysis - Reasons:

SRN4 Mk2/3	Excluded because of cost - approximately \$40 to \$50 million built in Britain, lack of licensing for US construction.
Monohull	Excluded partly because of cost - \$14 to \$15 million built in Britain and high power requirements and thus fuel cost for its speed.
SWATH	Excluded because of experimental nature and relatively high power requirements. Southeast Alaska waters are not rough enough sufficiently frequently to justify such a vessel.

TABLE 2.3

HIGH-SPEED CRAFT

Type	Craft Evaluated			
	30m Incat	13000 Westamarin	BH 350 B	
Characteristics	Catamaran	Catamaran	S.E.S.	
Passengers	90	340	180 or 280	
Vehicles - automobiles - trucks	14	30	41 or 27	
Length ft	98	130.25	160	
Breadth ft	35.75	41.25	41	
Draft ft	7.68	5.58	7.5	
Payload	not known	not known	not known	
Power (bhp)	4200	5500	13210	
Maximum speed	28 kn	25 kn	50 kn	
Speed SS3	25 kn (28mph)	22 kn (25mph)	40kn (46mph)	
Price	\$3.0 million	\$5.0 million	\$12.0 million	
Built in USA	Yes	No	Yes	
License for USA	Yes	Yes		
Type	Craft Excluded			
	Vosper High Speed SWATH	Air Cushion Vehicles SRN4/MK2 SRN4/MK3		
Characteristics	Ferry	(Seagull)		
Passengers	700	384	282	416
Vehicles - automobiles trucks	none	none	36	50
Length ft	204	117.8	130.2	185
Breadth ft	33.5	56.1	78	82
Draft ft	10.5	10.3	-n/a-	-n/a-
Payload (tons)	96	not known	78	114
Power (bhp)	12000	8100	13600	15200
Maximum speed	25 kn	25 kn	60 kn	65 kn
Speed SS3	24 kn	(24 kn)	32 kn	45 kn
Price	\$14 to \$15 million	\$8 to \$10 million	\$40 million	\$50 million
Built in USA	No	No	No	No
License for USA	Yes	Yes	No	No

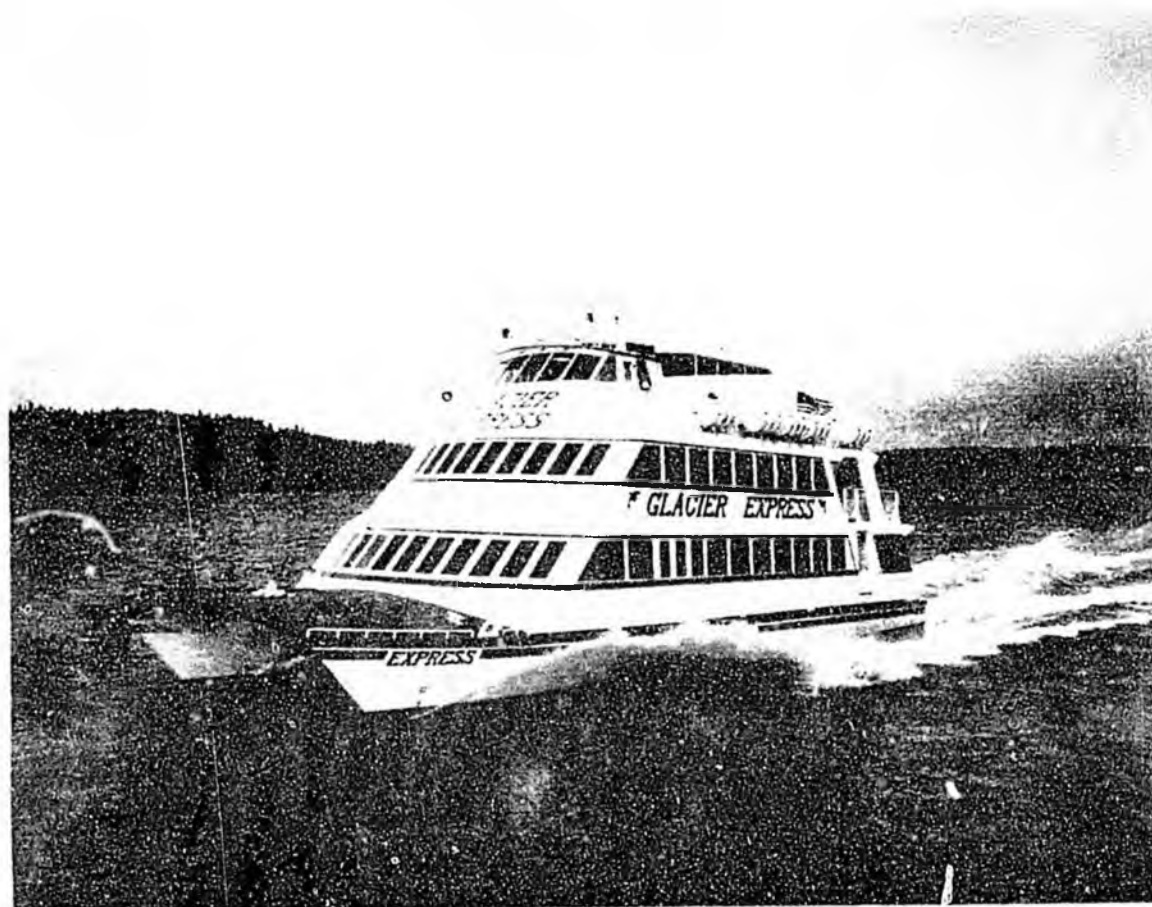


Figure 6
HIGH SPEED CATAMARAN

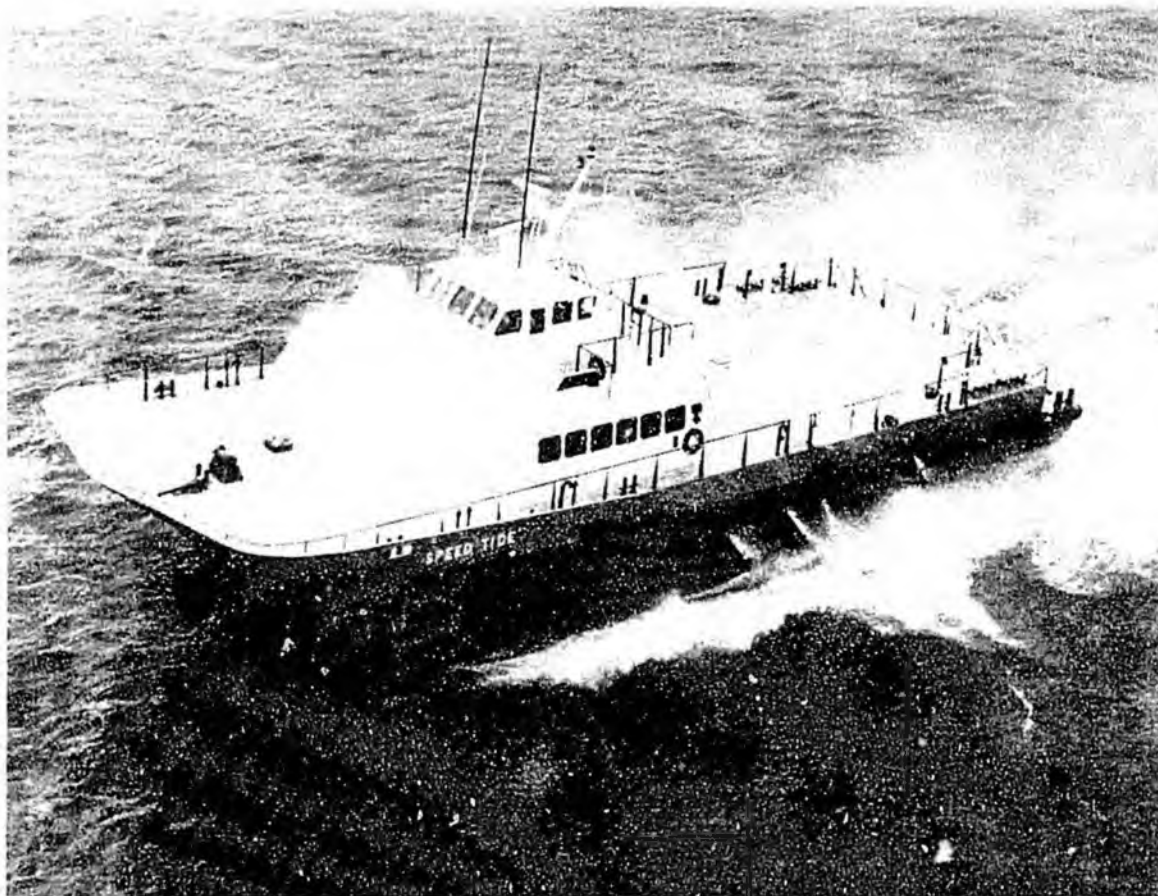


Figure 7

110-ft SES HIGH-SPEED CRAFT

carried on the small high-speed catamaran, but not heavy vans such as refrigerated trailers with a full load of frozen fish. The larger vessel by comparison could carry some heavy trailers, but the number would be limited by payload considerations.

The second area of technology development is related to improvements that could be incorporated in the existing AMH vessels to improve their performance and reduce operating costs. Examples of such developments include

- hull redesign
- improvements in propulsion and machinery
- course-keeping and routing techniques
- advanced machinery automation
- improvement in hull surfaces
- different grades of fuel, and
- adjustments to operating speed.

2.4.2 - Road Technology

No technological developments were foreseen in the road sector that would change the way in which freight was moved or in which tourists and residents would travel. It is expected that freight vehicles moving on the continental road system would increase in length, height, width and weight, making it more difficult for the existing ships to accommodate trucks and vans. In the future, certain road routes may be designated special log haul routes to support the timber industry. Overall, however, the freight business to Southeast Alaska, being a small specialized one, would likely not be impacted to any great extent by such changes for the foreseeable future.

2.5 - Alternative Marine Service Options

2.5.1 - Other Service Suppliers

The foreign flag liner operator has always been a part of the Alaskan cruise market. These operators brought in well over 100 000 tourists at the last count and are expected to continue to bring in a significant number of visitors. A new factor in the market place, however, is the foreign flag ferry operator working in competition with the Marine Highway for point to point travel. It is likely that such operators will increase their activity in the future from either Vancouver or Prince Rupert.

A further new development is that US flag operators are seriously considering building or converting vessels to serve the US cruise market and Alaska is identified by them as a prime destination. The vehicle carrying potential for such vessels is seen as an essential feature, with the result that there is a high probability the Marine Highway will see direct competition in Seattle before the mid-1990s.

Although this competition may skim off tourists from the Marine Highway and possibly reduce revenues, projected tourist departures from Seattle and Prince Rupert indicate that AMH vessels would still be operating close to capacity during the peak season. However, the presence of private operators may serve as an effective complement to Marine Highway services.

2.5.2 - Acquisition of Foreign Flag Vessels

A second new service option for the Region would be for the Marine Highway to acquire and operate a foreign-built ferry. Should a new mainline vessel be necessary, a foreign flag vessel could provide the required increase in capacity at a cost well below that of a new US-built vessel.

The Marine Highway has had past experience of foreign flag vessels with the m/v 'Wickersham'. The experience was not altogether favorable because it was intended to use the vessel in the Seattle/Southeast Alaska trade which

required a waiver from the 'Jones Act'. Such waivers are only given for purposes of national defense, and thus the 'Wickersham' was not acceptable on an ongoing basis.

However, the possibility of the AMH using a foreign flag vessel entirely within the requirements of US maritime legislation is feasible. Such a vessel could operate from Vancouver or Prince Rupert and carry tourists or residents from port of embarkation to port of disembarkation. The only restriction would be that the ship could not carry passengers between ports in Southeast Alaska. Such a vessel operating out of Vancouver or Prince Rupert could materially increase AMH capacity and release existing vessels to operate on those routes that require a US flag ship (i.e., US to US links).

This is essentially the service that Sundance Cruises is providing between Vancouver and Skagway with the m/v 'Stardancer'. The fact that a private operator is willing to provide such a service argues well in its favor although the private operator can usually benefit from lower costs due to greater flexibility in crewing and their ability to use the vessel in other areas during the off-season.

Ideally, therefore, the preference would be to have this service provided by the private sector. However, if private operators fail to provide service for some reason and the AMH is obliged to provide for a higher level of traffic, AMH acquisition of a foreign flag vessel might be a more cost-effective option than acquisition of a new US built ferry.

3 - EVALUATION METHODOLOGY

3 - EVALUATION METHODOLOGY

3.1 - General

The assessment of surface system alternatives was based, in large measure, upon a process whereby a wide range of transportation options were defined for the region and were then evaluated in terms of

- compatibility with goals of the regional transportation system, and
- effectiveness in terms of the service provided relative to the level of costs incurred.

In defining the alternatives, recognition was given to the expressed concerns and desires of the communities and also to the perceived requirements, limitations and opportunities associated with growth, development and new technology. The options developed for evaluation encompassed not only capital improvements (acquisition of new vessels, road and facilities construction) but also changes to the operating systems with a view to improving either the service provided, the system capacity and/or the ongoing operating costs.

The assessment process was aimed at establishing which of the surface options were best able to fulfil the transportation goals of the region in a cost-effective manner, where the goals were defined as

- meet the transportation needs of Alaska residents
- support the regional economy through provision of transportation services, and
- maintain fiscal responsibility through judicious allocation of public funds.

Unfortunately, these goals are not always mutually compatible and, with the present economic environment, may not be collectively achievable.

It was therefore necessary to work towards a compromise which would provide a balance between these diverse goals. In order to assess the implications of various compromises, it was necessary to fully understand the impacts associated with varying degrees of focus on these service-related and cost-related goals.

Accordingly, a wide range of options were specified which covered not only variations in the types of changes made (from a technological and operational perspective) but also variations in terms of the intensity of spending effort in order to meet demand. The analysis of the impacts associated with this range of options provided indications of the trade-offs involved as emphasis was shifted between service-related and cost-related goals.

Each of the proposed system options was evaluated from a number of viewpoints. Insofar as possible, all evaluation measures were quantified in order to provide a basis for comparison among alternatives. Specifically, the options were evaluated in terms of

- financial impacts on the Alaska Marine Highway, the State government and the transportation user
- total user costs including both financial costs and costs associated with the options' success or failure in meeting demand, and
- service/cost effectiveness which compared total user impacts associated with various options (including both cost and service level) with the costs to the government associated with providing the service.

The following sections briefly outline the methodologies used first in defining and then in evaluating the surface system options. A more detailed description of the process and the underlying theories, particularly with regard to the evaluations, is included in the appendixes.

3.2 - Specification of System Alternatives

The specification of the alternatives to be evaluated in the assessment of surface transportation systems was a multi-step process which focused both on developing viable solutions to current and anticipated problems and on developing a sufficiently broad range of solutions to ensure first that no options were overlooked and secondly that a clear picture of the tradeoffs between competing options could be ascertained.

The specifications process involved

1. Definition of the Problem - This entailed a review of community comments and inputs, discussions with operators, and an assessment of projected demand and capacity on various links within the system.
2. Listing of Conceptual Solutions - General concepts aimed at meeting future needs were drawn from a number of sources including community and operator suggestions, previous planning studies (e.g. 1980 Transportation Plan, Governor's Task Force on the Marine Highway) and the consultants' and Technical Committee's ideas with regard to new concepts which might be applied.
3. Prescreening of Corridor Alternatives - As noted in the introductory chapter, in certain subregions a preevaluation process was carried out whereby a number of similar options were prescreened and only the most promising carried forward for further analysis. Five corridors were treated in this manner
 - The Juneau Access corridor in which 11 service options were examined and narrowed down to 2.
 - The Ketchikan-Southern Terminus corridor in which nine options were examined and four retained for further analysis.
 - The Stikine corridor in which a total of ten options were examined and three retained for further analysis.

- The Sitka Access corridor in which four options were examined and three were retained for system evaluation.
- The Prince of Wales Island Access corridor in which four options were evaluated (including variations within some of the service concepts) and all were retained for further system analysis.

For a detailed discussion of these corridor studies, the reader is referred to the series of reports on "Evaluation of Corridor Alternatives."

4. Detailed Definition of System Characteristics - This involved specifying, for each system to be evaluated, the detailed cost, revenue, traffic, and operating characteristics, and included
 - specifying peak and off-peak schedules for existing and proposed new vessels
 - developing preliminary specifications for new vessels and obtaining builder estimates for construction and operating costs
 - defining and costing new terminal facilities where applicable
 - projecting passenger and vehicle demand over each link in the system and generating user costs for vehicle operations and/or ferry fares on each route.

3.3 - Financial Evaluations

Each of the defined system alternatives was first evaluated in terms of financial impacts, including capital and operating costs for the AMH and the State government, revenues received from users, and user costs for both private and public transportation service.

Costs and revenues were calculated for each year of a 20-year planning period (1986-2005), and were then discounted to 1985 dollars to provide an equitable basis for comparison.

In order to deal with the vast number of calculations involved, a computer model was developed which computed, for each year

- the forecast demand on each link in the system
- the capacity of the system to meet the demand and, from this, the number of passengers and vehicles actually carried between various origins and destinations
- the fares and vehicle operating costs of the traffic served (the fares also represented the revenues of the Marine Highway System)
- the capital and operating costs of road links
- the capital and operating costs of terminal facilities
- the capital and operating costs of both new and existing vessels, with operating costs being linked to the vessels' specified schedules.

Total financial costs were then calculated from the viewpoint of

- the Marine Highway, including vessel capital and operating costs, port capital and operating costs, and ferry revenues
- the State government, including road capital and operating costs and Marine Highway deficits
- the passengers and vehicles served, including fares paid and vehicle operating costs.

It should be recognized that, because of the double counting of Marine Highway deficits (as a net cost to the AMH and as a cost to the State), the

financial impacts are not additive. Total system costs are represented by the sum of State and user costs. However, because of concerns regarding the deficit position of the Marine Highway, their financial impacts were calculated separately from total State government impacts.

3.4 - Evaluation of User Impacts

While the financial analysis provided an important measure of comparison among alternative surface systems, it was unable to fully reflect many of the differences among system options and hence, in some respects, provided a distorted picture of the merits of various alternatives.

One major difference among options which distorted the financial picture was the level of traffic served and the manner in which it was served. Many of the options involved meeting less than the full level of service demand. Others involved serving some traffic in a manner other than that demanded by the user (e.g. by requiring users to divert from one port of embarkation to another), while another group involved serving traffic over and above projected basic demand because service under the proposed option was sufficiently more attractive to induce new users into the system. Thus a comparison strictly on the basis of total financial costs did not provide a complete picture of the differences among alternative systems, particularly insofar as user costs were concerned.

A second difference which the financial evaluation failed to account for was the difference in the level of service provided. Level of service encompasses many factors: travel time, frequency of service, transfers, reliability, comfort, convenience, etc. Some of these factors do not lend themselves to quantification and can only be evaluated in a subjective manner. However, factors such as travel time, frequency of service and need for transfers can, at least in part, be quantified and compared among alternatives.

Because of the need to take these differences among options into account in the overall analysis, a supplemental assessment was carried out for each

option with regard to 'user impacts' which quantified the differing effects of the alternatives in terms of demand served and quality of service and which, insofar as possible, assigned values to the differences.

3.4.1 - Differences in Traffic Served

The main effect of differences in the amount of traffic served is the impact in terms of total user cost. The user costs derived from the financial analysis, when presented in 'total' form, do not reflect differences in total traffic. On the other hand, converting these user costs to a 'cost per user' or 'cost per passenger mile' would not account, for example, for the losses of unserved passengers or the inconvenience to diverted users.

Accordingly, to compare options on an equivalent basis, it was necessary to make adjustments to user costs in order to accurately reflect the differences in traffic volumes and in the manner in which these volumes are served.

Differences in the amount and nature of traffic served under the various options arose from three main sources.

1. Unmet Demand - traffic desiring service but unable to be handled by the proposed system.
2. Diverted Traffic - Traffic desiring service to or from one port but presumed to be willing to divert to an alternate port if capacity is available (this primarily relates to excess vehicle demand to and from Seattle which could divert to Prince Rupert).
3. Induced Traffic - Traffic over and above the projected basic level of demand which is drawn to use the system as a result of lower travel costs.

Each of these sources of traffic variation required a somewhat different treatment in order to adjust user costs to a comparable basis.

The user costs associated with those potential users whose demands could not be met by the system was estimated by determining the net losses which they would incur as a result of being unable to make the trip. These losses will vary considerably depending on the purpose of the trip and the actions which the unserved user takes as a result of being unable to make the trip. Losses could range from zero (for a user who decides, for example, to travel elsewhere and derives as much enjoyment for his money there) to much larger sums (for a user who may be forced to take first class accommodation on a cruise ship, but does not derive any benefit from the greater amenities).

In order to estimate an average value for the net losses associated with unmet demand, the concepts of demand and surplus were introduced into the analysis. This is explained in detail in Appendix B. Briefly, the method involved postulating the shape of the demand curve for Marine Highway service and calculating the average difference between the maximum that users would have been willing to pay and the amount they would actually have had to pay for the trip (i.e. their surplus as measured by the difference between the trip's value to them and its cost).

Average lost surplus for passenger and vehicle trips was then multiplied by the number of unserved users under each option and the totals discounted to net present value.

The costs associated with diverted traffic, where users are routed to an alternate port, would be expected to include increases in travel cost and/or travel time as a result of the diversion. Since users would be expected to minimize their cost (or maximize their benefit), they would logically prefer that routing which offered them the highest advantage. Consequently, the persistently high demand for service out of Seattle would suggest that, to a large number of users, sailing out of Seattle was preferable to driving to Prince Rupert to catch the ferry.

In comparing the actual out-of-pocket costs associated with diversion, however, it was found that in most cases it was considerably less expensive to drive to an alternate port of embarkation rather than to take the ferry for the full distance. Even when the additional travel time for diverted

passengers was taken into account, it was found that users would have to assign an unacceptably high cost to travel time to offset the out-of-pocket savings.

The implication of these findings is that users demanding service out of Seattle rather than Prince Rupert assign some nonmonetary value to the Seattle trip which more than offsets its higher cost. This value could arise from an aversion to driving, from the amenities of the ferry service, or possibly from a preference for door-to-door service.

As a result, the user costs described in the financial analysis, which are based on out-of-pocket expenses for fares and vehicle operation, must understate, in many cases, the full costs associated with diverting passengers, and hence require upward adjustment. Theoretically, this adjustment should more than offset the out-of-pocket savings. However, in the absence of indications as to the amount of extra value assigned to the direct versus the diverted journey, it was decided to assume, conservatively, that diverted users would assign an equal total cost to each and would hence be indifferent among the alternatives. Diversions were therefore presumed to generate zero user impacts in the analysis of user benefits and costs and any out-of-pocket savings accruing to diverted passengers were removed from the analysis by upward adjustment of user costs to the levels incurred by nondiverted traffic.

User costs associated with induced traffic was the third category requiring adjustment. Generally, options which generated induced traffic yielded lower travel costs on a per-user basis (hence the inducement to greater travel). However, many of the induced passengers would not have traveled without the benefit of the lower cost and hence cannot be considered to enjoy the full saving associated with the new system. Accordingly, the travel costs of induced passengers were adjusted upwards by half the difference between the old cost and the new (i.e. cost savings to induced passengers were cut in half for purposes of calculating total savings).

3.4.2 - Differences in Travel Time

An attempt was also made to account for the differing impacts of system alternatives in terms of quality of services provided. While service quality encompasses a number of aspects, it was felt that the aspects which could be measured in a quantitative and an objective manner were those relating to service time, including travel time, waiting time related to service frequency, and waiting time associated with transfers.

In order to calculate the travel time associated with each system option, a computer program was developed which converted the proposed ferry schedule and road network into a matrix of total travel times between all points served in the region. The model calculated in-transit time (based on either vehicle speeds or the speed of the vessel being used), frequency related delays (based on one-quarter of the interval between vessel departures) and transfer times (based on an average 12-hour delay whenever a vessel-to-vessel transfer was required).

Separate travel-time matrices were calculated for each schedule, taking into account peak, shoulder and low-season schedule variations as well as changes over the years within a particular option. These travel time matrices were then multiplied by the number of passengers traveling between the various origins and destinations each year on a seasonal basis.

As with user costs, travel time impacts also required adjustment to reflect the differences among the various options in traffic served. These adjustments are explained in greater detail in the Appendix. Basically the adjustments were as follows:

- where unmet demand occurred, total travel time impacts (increases or savings) were reduced by the amount of impact which would have accrued to the unserved passengers had their demands been met;
- for diverted passengers, travel time impacts were assumed to be zero (i.e., both increases and decreases in travel time were ignored);

- for induced passengers, travel time impacts were reduced by one-half to reflect the marginal nature of this traffic.

3.5 - Service/Cost Effectiveness

The actual selection of preferred choices among the various surface system options was based on a measure which was called 'service/cost effectiveness.' This essentially involved measuring the total user impacts (both positive and negative) associated with changes in the system proposed, and comparing these with the impacts on government costs.

In order to calculate the impacts of changes, it was necessary to specify one option as a base case against which other options could be evaluated. In the short term, the base case was represented by continuation of the existing system and changes in user impacts and government costs arising from new short-term options were measured in comparison with the existing service. In the long-term, the base case was represented by the concepts of the June 1980 Plan which presumed that the existing ferry route structure would be maintained and that new mainline vessels would be added as demand required. Other long-term options were evaluated in terms of the benefits and costs they generated relative to the June 1980 Plan system.

Measurable user impacts fell into two categories

- increases or decreases in user cost as compared with the base case, and
- increases or decreases in user travel time.

For evaluation purposes, the adjusted user costs and travel times (as described in Sections 3.4.1 and 3.4.2) were used to calculate differences in impact.

Government cost impacts included

- increases or decreases in the deficit of the Marine Highway, and

- increases or decreases in the cost of road construction and operation (in actual fact only increases occurred in this category of costs since none of the options envisioned eliminating existing road links).

The evaluation of service/cost effectiveness was carried out in two stages. The first stage involved comparing user cost impacts (increases or savings) with government cost impacts (increases or decreases) to determine whether the monetary benefits to one group exceeded the monetary costs to the other. If both groups enjoyed benefits relative to the base case, the option was preferable to both parties. If both groups suffered higher costs, then the base case would be preferable to both. However, where one group enjoyed benefits and the other suffered cost increases, a comparison was necessary to assess whether the benefits achieved justified the costs incurred.

The second phase of the service/cost effectiveness evaluation involved incorporating travel time impacts into the analysis. These could have been included with user cost impacts simply by assigning an hourly value to travel time and adding the resultant total value of time costs or savings to the value of user cost impacts. The choice of an appropriate value for travel time is, however, a complex issue and any value selected would be open to criticism. Because of the problems associated with developing a defensible measure of time value, an 'imputed value' approach was taken in this analysis.

Under this approach, the total travel time impacts of each option relative to the base case were calculated in terms of hours. Next, the difference was calculated between the monetary impacts accruing to the user and those accruing to the government. This provided a measure of the value which total time impacts would have to have in order for the combined user cost and time impacts to exactly offset the impacts on government costs. The 'required time value' was then divided by the number of hours involved to generate a required hourly value of time (either minimum or maximum depending on whether users incurred travel time savings or travel time increases). These required hourly values of time could then be compared both between options and against subjective measures to determine the

relative rankings of the various alternatives and also the likelihood that total positive impacts (benefits) of a system would exceed total negative impacts (costs).

One caution should be noted in assessing the merits of various system options under the service/cost effectiveness method. Because of the calculation procedure, the method used focuses only on the differences between the options considered. As such it provides a measure of incremental benefits and costs associated with one system as compared with another. It does not presume, however, to measure the total benefits and costs associated with a transportation system per se. Those impacts which are common to all systems are eliminated, by subtraction, from the analysis. Thus, comparison among options should be assessed with caution. An option which generates, for example, a \$2 million increase in benefits is not necessarily twice as good as one which generates a \$1 million increase since the base benefits accruing to all systems may be \$100 million and the more appropriate comparison would be between \$102 million and \$101 million.

4 - EVALUATION OF SHORT-TERM
SURFACE SYSTEM ALTERNATIVES

4 - EVALUATION OF SHORT-TERM SURFACE SYSTEM ALTERNATIVES

4.1 - General

The objective of the analysis of system alternatives was to provide guidelines to changes which could be made in the transportation system over a 20-year period. There is, however, a division between changes that can be accomplished (and are required) in a short time period and changes that can be accomplished (and may be necessary) over a longer time frame. Major capacity additions, for example, in the form of constructing new roads or new mainline vessels may require several years to accomplish, while schedule changes or the introduction of 'off-the-shelf' vessels can be implemented in the near future. For this reason, two separate sets of surface system alternatives were defined with one set aimed at the short-term and the other at the long-term planning horizon. This section describes and evaluates the options considered as short-term solutions. Section 5 deals with the long-term alternatives.

4.2 - Short-Term System Alternatives

In all cases, the system options examined were aimed at meeting the transportation goals in terms of

- meeting the travel needs of Alaska residents
- supporting the regional economy by providing the required transportation services, and
- ensuring a judicious use of government funds.

Apart from this, however, short-term alternatives were defined to meet the following specific criteria

- they could be easily implemented (with a 1- to 3-year period)
- they would improve the system's ability to meet demand through the late-1980s/early-1990s, and
- they were sufficiently flexible that they would not preclude any longer-term options.

The following sections describe the seven options considered as short-term system alternatives.

4.2.1 - Option 1 - Continue Existing Service

This option served as a base case against which all short-term system alternatives were compared. It involved maintaining the existing (1985) routings and schedules for both mainline and feeder ferry service.

During the peak season the Columbia would operate on a weekly schedule out of Seattle while the Matanuska, Malaspina and Taku would operate twice weekly out of Prince Rupert. Each vessel would call at Sitka on a weekly basis. The Aurora and LeConte would continue to serve the feeder communities with Aurora focussing on the Prince Rupert-Ketchikan-Prince of Wales triangle and LeConte focusing on the Sitka-Juneau corridor. The Chilkat would continue to serve Metlakatla.

In terms of meeting demand, this option would result, over a 20-year time frame, in substantial unserved traffic, particularly to and from Seattle. In total, approximately 38% of the peak season passenger demand out of Seattle (260 000 passengers) could not be served and 10% (66 000 passengers) would have to be diverted to Prince Rupert. In addition, some 46 000 vehicle trips would be lost to the ferry system.

4.2.2 - Option 2 - Matanuska to Seattle

This option involved operating a second mainline vessel (probably the Matanuska) out of Seattle during the peak season. All other schedules and routings were unchanged from the base case.

The two-vessels-to-Seattle option provided a somewhat better picture in terms of ability to meet demand out of Seattle. Under this option, a total of 73 000 Seattle passengers (10% of peak demand) and 33 100 Seattle vehicles were unserved over 20 years. However, the loss of two trips per week out of Prince Rupert without any offsetting additional service there, resulted in a loss of 126 000 passengers (12.7% of peak Prince Rupert demand) and 57 400 vehicles out of Prince Rupert over 20 years. In addition, because of these capacity problems at Prince Rupert, no excess Seattle traffic could be diverted.

4.2.3 - Option 3 - Prince Rupert Summer Terminus

Under the third short-term option, all mainline vessels would operate twice weekly out of Prince Rupert during the peak season. Because of the increased capacity out of Prince Rupert, the Aurora was shifted to a Ketchikan base in order to provide additional service to feeder communities. Passengers desiring service to and from Seattle were assumed to transfer to Prince Rupert provided they were traveling with a vehicle. Seattle foot passengers, however, were assumed to be lost to the ferry system.

In total over 20 years this option resulted in the loss of 394 000 passengers out of Seattle (57% of the peak demand) as well as 20 700 vehicle trips. The balance of Seattle demand, a total of 296 400 passengers and 135 000 vehicles, were assumed to transfer to Prince Rupert. All demand to and from Prince Rupert was met by the system since Prince Rupert demand was given priority over Seattle transfers.

4.2.4 - Option 4 - Columbia Shuttle

Option 4 involved shuttling the Columbia between Seattle and Ketchikan during the summer peak, enabling her to make two round trips per week out of Seattle. The other three mainline vessels were presumed to continue their existing routes. However, to compensate for the loss of the Columbia's service north of Ketchikan, the Aurora and LeConte were drawn into quasi-mainline service with Aurora operating weekly out of Prince Rupert and LeConte twice-weekly out of Ketchikan.

Over the 20-year planning period, this option resulted in a loss of 43 200 Seattle passengers (6.3% of peak demand) and 18 500 vehicles. In addition, some 33 200 Prince Rupert passengers and 15 100 vehicles would be lost to the system. Transfers from Seattle to Prince Rupert would be minimal since, by the time capacity became critical at Seattle, it would also be reaching critical levels at Prince Rupert.

4.2.5 - Option 5 - Foreign Flag Vessel

This option required the Marine Highway to acquire and refurbish a foreign-built ferry and operate it out of Vancouver during the peak season. While the vessel could not carry traffic between points within the Southeast region, it could provide relief for capacity problems out of Seattle and thus free up space on the other mainline vessels. All other vessels were assumed to operate on their current schedules.

The addition of a foreign flag vessel enabled the system to meet all demand through to the mid-1990s after which some transfers from Seattle to Prince Rupert would be necessary, and some foot passengers out of Seattle would be lost. In total over 20 years, 10 400 Seattle passengers would be lost (1.5% of peak demand) and a further 22 500 would be transferred to Prince Rupert.

4.2.6 - Option 6 - High-Speed Catamarans

The sixth short-term option focused on using high-speed catamaran-type ferries to provide intra-regional ferry service during the peak season, and concentrating peak mainline service on the Seattle route.

In total, a fleet of four catamaran ferries was presumed, each with capacity to carry 14 vehicles and 90 passengers. These vessels would operate on a variety of both feeder and high-density routes in the region. The Columbia, Malaspina and Matanuska were all presumed to operate once a week out of Seattle while the Taku and LeConte would operate out of Prince Rupert. Aurora was assumed to operate on a combination mainline-feeder route out of Ketchikan providing additional mainline capacity as well as heavy-freight service into feeder communities.

In terms of total traffic served, this option resulted in the loss, over 20 years, of 21 000 peak Seattle passengers (3% of peak demand) and 9 500 Seattle vehicle trips. In addition, there would be a capacity shortfall out of Prince Rupert resulting in a total loss of 96 600 passengers (9.7% of peak demand) and 43 900 vehicle trips to and from the port.

4.2.7 - Option 7 - High-Speed SES Ferries

The final short-term option involved using larger high-speed ferries to provide peak intra-regional service and again concentrating mainline service on Seattle.

Under this scenario, it was presumed that two large (180-passenger, 40-vehicle) SES-type high-speed ferries would be acquired and operated on combined feeder-mainline routes throughout the region. The Columbia, Malaspina and Matanuska would operate out of Seattle while the Taku would continue her existing twice-weekly schedule out of Prince Rupert. In addition, the Aurora would operate on a mainline route out of Prince Rupert

while the LeConte would serve Prince Rupert, Ketchikan and Hollis on a daily round trip basis.

This option had essentially the same impact on Seattle traffic as Option 6; over 20 years a total of 20 800 passengers and 9 400 vehicle trips would be lost. The increased service level out of Prince Rupert, however, resulted in lower losses there. In total, 30 600 Prince Rupert passengers (3.1% of peak demand) and 13 900 vehicles would be lost to the system.

4.3 - Evaluation of Short-Term Options

4.3.1 - Financial Evaluation

As described in the methodology section (Section 3), each option was first evaluated with respect to financial impacts on the Marine Highway, the State government and the user. The results of this analysis (in terms of discounted 20-year total costs and revenues) are shown in Table 4.1.

The table does not provide a separate figure for cost to the State since, under the short-term options, the only changes in costs to the State would arise as a result of changes in the AMHS deficit. Thus net costs to the AMH and total State costs would be the same.

The table indicates that two of the system alternatives, Option 2 (Matanuska to Seattle) and Option 4 (Columbia shuttle), result in a lower financial cost to the State than would arise under continuation of the existing system. In addition, as noted earlier, both options would meet a higher portion of projected demand.

The remaining options all result in higher financial costs than in the base case. However, with the exception of Option 3 (Prince Rupert terminus), all provide service to a greater portion of total demand. As a result, the total costs per effective passenger mile are all (with the exception of Option 3) lower than in the Base Case-Existing System option.

TABLE 4.1

FINANCIAL IMPACTS - SHORT-TERM SYSTEM OPTIONS

(Net Present Value, Total over 20 years discounted at 5% - \$ Millions)

<u>System Option</u>	<u>Existing System</u>	<u>Matanuska to Seattle</u>	<u>Prince Rupert Terminus</u>	<u>Columbia Shuttle</u>	<u>Foreign Flag Vessel</u>	<u>High-Speed Catamarans</u>	<u>High-Speed SES Ferries</u>
<u>Cost to AMHS</u>							
Vessel Capital	\$241.3	\$241.3	\$241.3	\$241.3	\$253.3	\$255.7	\$270.1
Vessel Operating	671.2	671.2	671.2	673.8	740.5	703.8	711.3
Port Capital	-	-	0.4	3.9	-	-	-
Port Operating	28.2	28.2	28.2	28.2	28.2	28.2	28.2
Less Fare Revenue	(486.3)	(512.0)	(437.2)	(520.1)	(539.4)	(530.6)	(537.9)
Net Cost	454.4	428.7	503.9	427.1	482.6	457.1	471.7
<u>Cost to User</u>							
Ferry	\$486.3	\$512.0	\$437.2	\$520.1	\$539.4	\$530.6	\$537.9
Veh. Operating Cost	5.4	-	21.8	0.3	2.0	-	-
Total	491.7	512.0	459.0	520.4	541.4	530.6	537.9
<u>Total Cost</u>	946.1	940.7	962.9	947.5	1024.0	987.7	1009.6
Effective passenger miles (millions)	2063.4	2211.9	1929.1	2268.3	2311.7	2273.4	2298.8
Total cost per effective passenger-mile (dollars)	\$0.458	\$0.425	\$0.499	\$0.417	\$0.443	\$0.434	\$0.439

4.3.2 - Service Cost Effectiveness

As noted in the methodology section, however, the financial analysis does not reflect the full range of impacts associated with the various options. In the first place, the financial costs do not reflect the user costs associated either with unmet demand or with the need to divert from one port to another. In the second place, they fail to include the impacts of better service quality (particularly as regards travel time) under certain of the service options.

Accordingly, for each option, the user costs were adjusted to reflect the differences in the number of passengers and vehicles served. In addition, the total travel times under each option were calculated and adjusted to reflect differences in traffic levels.

Each system option was then compared to the base case (Option 1) in terms of total adjusted user costs and total costs to the State, and the differences calculated. The results of this analysis are shown in Table 4.2.

Strictly in terms of user versus government costs, three options appear to have clear cut advantages over the existing system: Option 2 (Matanuska to Seattle), Option 4 (Columbia shuttle) and Option 6 (high-speed catamarans). The first two (Options 2 and 4) offer cost savings to both users and the State and hence are preferable to the current system for both parties. The third option (Option 6) is more costly to the State (by \$2.7 million) but offers user cost savings which more than offset the State's cost increase.

Of the other options, Option 5 (foreign flag vessel) and Option 7 (high-speed SES ferries) both offer user cost savings, but the increase in costs to the State more than offsets the users' monetary benefits. The remaining option (Option 3, Prince Rupert terminus), however, is less attractive than the existing system in terms of both user costs and government costs and hence appears to be undesirable to both from the cost perspective.

TABLE 4.2

SHORT- TERM SYSTEM OPTIONS -
IMPACTS ON USER AND GOVERNMENT COSTS

<u>Option</u>	<u>Change¹ in User Cost²</u> (Smillions)	<u>Change¹ in Government Cost²</u> (Smillions)	<u>Comments</u>
2 - Matanuska to Seattle	-1.4	-25.7	Both better off.
3 - YPR Summer Terminus	+2.0	+49.5	Both worse off.
4 - Columbia Shuttle	-4.3	-27.3	Both better off.
5 - Foreign Flag Vessel	-5.8	+28.2	User saves 21¢ per dollar of added government cost.
6 - High-Speed Catamarans	-3.8	+2.7	User saves \$1.41 per dollar of added government cost.
7 - High-Speed S.E.S.	-5.0	+17.3	User saves 29¢ per dollar of added government cost.

¹ As compared with existing system (Option 1).

² NPV of 20-year total costs.

Apart from cost impacts, consideration must also be given to the travel time impacts under the various options. The total adjusted changes in travel time are given in the first column of Table 4.3. The figures indicate that, with the exception of Option 4 (Columbia shuttle) all options lead to net travel time savings as compared with the base case. The highest savings are generated under the two high-speed ferry options (Options 6 and 7) and the lowest under the Prince Rupert terminus case.

In order to assess the value of these time savings, an 'imputed value' approach was used (as described in Section 3). First the total 'required' time value was determined by calculating the algebraic difference between monetary costs and savings (from Table 4.2). This figure represented the total value which would have to be assigned to travel time differences in order for positive impacts (savings) to equal or exceed negative ones (cost increases). The resultant values are shown in column 2 of Table 4.3.

These required total values were then divided by the number of hours saved (or lost) in order to determine the minimum hourly value (or maximum in the case of travel time increases) which would have to be assigned to travel time in order to equalize benefits and costs.

The figures indicate that in two cases (Option 2, Matanuska to Seattle, and Option 6, high-speed catamarans) the value of travel time savings can be as low as zero. Since monetary savings exceed monetary cost increases, the savings in travel time represent an added bonus which serves to enhance the merits of the system.

Three other options can be ranked in order of relative merit based on required time values. These are, in order of preference: Option 7 (high-speed SES ferries) where benefits would exceed costs when the value of travel time exceeds \$1.15 per hour; Option 5 (foreign flag vessel), where travel time value must exceed \$6.35 per hour; and Option 3 (Prince Rupert terminus) where the hourly value of travel time savings must exceed \$83.10 per hour (an unlikely prospect).

TABLE 4.3

SHORT-TERM SYSTEM OPTIONS - USER TRAVEL
TIME IMPACTS AND REQUIRED VALUE OF TIME

<u>Option</u>	<u>Change¹ in User Travel Time (million hours)</u>	<u>Required Total Time Value² (Millions)</u>	<u>Required Hourly Time Value (\$/h)</u>
Matanuska to Seattle	- 3.94	(27.1)	∅
Prince Rupert Terminus	- 0.62	51.5	> 83.10
Columbia Shuttle	+ 3.33	(31.6)	< 9.45
Foreign Flag Vessel	- 3.52	22.4	> 6.35
High-Speed Catamaran Ferries	- 9.16	(1.1)	∅
High-Speed SES Ferries	-10.73	12.3	> 1.15

¹ As compared with Option 1; existing system.

² Brackets denote negative required value.

The remaining option, the Columbia shuttle, is more difficult to rank since it generates substantial increases in travel time which offset its monetary advantages. In this case, the hourly value of travel time must be less than \$9.45 per hour. Otherwise the cost of travel time increases will offset the monetary savings.

4.3.3 - Summary

The evaluation of the service/cost effectiveness of short-term system options indicates that two alternatives (sending the Matanuska to Seattle and acquiring high-speed catamarans) offer clear advantages over the existing surface system. In both cases, the monetary savings exceed the monetary cost increases. In addition, both options yield significant savings in user travel time.

The remaining options, while potentially better than the existing system (with the exception of the Prince Rupert terminus), are less advantageous than the two preferred alternatives.

The major drawbacks of the two preferred system options would be

- the substantial traffic losses out of Prince Rupert in the case of the 'Matanuska to Seattle' option, and
- the increase in the AMP operating deficit as a result of purchasing four high-speed ferries under the 'high-speed catamaran' option.

These problems are not without solution, however. For example, by combining the two concepts, a compromise situation could be reached whereby two vessels would operate out of Seattle (rather than the three presumed in the high-speed catamaran option) and a smaller number of catamarans could be used to free up one of the feeder ferries (e.g. the Aurora) to operate more frequently out of Prince Rupert.

5 - EVALUATION OF LONG-TERM
SYSTEM ALTERNATIVES

5 - EVALUATION OF LONG-TERM SYSTEM ALTERNATIVES

5.1 - General

The definition and assessment of long-term surface system alternatives involved a changed perspective from the short-term in terms of both the demands to be met and the range of options available to provide service. While traffic demand is expected to continue to increase in the future, it is possible, in the long term, to envision major changes in the transportation system through the acquisition of additional mainline vessels, the development of new road links, the purchase of high-capacity, high-speed ferries, and the phased introduction of more substantial schedule changes.

As in the short-term, however, the key concern was to establish a balance between the goals of serving resident demand, supporting the regional economic sectors, and allocating government funds in a judicious and beneficial manner. A range of long-term alternatives was therefore specified not only in terms of operating characteristics but in terms of the level of investment in new capacity in order to meet demand.

The issue of investing to meet demand was of particular concern since it was recognized that new investment in mainline vessel capacity would primarily serve peak season tourist demand out of Seattle. During the off-peak season these vessels would not be required. It was therefore decided to investigate a range of options in terms of investing to meet peak tourist demand in order to determine the savings and impacts associated with providing lower levels of capacity.

Two investment scenarios were therefore analyzed.

- Acquire sufficient vessels to meet peak season demand out of both Seattle and Prince Rupert
- Acquire new mainline vessels only when combined vehicle demand out of Seattle and Prince Rupert exceeds combined vessel capacity. This implies

acceptance of the idea that passengers with vehicles will be willing to transfer from Seattle to Prince Rupert if ferry capacity is available.

In addition, for sensitivity testing, selected scenarios were evaluated whereby no new mainline vessels were acquired and demand in excess of capacity was presumed to be lost.

5.2 - Long-Term System Alternatives

Alternatives for surface system operations were defined as a series of 'Focuses' where each focus involved emphasizing a particular concept in terms of regional service and evaluating its impact throughout the system in terms of cost and service effectiveness.

Five key 'focus' areas were developed and are described in the following sections. It should be noted at the outset that definition of these 'focus' areas was not meant to suggest that all service improvements should be focused in a single region. Rather, the intent was to determine the relative system-wide impacts associated with these various improvements and select those which offered the greatest benefits relative to their costs.

5.2.1 - Option 1 - Mainline Service Focus

This option represented the base case against which all long-term options were evaluated. Essentially it involved continuing the philosophy of the June 1980 Regional Transportation Plan whereby the existing mainline and feeder route structures were proposed and additional system capacity provided, as required, by the acquisition of new mainline vessels.

For costing and capacity purposes, a conceptual new mainline vessel was defined which would be used in all cases where additional mainline ferries were required. The conceptual vessel, termed the 'AMH Special', was envisioned as providing effective capacity for 200 vehicles and 750 passengers, at a cruising speed of 18 miles per hour. Total capital cost was estimated at \$45 million, while crewing and fuel costs were based

on the costs incurred by the Colombia. Maintenance costs were based on the average costs for mainline vessels.

Under the mainline service focus option, three of these new vessels would be required over the 20-year planning period. While one is needed immediately on the Seattle route, it was estimated that such a vessel could not be brought into service before 1989. A second 'AMH Special' would be required on the Seattle route by 1993, and a third vessel would be required, this time out of Prince Rupert, by the early 2000s.

Once the first 'AMH Special' was brought into operation in 1989, this option would successfully meet all system demand throughout the planning period. Between 1986 and 1989, a total of 12 500 passengers would be lost due to capacity shortfalls out of Seattle.

5.2.2 - Lynn Canal Focus

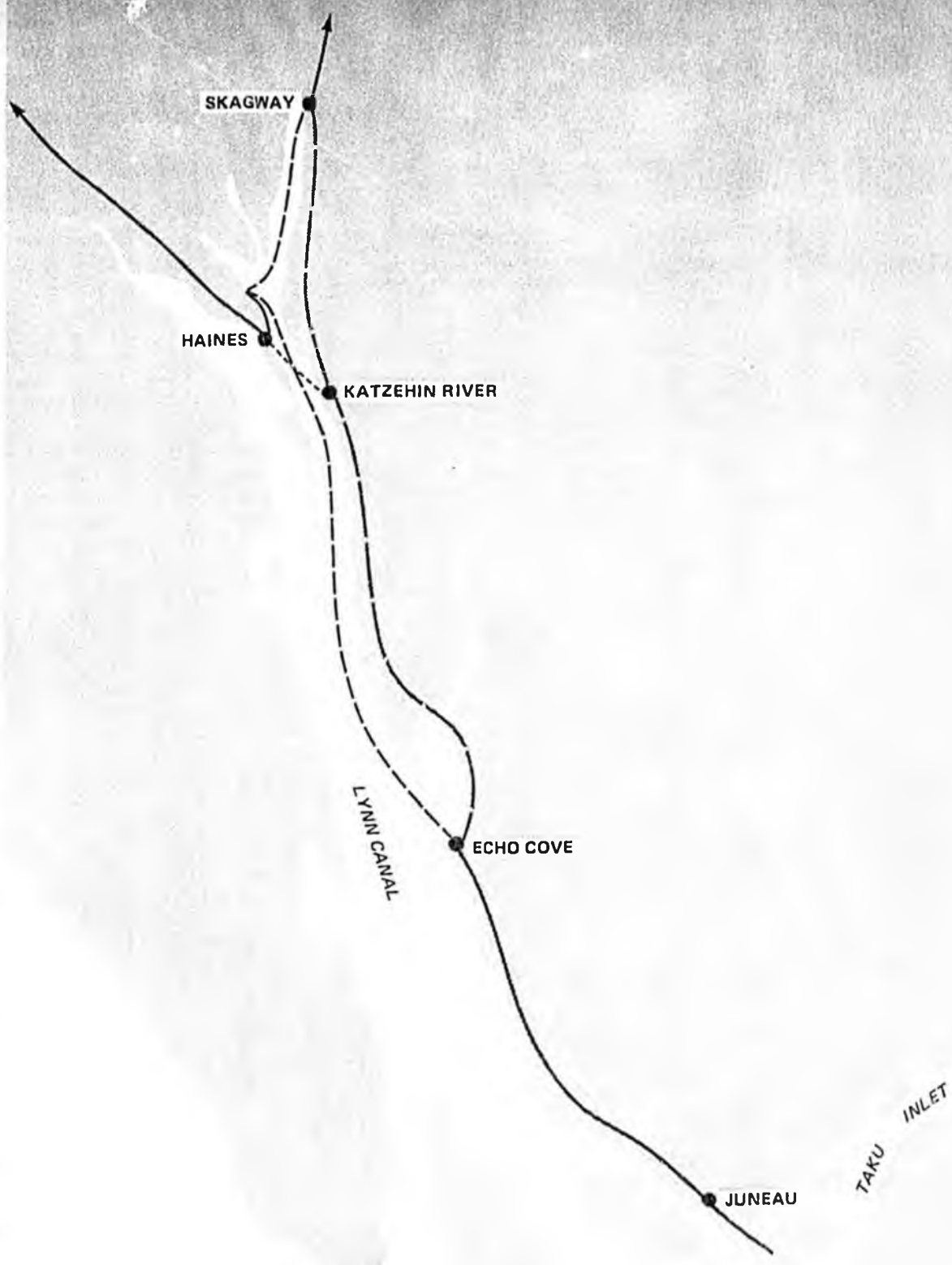
These options emphasized changes within the Lynn Canal corridor, analyzing their impacts on both Lynn service and on service throughout the region. Two Lynn service options, representing the preferred Lynn corridor alternatives, were evaluated (see Figure 8).

- An east-side road from Juneau to Skagway with a shuttle ferry from Haines to the Katzehin River.
- Two high-speed SES shuttle ferries from Echo Cove to Haines and Skagway.

In both cases, northbound mainline ferry service was assumed to terminate at Juneau.

Investment

The Lynn road option involved extending the existing road from Echo Cove up the east side of the Lynn Canal to Skagway. A new ferry terminal would be built near the mouth of the Katzehin River and two shuttle ferries would operate between the new terminal and the existing terminal at Haines,



LEGEND

- Existing Road
- - - New Roads
- Shuttle Ferry
- . - . High-Speed Shuttle

Figure 8

LYNN FOCUS ALTERNATIVES

providing a connection from Haines and the Haines Highway to the new road. Total capital investment for the road, terminal and shuttle ferries would be in the order of \$274 million.

Under the high-speed shuttle option, the Marine Highway would acquire two SES-type, high-speed ferries to provide service between Echo Cove, Haines and Skagway. Each vessel was assumed to make three round trips per day during the summer season, calling at Haines on both the northbound and southbound runs. For purposes of analysis, the high-speed ferries were assumed to operate during the summer season only. However, they could potentially operate on a reduced schedule during the off season if required. Total capital investment, including upgrading parts of the road to Echo Cove, constructing a new terminal there, and acquiring two high-speed ferries, was estimated at \$31 million.

From the viewpoint of the system as a whole, two levels of investment were defined for each of these Lynn cases. In the 'meet demand' cases, new mainline vessels would be required in 1989 and in 1998, both operating on the Seattle route. In the 'reduced investment' cases, only one new mainline vessel would be added in 1998.

Ferry Schedules

In order to take advantage of the termination of mainline and feeder ferry service up the Lynn Canal revised schedules were defined for the existing and proposed new ferries. These are outlined in Figures 9 and 10. Under the 'meet demand' scenario, the proposed peak season Seattle service (Figure 9) would have both the Columbia and the second (1998) new ferry operating on an 'open jaw' route, running north from Seattle to Juneau, south to Prince Rupert, then back north to Juneau and south to Seattle. A trip from Seattle to Prince Rupert would require 4.5 days, so each vessel would return to Seattle every nine days. Two other vessels, the Matanuska and the first new mainline ferry would operate on a weekly round trip service from Seattle to Juneau, calling at Sitka in both directions.

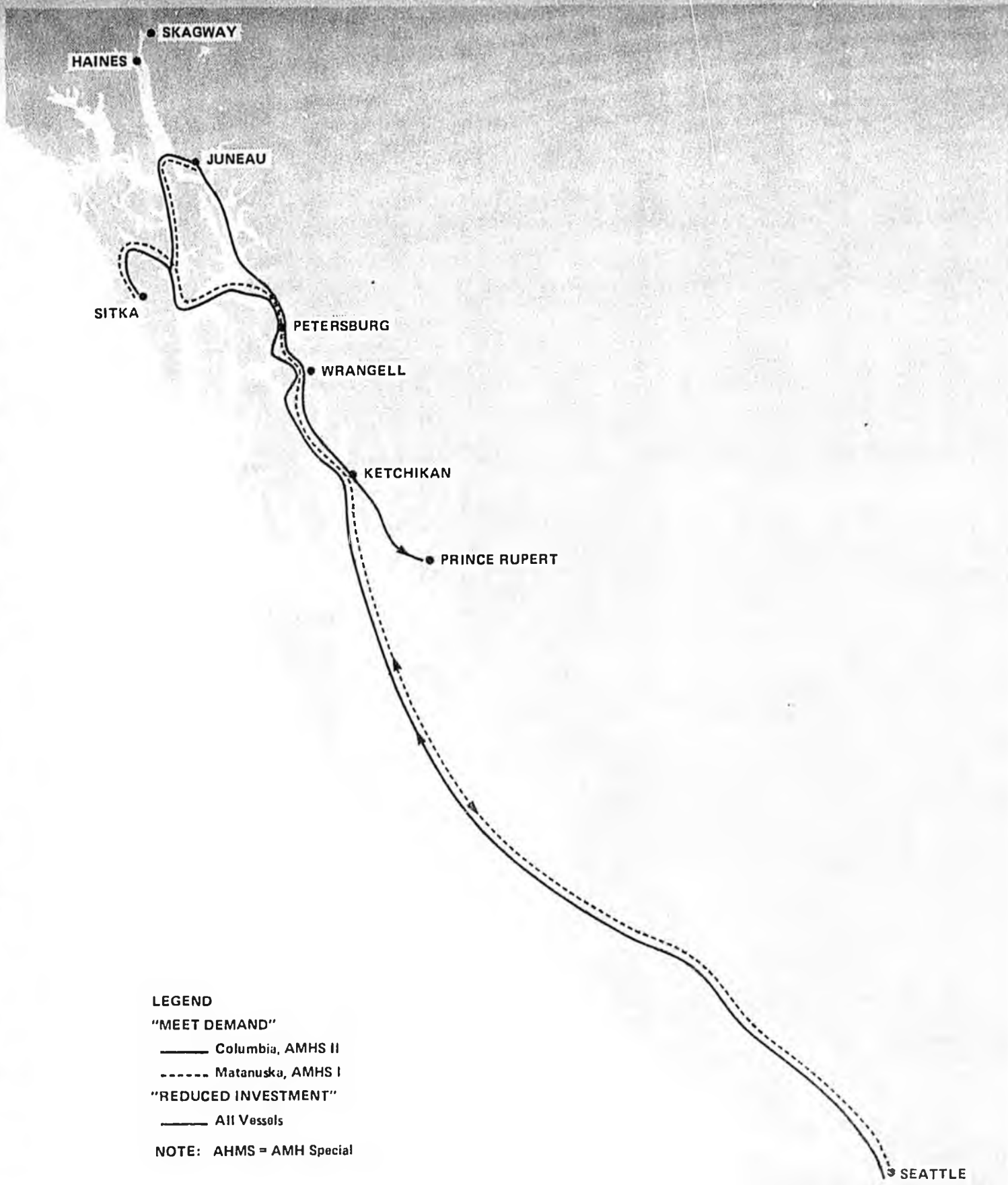


Figure 9
 LYNN FOCUS OPTIONS
 SEATTLE SERVICE

LEGEND

- Malaspina, Taku – 2 trips/2 weeks
- - - - - Malaspina, Taku – 3 trips/2 weeks

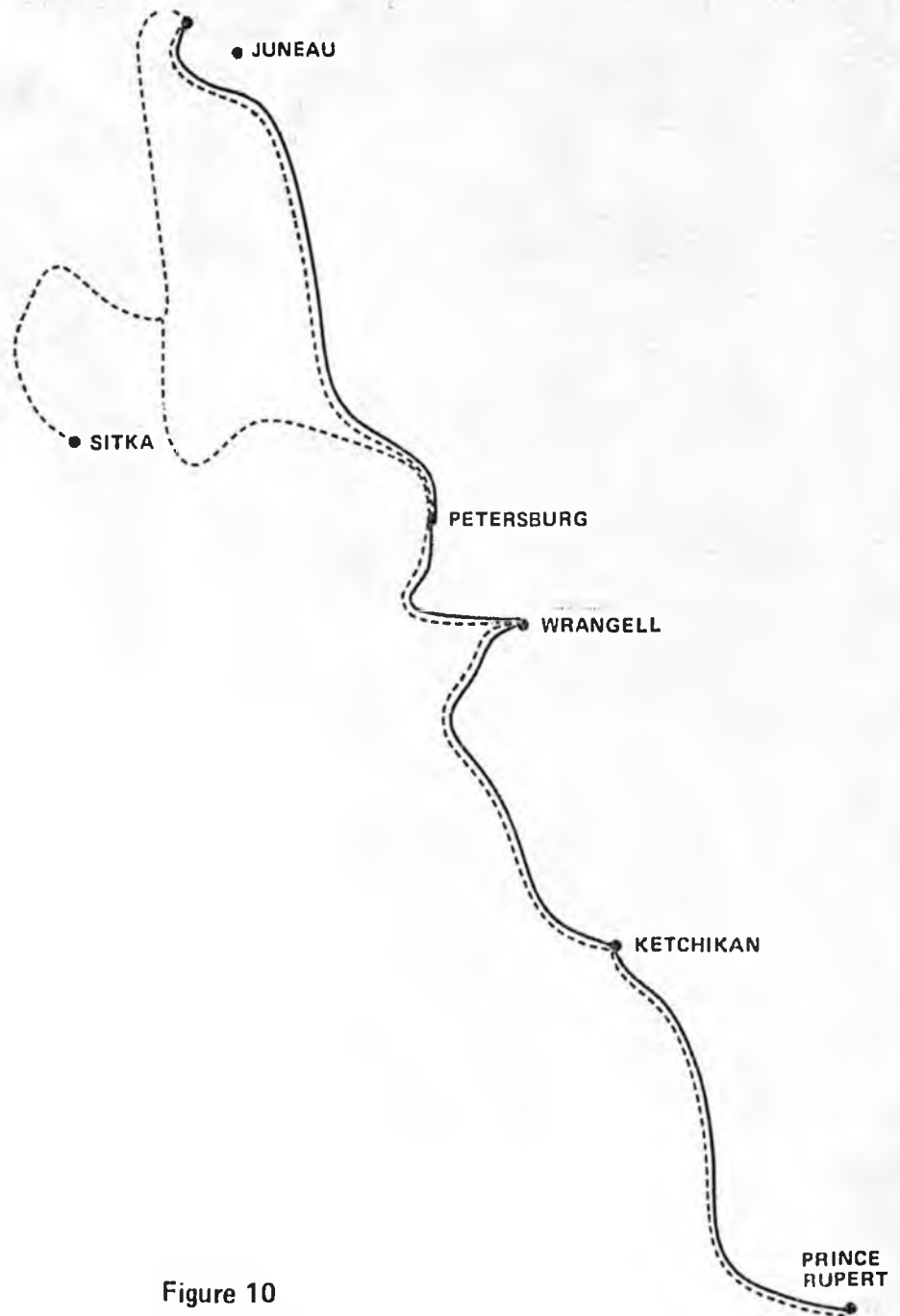


Figure 10

**LYNN FOCUS OPTIONS
PRINCE RUPERT FERRY SERVICE**

Under the 'reduced investment' scenario, where only one new mainline vessel was acquired, the Columbia, the Matanuska, and the new ferry would all operate on the 'open jaw' schedule.

Revised ferry routings out of Prince Rupert are shown in Figure 10. The Malaspina and Taku would operate on routes very similar to their existing schedules, calling at Sitka on alternate trips, but would not travel up the Lynn Canal. This allows a slight increase in the number of trips from two per week to five in a two-week period. These schedules would apply under both the 'meet demand' and 'reduced investment' scenarios.

In terms of feeder ferry service, a number of alternatives would be possible under the Lynn options. The added mainline service between Prince Rupert and Petersburg could free the Aurora to provide more links for Prince of Wales Island. Similarly, the termination of Lynn Canal service and the added mainline trips would allow the LeConte to focus on linking northern feeder communities to a greater number of destinations.

Traffic Impacts

Under the 'meet demand' scenarios, the Lynn options would provide service to all traffic throughout the system after 1989 (when the first new mainline vessel was acquired). Under the 'reduced investment' scenarios, the Lynn road option would result in total losses of 31 100 passengers and 1 000 vehicles out of Seattle over 20 years, primarily between 1986 and 1989 (4.5% of peak demand) and the diversion of 85 600 passengers (12.4% of peak demand) and 38 900 vehicles from Seattle to Prince Rupert.

The 'reduced investment' Lynn high-speed shuttle option would result in the loss of 13 000 passengers out of Seattle (2% of peak demand) and the diversion of 82 200 passengers (11.9% of peak demand) and 37 400 vehicles from Seattle to Prince Rupert.

Within the Lynn corridor itself, both Lynn options were assumed to generate a measure of induced traffic (i.e. passengers and vehicles which would not have made the trip under the existing system but which were persuaded by

lower costs and/or better service to travel in the corridor). Different inducement factors were used for the road and the shuttle options. Under the road option it was assumed that the lower cost and improved travel time would generate an average of 100 000 additional vehicle movements per year. The shuttle option, with a lower service level and higher cost was assumed to generate on average an additional 25 000 vehicle trips per year. With summer operation only, induced traffic was estimated at one-half the annual figure or an average of 12 500 vehicle trips.

5.2.3 - Sitka Focus

The Sitka options focused on long-term changes in the way in which the Sitka community was incorporated into the surface system. Three service options were assessed.

- Construct a road from Sitka to Baranof and operate mainline and feeder service out of Warm Springs Bay.
- Construct a road from Sitka to Rodman Bay and provide mainline and feeder ferry services out of a Rodman Bay terminal.
- Provide high-speed SES ferry service on the Sitka-Juneau and Sitka-Petersburg links. Terminate mainline service into Sitka.

A map highlighting these options is shown in Figure 11.

Investment

The Baranof road option would involve the construction of a new road from Sitka to Warm Springs Bay. In total, 26 miles of new road, including a tunnel and substantial avalanche protection, would be required and a new mainline/feeder ferry terminal would have to be constructed. Total capital cost to implement this option was estimated at \$181.5 million.

The Rodman Bay road option would involve a 46 mile extension of the existing northbound road and construction of a new mainline/feeder ferry terminal on

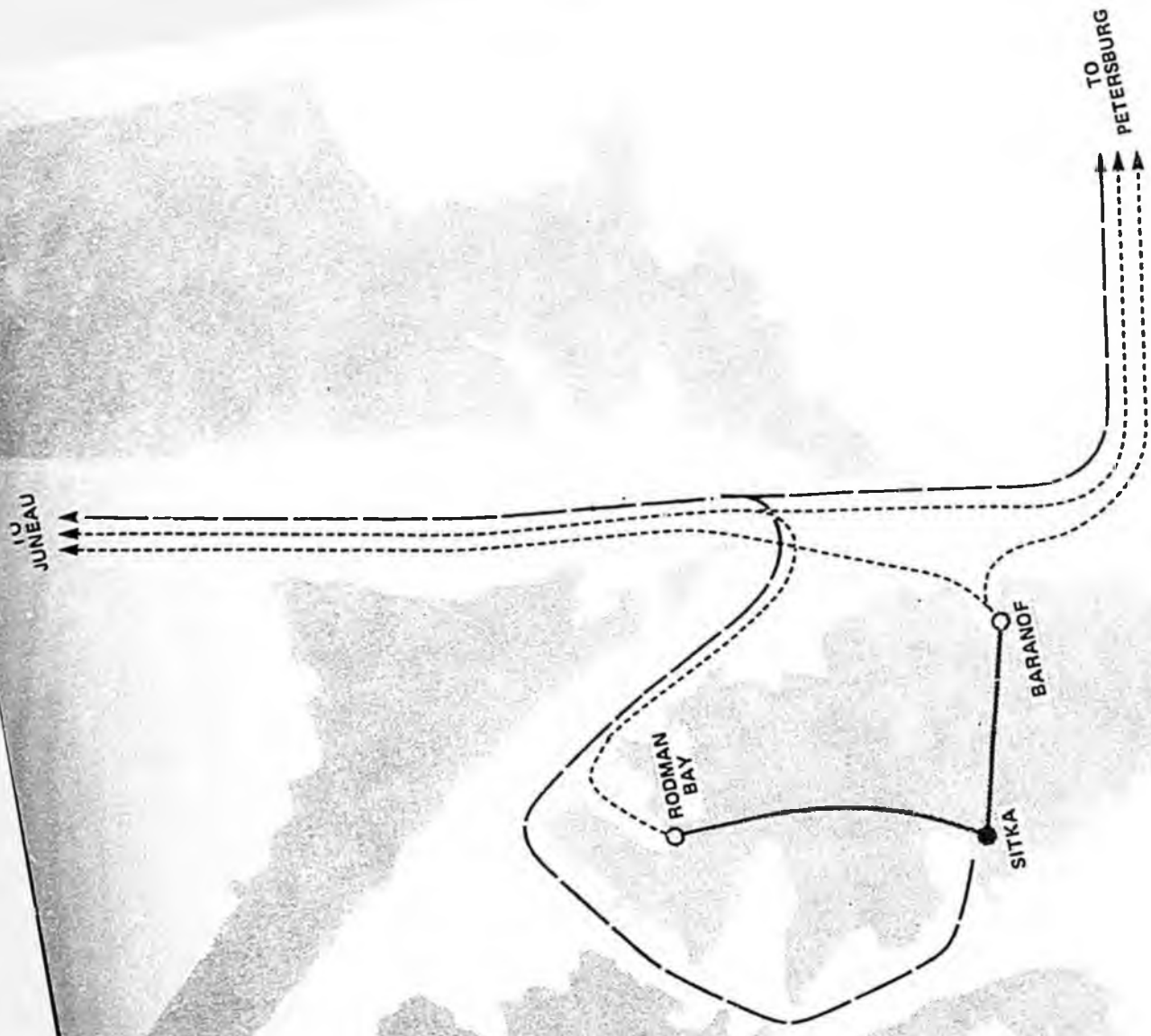


Figure 11
SITKA FOCUS ALTERNATIVES

Rodman Bay. Although the road distance is substantially greater than under the Baranof option (the new terminal would be approximately 54 miles from Sitka), the terrain is less severe and total capital cost for the road and terminal was estimated at \$160 million.

The third Sitka option would involve the use of two large SES-type high-speed ferries to link Sitka to Juneau, Petersburg, and the feeder communities in between. One vessel would make a daily round trip from Sitka to Juneau calling at Angoon in both directions and at Tenakee Springs and Hoonah on either the outbound or return leg. The second vessel would make a daily round trip from Sitka to Petersburg, calling at Kake in both directions. For analytical purposes, these vessels were assumed to operate during the peak season only, with normal mainline and feeder services being resumed in the off-peak. However, as with the Lynn high-speed option, these vessels could potentially operate over a longer season on a reduced schedule if required. Total new capital investment in this option would be \$24 million - \$12 million per vessel.

The required mainline capacity additions under each of these Sitka options were essentially the same. Under the 'meet demand' scenarios, all options were found to require new mainline vessels in 1989 and in 1998. Under the 'reduced investment' scenarios, each option presumed a new mainline vessel in 1998 only.

Ferry Schedules

Ferry schedules under the Baranof and Rodman Bay road options were adjusted to take advantage of the time saving arising from the reduced sailing distance and elimination of the tide delays in Sergius Narrows. The proposed mainline routes are shown in Figures 12 and 13.

Figure 12 shows the Seattle ferry service under the two Sitka road options. Under the 'meet demand' scenarios, two vessels, the Columbia and the second new ferry, would operate on an 'open jaw' route from Seattle north via Baranof/Rodman Bay to Skagway, then south to Prince Rupert. At Prince Rupert they would turn back north to Skagway, then south via Baranof/Rodman

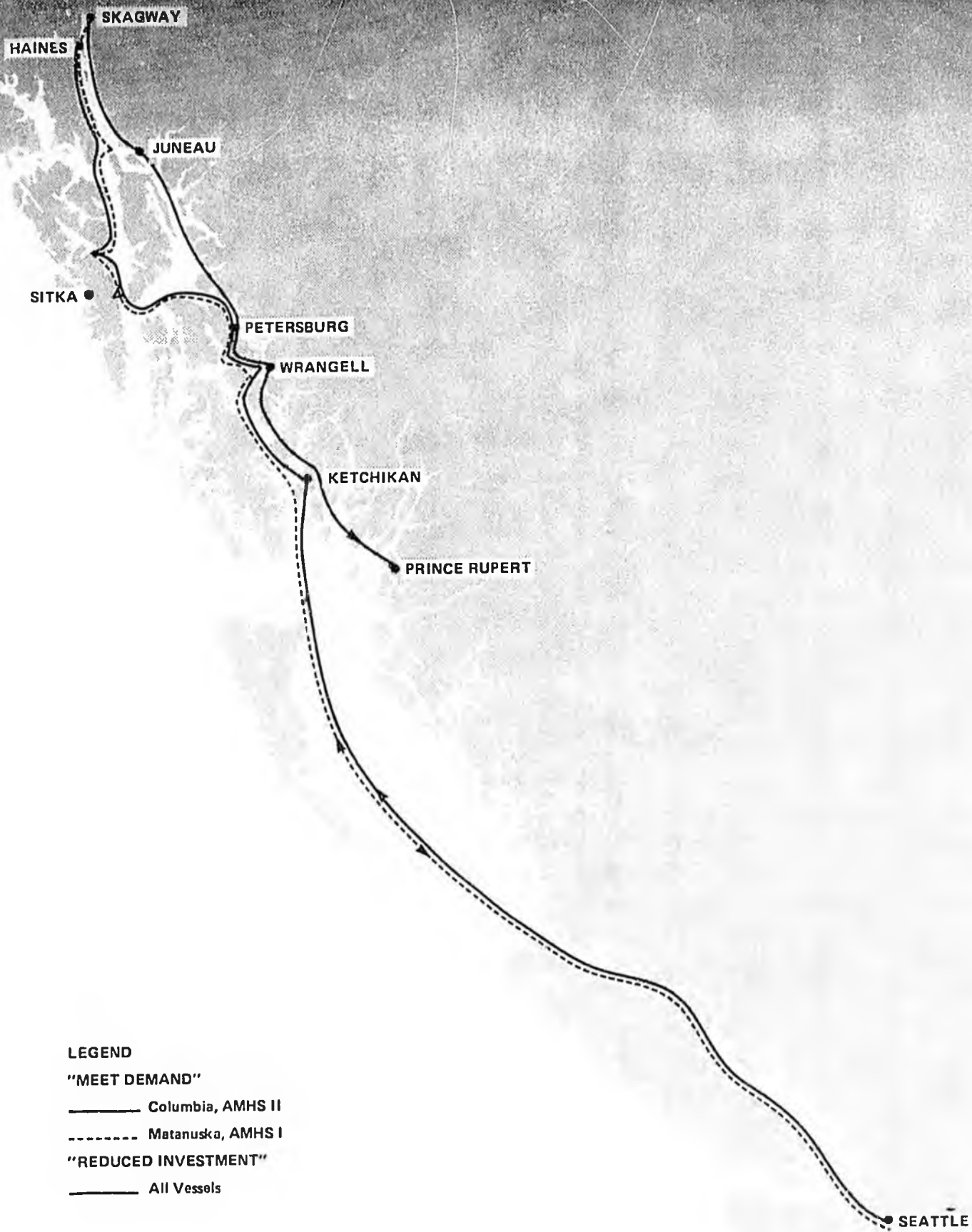


Figure 12

SITKA ROAD OPTIONS
SEATTLE FERRY SERVICE

LEGEND

———— Malaspina, Taku — 2 trips/week

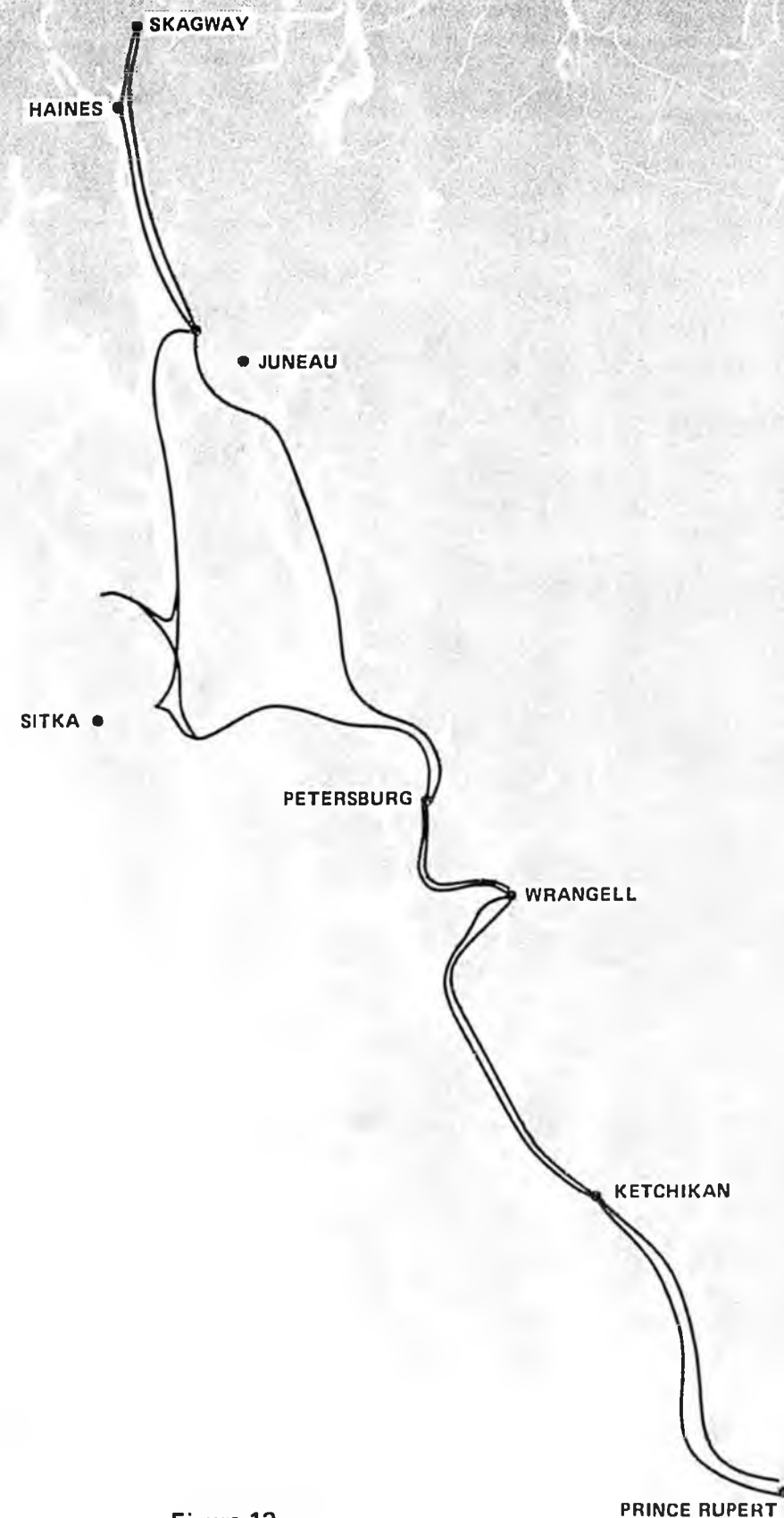


Figure 13

SITKA ROAD OPTIONS
PRINCE RUPERT FERRY SERVICE

Bay to Seattle. Each trip from Seattle to Prince Rupert would take 4.5 days so each vessel would return to Seattle every nine days. Two other vessels, the Matanuska and the first new ferry would operate a weekly round trip service from Seattle to Skagway, calling at Baranof/Rodman Bay in both directions.

Under the 'reduced investment' scenarios, Seattle service would involve three vessels, the Columbia, the Matanuska, and the new ferry, operating on the 'open jaw' route between Seattle and Prince Rupert.

The proposed Prince Rupert service is shown in Figure 13. Under the road options, the Malaspina and Taku would operate twice weekly on a route basically similar to their current 'Sitka' run. However, instead of making only one trip per week via Sitka, they would call at Baranof/Rodman Bay on both round trips.

The road options would also allow greater utilization of the LeConte. The time saved by eliminating three weekly trips into Sitka harbor could be used to provide additional trips into the feeder communities of Kake, Angoon, Hoonah, Tenakee Springs and Pelican.

The Sitka shuttle option involved somewhat different ferry schedules for the mainline and feeder services. Since Sitka would be served, under this option, by high-speed ferries to Juneau and Petersburg, the mainline ferries were able to sail directly between Juneau and Petersburg without traveling west of Admiralty Island.

The proposed mainline routes out of Seattle and Prince Rupert are shown in Figures 14 and 15 respectively. The Seattle service, under the 'meet demand' scenario, would involve operating the Columbia, the Matanuska and the second new mainline ferry on an 'open jaw' route between Seattle, Skagway and Prince Rupert. The first new ferry would operate a weekly round trip service between Seattle and Skagway.

Under the reduced investment scenario, all three vessels would operate on an 'open jaw' route out of Seattle. These routes and schedules offer essentially the same Seattle service as under the road options.

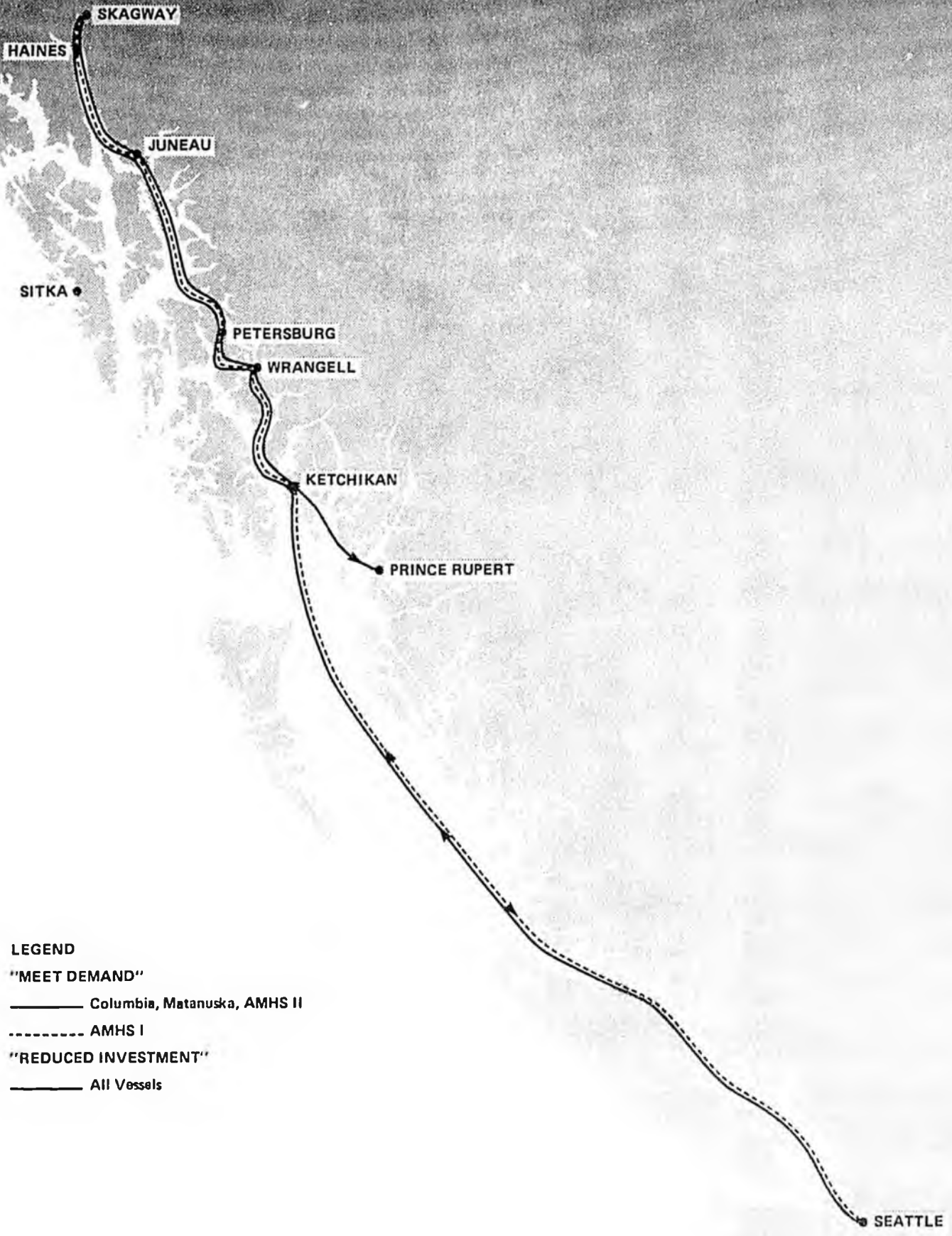
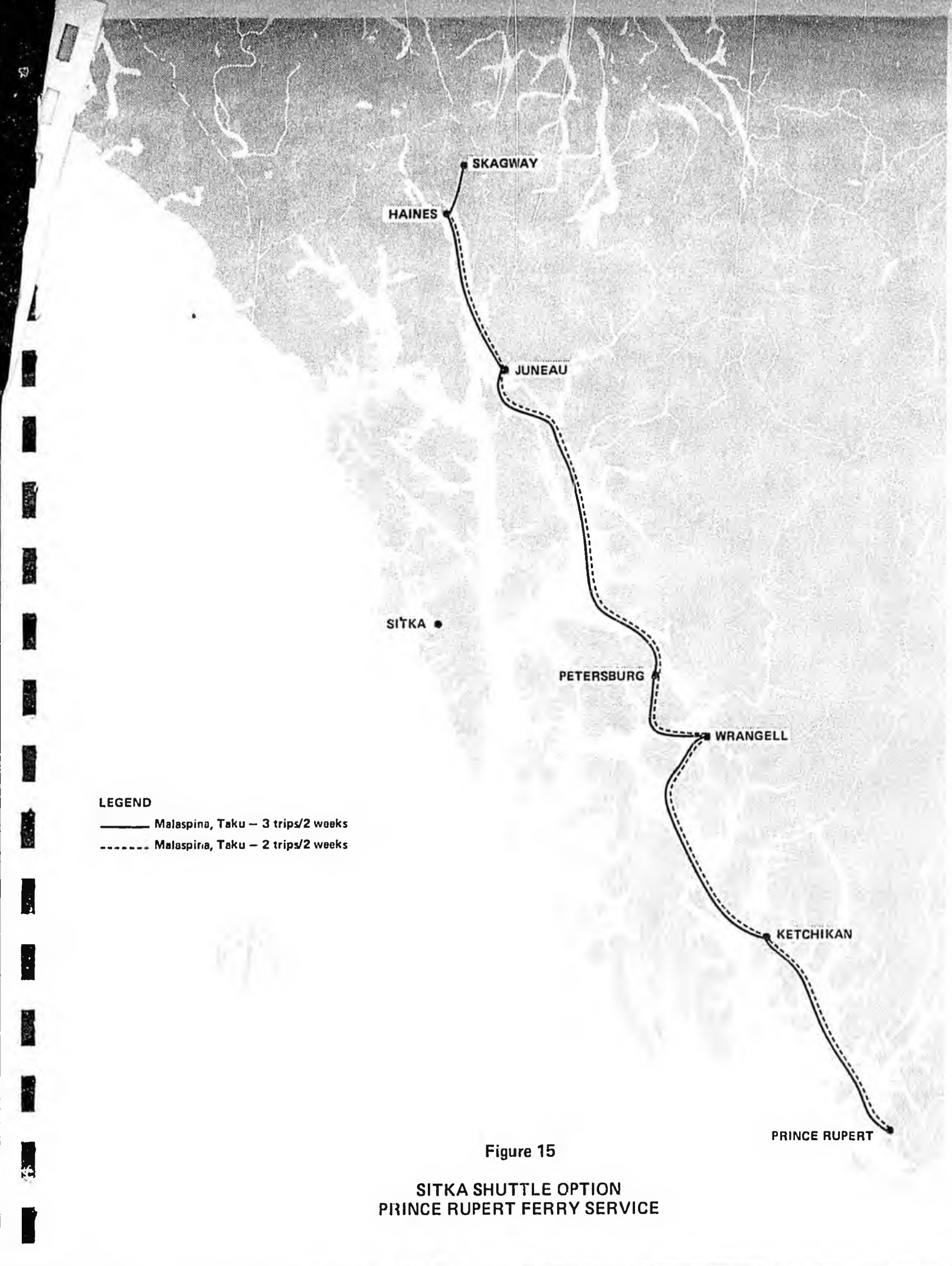


Figure 14

SITKA SHUTTLE OPTION
SEATTLE FERRY SERVICE



LEGEND

- Malaspina, Taku - 3 trips/2 weeks
- - - - Malaspina, Taku - 2 trips/2 weeks

Figure 15

**SITKA SHUTTLE OPTION
PRINCE RUPERT FERRY SERVICE**

Prince Rupert service under the Sitka shuttle option would be somewhat better than under the road options, however. Rather than two round trips per week out of Prince Rupert, the Malaspina and Taku could each make five round trips over a two-week period. On three of these voyages they would travel as far as Skagway. On the remaining two, however, they would have to turn at Haines. Skagway would, however, be served on all voyages by the Seattle vessels.

Proposed changes in feeder service under the Sitka shuttle option were minor. The LeConte would continue to serve Pelican but on a more frequent basis. In addition, she would continue to provide service in the Juneau-Sitka-Petersburg region for movement of heavy freight and oversized vehicles.

Traffic Impacts

The traffic impacts of the Sitka options were roughly the same under the 'meet demand' scenarios. Apart from some losses during the early years until a new mainline vessel could be brought into service, all options met system demand throughout the planning period. The shuttle option involved somewhat lower losses, however, since it could be implemented earlier than the road options and could therefore provide additional Seattle and Prince Rupert service at an earlier date.

Under the 'reduced investment' scenarios, where no new vessels were added until 1998, the shuttle option resulted in lower losses than did the two road alternatives. The Baranof and Rodman Bay options resulted in losses of 83 800 Seattle passengers (12.1% of peak demand) and 24 900 Seattle vehicles over 20 years, and a small portion of Prince Rupert demand (6 900 passengers and 3 200 vehicles) could also not be served. In addition, 33 000 Seattle passengers and 15 000 vehicles would be diverted to Prince Rupert.

The reduced investment shuttle option resulted in the loss of 13 000 Seattle passengers (1.9% of peak demand) over 20 years. Diversions would be higher than in the road options, however, with 71 700 Seattle passengers obliged to transfer to Prince Rupert.

The Sitka high-speed ferry option was also expected to attract a small amount of induced traffic, largely from the air service. While the high-speed service would be significantly better than the existing ferry service, it would not, however, provide a service comparable to the daily jet flights to and from Juneau and Ketchikan. Accordingly, the high-speed ferry was estimated to attract approximately 5% of the projected peak internal jet passengers or an average of approximately 1 375 passengers per year.

5.2.4 - Prince of Wales Island Focus

The Prince of Wales Island focus concentrated on the local and system-wide impacts of changes in the service to and from Prince of Wales Island. Four separate options were evaluated. (See Figure 16.)

- Relocate the Clark Bay terminal to Tolstoi Bay, and provide mainline and partial feeder service through the new terminal. Connect Tolstoi Bay to the Island communities by extending the road from Thorne Bay or from Hollis.
- Develop a new terminal at Red Bay on the north end of the Island, connected by road to the existing Klawock-Thorne Bay highway. Provide ferry service from Red Bay to Blind Slough and Wrangell, and from Hollis to Ketchikan.
- Acquire a high-speed catamaran-type ferry to provide twice-daily service between Hollis and Ketchikan. Move the Aurora to other routes.
- Acquire a high-speed catamaran-type ferry to provide service in the Hollis-Ketchikan-Clarence Straits region. Supplement Hollis-Ketchikan service with alternate-day service by the Aurora.

Investment

The Tolstoi Bay terminal option would require construction upgrading of approximately 17 miles of road to connect Thorne Bay to the new site. In

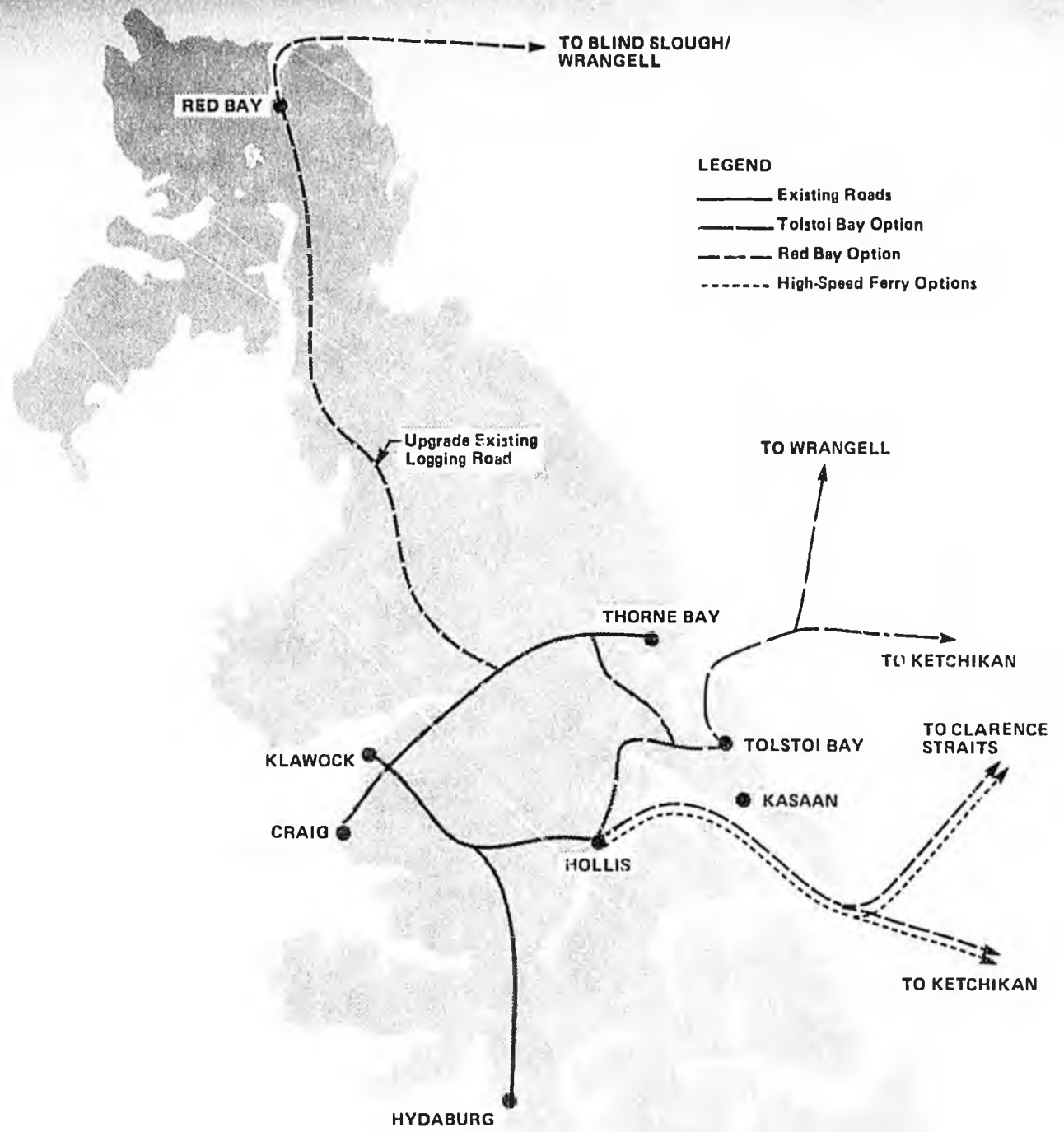


Figure 16

PRINCE OF WALES FOCUS OPTIONS

addition, a new mainline/feeder ferry terminal would have to be constructed. Estimated capital cost for this option was \$18.3 million. The alternative of connecting to Tolstoi Bay through Hollis would involve 16 miles of new road construction. Estimated capital cost (including terminal development) would be \$26.8 million.

The Red Bay terminal option would require the upgrading and extension of an existing forest service road. The total distance from Red Bay to the junction with the Klawock-Thorne Bay road would be approximately 53 miles. In addition, new shuttle terminals would be required at Blind Slough (on the southern shore of Mitkof Island) and at Red Bay, and a small (15-vehicle) shuttle ferry would have to be acquired. Total estimated capital cost for the road, terminals and ferry was estimated at \$71 million.

The two high-speed ferry options would each involve purchase of a single high-speed catamaran-type vessel at a cost of approximately \$3 million. Some port modifications might also be necessary, but the extent of these would depend on the locations being served and on the level of sophistication desired.

Investment in the existing ferry system under the 'meet demand' scenarios was the same for all four Prince of Wales options; specifically, new mainline ferries were added to the system in 1989 and 1993. This corresponded closely to the additions required in the 'mainline service' option. However, the Prince of Wales options did eliminate the need for additional capacity out of Prince Rupert at the turn of the century.

Under the 'reduced investment' scenarios, a single new vessel was required by the system in 1993 under all Prince of Wales options.

Ferry Schedules

Modifications to the existing mainline and feeder ferry schedules under the Prince of Wales focus were most significant under the Tolstoi Bay terminal options. For the mainline vessels travelling out of Seattle, (the Columbia and the new mainline ferries), the revised schedule would involve calling at

Tolstoi Bay on both the northbound and southbound legs of their weekly voyages. The mainline vessels sailing out of Prince Rupert (the Matanuska, Taku and Malaspina) would call at Tolstoi Bay on their weekly trip via Sitka. On their direct Prince Rupert-Skagway voyage, however, they would bypass Tolstoi Bay. In order to supplement service out of Prince Rupert and in the Clarence Straits region, the Aurora was assumed to make 2-day round trips from Prince Rupert to Petersburg, calling at Tolstoi Bay in both directions.

The Red Bay option involved no change to existing mainline ferry service. Feeder service was provided by the shuttle ferry which would make a daily round trip between Red Bay, Blind Slough and Wrangell, and by the Aurora which would operate on a 2-day round-trip schedule calling at Prince Rupert, Ketchikan, Hollis, Wrangell and Blind Slough.

The high-speed shuttle and high-speed loop service options also involved no change in the mainline ferry service. Under the high-speed shuttle option, the catamaran could make two round trips per day between Hollis and Ketchikan. Alternatively, on some days (e.g. mid-week or Sundays) it could make one round trip to Hollis (and possibly Kasaan) plus two round trips between Ketchikan and Metlakatla. The Aurora could then be used to serve the Prince Rupert-Clarence Straits corridor as far north as Kake on a 2-day round-trip basis.

The Prince of Wales loop option would be similar to the shuttle option except that there would be more focus on multi-community high speed routes and less focus on direct Hollis-Ketchikan links. The Aurora would then supplement service between Hollis and Ketchikan, operating on a 2-day round trip route to Prince Rupert, Ketchikan, Hollis and Wrangell.

Traffic Impacts

Traffic impacts of the various Prince of Wales options were similar to other 'focus' options under the 'meet demand' scenarios. Once a new mainline vessel was brought into service in 1989, all demand would be met throughout the planning period.

Under the 'reduced investment' scenarios, the Tolstoi Bay and Red Bay options would both result in the loss of 46 100 passenger trips and 5 400 vehicle trips out of Seattle (6.7% of peak passenger demand) over the 20-year planning period. An additional 41 900 passengers (6.1% of peak demand) and 19 000 vehicles would be diverted from Seattle to Prince Rupert.

Under the two high-speed ferry options, losses out of Seattle would amount to 22 700 passengers and 5 600 vehicles over the study period (3.3% of peak passenger demand). In addition, 23 600 passengers and 10 700 vehicles would be diverted from Seattle to Prince Rupert.

5.2.5 - Stikine Focus

The final group of long-term system options emphasized development of a mid-region road access to supplement mainline ferry service. The two preferred options from the corridor studies were evaluated in the systems context, and a third option--constructing a road from Ketchikan to the Canadian border with a connecting link to Wrangell-- was also included.

The three Stikine options therefore involved the following (see Figure 17).

- Construct a road from Wrangell to the Canadian border. Provide shuttle ferry service between Wrangell and Petersburg via Blind Slough.
- Construct a road from Petersburg to the Canadian border. Provide shuttle ferry service between Wrangell and Petersburg via Blind Slough.
- Construct a road from Ketchikan to the Canadian border with a connecting link to Wrangell. Operate ferry services south of Ketchikan/Hollis and north of Wrangell.

Investment

The Wrangell road/shuttle option involved extending the existing road south past Pat's Creek, across Wrangell Island, crossing to the mainland at the

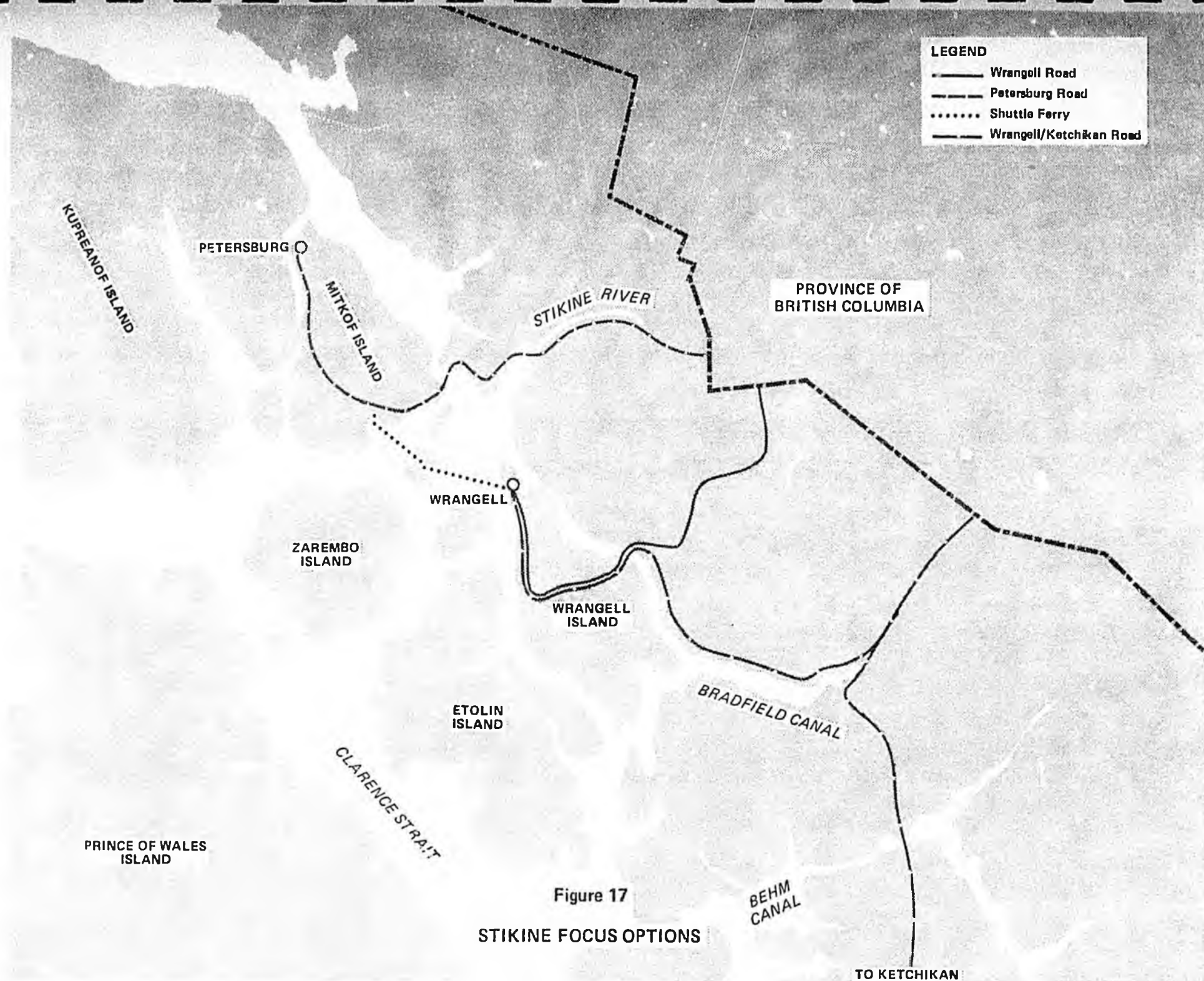


Figure 17
STIKINE FOCUS OPTIONS

Narrows, and following Aaron's Creek and the West Fork to the border. A total of 49 miles of new road would be required at an estimated cost of \$157 million. In addition, a new ferry terminal would be built at Blind Slough, and a small shuttle ferry purchased which would be used to link Petersburg to Wrangell and the new highway. Capital cost for these items, together with some upgrading of the Mitkof highway, would add a further \$6.5 million to the capital cost.

The Petersburg road option involved extending the existing Mitkof Highway across Dry Strait and along the south bank of the Stikine River (crossing over at Limb Island) to the Canadian border. As with the Wrangell option, a shuttle ferry service would be provided so that both communities could be linked to the highway. This option would involve construction of 34 miles of new road at an estimated capital cost of \$120 million. The shuttle ferry and terminal would add a further 6.5 million to the cost.

The Wrangell-Ketchikan road option would involve a significantly more substantial road-building effort. The link out of Ketchikan would align northeasterly to Carroll Inlet, then follow the general alignment of Carroll Creek up to the north end of Revillagigedo Island. A shuttle ferry would be used to cross the Behm Canal just east of Bell Island after which the road would follow the Eagle River to Bradfield Canal and the North Fork of the Bradfield River and Craig River to the border. The Wrangell link would follow the alignment of the proposed Wrangell/Stikine road to Aaron's Creek, then turn south to follow the Blake Channel and Bradfield Canal, linking up with the Ketchikan Road at the mouth of the North Fork-Bradfield River.

Total construction would involve 176 miles of new road plus two shuttle-ferry docks at the Behm Canal for a total capital cost of \$374 million. The shuttle ferry would add approximately \$1 million to this total.

The need for mainline ferry capacity additions under the Stikine alternatives was approached in a somewhat different manner than under the other 'focus' options. While the 'meet demand' scenarios for other options involved providing ferry capacity to meet demand at both Seattle and Prince

Rupert, in the case of the Stikine road options the presumption was that the road would be used as an alternative to additional mainline capacity. Accordingly, under the Stikine options, 'meet demand' implied providing sufficient ferry capacity to carry traffic entering the system at Prince Rupert and/or at Wrangell-Petersburg. Thus, this scenario related more closely to the other options' 'reduced investment' scenarios where passengers with vehicles were obliged to transfer from one port to another in order to obtain ferry service.

Under this criterion, the Wrangell and Petersburg road options required the addition of one vessel operating out of Seattle in 1993 and a second vessel operating out of Prince Rupert in 1997. In this way, they were able to serve all vehicle traffic into the southeast region and at the same time keep the losses of Seattle foot passengers at a reasonable level.

Ferry Schedules

Apart from the added vessels, the existing ferry route structure was maintained throughout the planning period for the Wrangell and Petersburg road options.

The Wrangell-Ketchikan road option involved more drastic modifications to the ferry route structures. Since the policy of the transportation system is not to run ferry service in parallel with regional roads, it was presumed that ferry service would be eliminated between Wrangell and Ketchikan. Thus, through traffic from points south of Ketchikan to points north of Wrangell would have to travel either via road and then ferry or alternatively by ferry-road-ferry if they do not have direct access to the road system.

The proposed ferry service involved operating the Columbia on a twice-weekly shuttle service between Seattle and Ketchikan. The Aurora would provide daily round-trip service between Prince Rupert, Ketchikan and Hollis. All traffic between Seattle and Ketchikan/ Hollis and between Prince Rupert and Ketchikan/Hollis would be accommodated by one of these vessels.

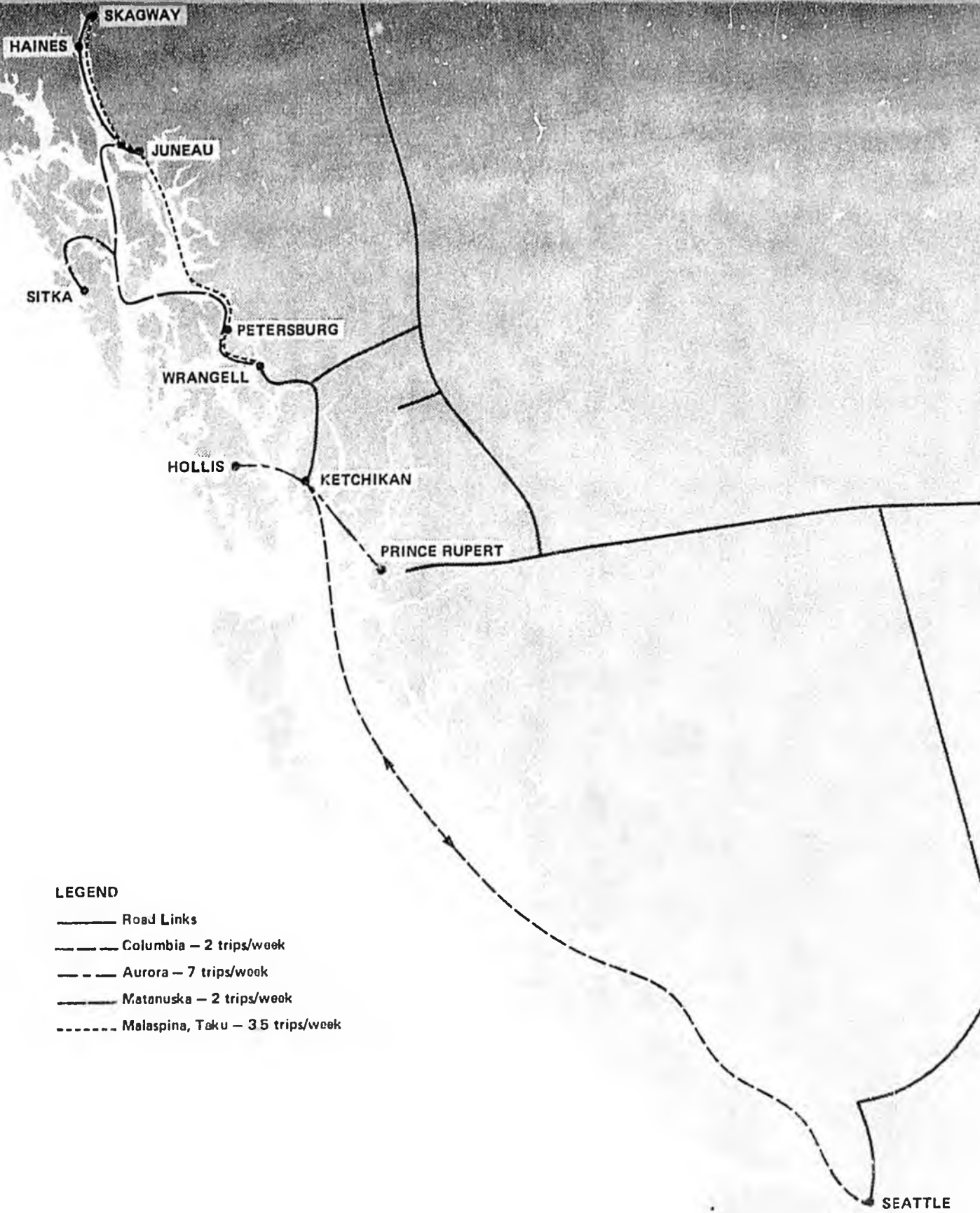
Traffic from the southern termini and Ketchikan/Hollis to Wrangell and points north would use the road system (the Stewart-Cassiar Highway and/or the new Ketchikan road) to get to Wrangell. Ferry service out of Wrangell would be provided by the Malaspina, Taku and Matanuska. The Matanuska would provide twice-weekly service between Wrangell and Skagway calling at Sitka in both directions. The Malaspina and Taku would each provide two day round-trip service from Wrangell to Petersburg, Juneau, Haines and Skagway. The LeConte would continue on her existing routes. These scheduling changes are summarized in Figure 18.

Traffic Impacts

The traffic impacts of the Wrangell and Petersburg road options would involve the loss, over 20 years, of a total of 55 300 Seattle foot passengers (8% of peak season demand) and just under 1 000 vehicles. Total diversion of Seattle traffic to either Prince Rupert or the Stikine would amount to 71 800 passengers and 32 600 vehicles. This includes a total of 16 400 passengers and 7 500 vehicles travelling from Seattle to either Wrangell or Petersburg.

The traffic impacts of the Wrangell/Ketchikan road are more difficult to quantify. Theoretically, this system would fail to meet the needs of foot passengers travelling between the southern termini and points north of Ketchikan since some sort of vehicle would be required to get from Ketchikan to Wrangell. Similarly, foot-passenger traffic between Hollis/ Ketchikan and points north could be lost unless the passengers have a vehicle available to them at either Ketchikan or Wrangell. In addition, existing vehicle traffic from Seattle, Prince Rupert and Ketchikan to Wrangell, while served by the road system, would be lost to the ferry service. In total, as many as 700 000 passengers could be lost to the ferry system over the 20-year period, of which 526 000 would represent unserved demand.

Whether or not this is a fair assessment of impacts is questionable however. To evaluate a system which represents a fundamental departure from the existing type of service on the same basis as options which essentially conform to the existing pattern of demand can lead to misleading results.



LEGEND

- Road Links
- - - - Columbia - 2 trips/week
- - - - Aurora - 7 trips/week
- - - - Matanuska - 2 trips/week
- - - - Malaspina, Taku - 3.5 trips/week

Figure 18

**WRANGELL/KETCHIKAN ROAD
FERRY SERVICE**

While the Wrangell/Ketchikan road option would seriously disrupt foot-passenger traffic to and from the region it could also, potentially, generate substantial new traffic into the area by drawing in through traffic from the Stewart-Cassiar and Alcan Highways.

5.3 - Evaluation of Long-Term System Options

5.3.1 - Financial Evaluation

Each of the long-term system options was first evaluated with respect to financial impacts on the Marine Highway, the state government, and the transportation user. The results of this analysis are summarized in Table 5.1 for the 'meet demand' scenarios and in Table 5.2 for the 'reduced investment' cases.

Looking first at the 'meet demand' scenarios (Table 5.1), it is apparent that one of the least costly options from the viewpoint of the state is the June 1980 Plan. All Lynn, Sitka and Stikine options and the Prince of Wales-Red Bay alternative represent a higher state cost yet serve essentially the same, or, in the case of the Stikine, a lower level of demand. However, there are three options which involve a lower overall cost to the state, all in the Prince of Wales region: the Tolstoi Bay terminal and the two high-speed ferry options.

Turning to the 'reduced investment' scenario (Table 5.2), however, leads to somewhat different results. If a slippage is allowed in terms of meeting demand as requested out of the southern terminus ports, the state can realize substantial savings over the June 1980 Plan under a number of service options. Once again, three of the Prince of Wales options appear most attractive. However, the Sitka shuttle and Lynn shuttle options also begin to look attractive.

TABLE 5.1

LONG TERM SYSTEM OPTIONS - "MEET DEMAND" SCENARIOS

FINANCIAL IMPACTS

NET PRESENT VALUE - 20 YEAR TOTAL - DISCOUNTED AT 5%

(\$ Million)

	June 1980 Plan (\$)	Lynn		Sitka			Prince of Wales				Stikine		
		Road (\$)	Shuttle (\$)	Baranof (\$)	Rodman (\$)	Shuttle (\$)	Toistol Bay Terminal (\$)	Rod Bay Terminal (\$)	HI-Speed Shuttle (\$)	HI-Speed Loop Route (\$)	Wrangell Road/Shuttle (\$)	Petersburg Road/Shuttle (\$)	Wrangell/ Ketchikan Road (\$)
<u>Cost to AMHS</u>													
Ship Capital	321.6	302.3	327.4	299.2	299.2	327.4	312.5	312.5	316.1	316.1	282.9	282.9	241.3
Ship Operating	773.9	747.6	787.0	716.6	720.4	785.5	753.2	762.3	770.4	771.0	724.5	724.5	667.9
Port Capital	-	3.6	2.2	3.0	3.0	-	2.6	3.9	-	-	2.0	2.0	-
Port Operating	28.2	29.9	33.5	28.2	28.2	28.2	28.2	29.0	28.2	28.2	29.0	29.0	28.2
Less fare revenue	(539.8)	(503.0)	(538.9)	(536.3)	(536.3)	(540.7)	(539.0)	(538.5)	(544.3)	(544.3)	(518.6)	(518.6)	(443.6)
Net cost to AMHS	<u>\$583.9</u>	<u>\$580.4</u>	<u>\$611.2</u>	<u>\$510.7</u>	<u>\$514.5</u>	<u>\$600.4</u>	<u>\$557.5</u>	<u>\$569.2</u>	<u>\$570.4</u>	<u>\$571.0</u>	<u>\$519.8</u>	<u>\$519.8</u>	<u>\$493.8</u>
<u>Cost to User</u>													
Fares	539.8	503.0	538.9	536.3	536.3	540.7	539.0	538.5	544.3	544.3	518.6	518.6	443.6
Vehicle Operating Cost	1.5	20.4	4.9	2.7	3.9	1.0	1.7	1.6	0.4	0.4	7.1	7.1	28.2
Total Cost to User	<u>\$541.3</u>	<u>\$523.4</u>	<u>\$543.8</u>	<u>\$539.0</u>	<u>\$540.2</u>	<u>\$541.7</u>	<u>\$540.7</u>	<u>\$540.1</u>	<u>\$544.7</u>	<u>\$544.7</u>	<u>\$525.7</u>	<u>\$525.7</u>	<u>\$471.8</u>
<u>Cost to State</u>													
AMHS Deficit	583.9	580.4	611.2	510.7	514.5	600.4	557.5	569.2	570.4	571.0	519.8	519.8	493.8
Road Capital	-	176.7	1.6	121.5	107.1	-	14.6	42.2	-	-	106.4	80.3	251.7
Road Operating	-	15.8	6.4	10.5	5.0	-	1.9	6.8	-	-	14.3	7.1	32.6
Total Cost to State	<u>\$583.9</u>	<u>\$772.9</u>	<u>\$619.2</u>	<u>\$642.7</u>	<u>\$626.6</u>	<u>\$600.4</u>	<u>\$574.0</u>	<u>\$618.2</u>	<u>\$570.4</u>	<u>\$571.0</u>	<u>\$640.5</u>	<u>\$607.2</u>	<u>\$778.1</u>
PAX not served ('000)	12.5	12.5	7.8	12.5	12.5	7.8	12.5	12.5	0	0	55.3	55.3	525.9

TABLE 5.2

LONG TERM SYSTEM OPTIONS - "REDUCED INVESTMENT" SCENARIOS

FINANCIAL IMPACTS

NET PRESENT VALUE - 20 YEAR TOTAL - DISCOUNTED AT 5%
(\$ Million)

	June 1980 Plan (\$)	Lynn		Sitka			Prince of Wales			
		Road (\$)	Shuttle (\$)	Baranof (\$)	Rodman (\$)	Shuttle (\$)	Tolstoi Bay Terminal (\$)	Red Bay Terminal (\$)	HI-Speed Shuttle (\$)	HI-Speed Loop Route (\$)
<u>Cost to AMH</u>										
Ship Capital	321.6	260.1	281.4	256.9	256.9	281.4	270.3	270.3	273.9	273.9
Ship Operating	773.9	699.2	725.6	659.2	663.8	726.5	699.2	708.1	716.2	716.8
Port Capital	-	3.6	2.2	3.0	3.0	-	2.6	3.9	-	-
Port Operating	28.2	29.9	33.5	28.2	28.2	28.2	28.2	29.0	28.2	28.2
Less fare revenue	(539.8)	(482.6)	(519.8)	(509.6)	(509.6)	(524.5)	(524.8)	(524.2)	(533.7)	(533.7)
Net cost to AMHS	<u>\$583.9</u>	<u>\$510.2</u>	<u>\$522.9</u>	<u>\$437.7</u>	<u>\$442.3</u>	<u>\$511.6</u>	<u>\$475.5</u>	<u>\$487.1</u>	<u>\$484.6</u>	<u>\$485.2</u>
<u>Cost to Users</u>										
Fares	539.8	482.6	519.8	509.6	509.6	524.5	524.8	524.2	533.7	533.7
Vehicle Operating Cost	1.5	25.5	10.2	4.2	5.4	5.7	3.7	3.6	1.6	1.6
Total Cost to User	<u>\$541.3</u>	<u>\$508.1</u>	<u>\$530.0</u>	<u>\$513.8</u>	<u>\$515.0</u>	<u>\$530.2</u>	<u>\$528.5</u>	<u>\$527.8</u>	<u>\$535.3</u>	<u>\$535.3</u>
<u>Cost to State</u>										
AMH Deficit	583.9	510.2	522.9	437.7	442.3	511.6	475.5	487.1	484.6	485.2
Road Capital	-	176.7	1.6	121.5	107.1	-	14.6	42.2	-	-
Road Operating	-	15.8	6.4	10.5	5.0	-	1.9	6.8	-	-
Total	<u>\$583.9</u>	<u>\$702.7</u>	<u>\$530.9</u>	<u>\$569.7</u>	<u>\$554.4</u>	<u>\$511.6</u>	<u>\$492.0</u>	<u>\$536.1</u>	<u>\$484.6</u>	<u>\$485.2</u>
PAX not served ('000)	12.5	31.1	13.0	90.7	90.7	13.0	46.1	46.1	22.7	22.7

5.3.2 - Service Cost Effectiveness

As noted in the methodology section, however, the financial analysis does not provide an assessment of the full impacts of the different levels of traffic served, nor does it provide a measure of the quality of service being offered under the different system options.

Accordingly, a supplemental analysis was carried out whereby user costs were adjusted to take into account the different degrees of service being provided, and a travel time assessment was developed to provide a measure of service quality.

The adjusted differences between each option and the base case (June 1980 Plan) were then calculated in terms of user costs and user costs plus travel time. The values of these 'impacts' were then compared with the increases or decreases in government cost under each option relative to the base case.

The comparative monetary impacts of the various long-term options are given in Table 5.3 for the 'meet demand' scenarios and in Table 5.4 for the 'reduced investment' scenarios.

The figures in Table 5.3 indicate that, based on quantifiable monetary impacts, three of the Prince of Wales options (Tolstoi Bay terminal and the two high-speed craft options) are more attractive than the June 1980 Plan from both the user and government perspectives. The two Lynn options, the Sitka shuttle and the three Stikine options provide some monetary savings to users, but these savings are less than the corresponding increases in government costs. The remaining three options are less attractive to both users and the state from the monetary viewpoint (although service advantages may serve to offset some of these costs).

Turning to Table 5.4 which presents the analysis of 'reduced investment' scenarios, it is apparent that, by allowing a slackening of the efforts to meet demand at the southern termini, the government can realize substantial savings at very little monetary cost to the user. In the 'reduced

TABLE 5.3

LONG-TERM SYSTEM OPTIONS -
 'MEET DEMAND' SCENARIOS
 ANALYSIS OF MONETARY IMPACTS

<u>Option</u>	<u>Change in User Costs¹⁾²⁾ (\$millions)</u>	<u>Change in Government Costs¹⁾²⁾ (\$millions)</u>	<u>Comments</u>
<u>LYNN</u>			
- Road	-73.6	+189.0	Users save \$0.39 per dollar of added state cost
- Shuttle	- 9.1	+ 35.3	Users save \$0.26 per dollar of added state cost
<u>SITKA</u>			
- Baranof	+ 1.2	+ 58.8	Less attractive to both users and state
- Rodman	+ 2.4	+ 42.7	Less attractive to both users and state
- Shuttle	- 0.1	+ 16.5	Users save \$0.01 per dollar of added state cost
<u>PRINCE OF WALES</u>			
- Tolstoi Bay	+ 0.2	- 9.9	Government saves \$49.50 per dollar of added user cost
- Red Bay	+ 0.1	+ 34.3	Less attractive to both users and state
- Shuttle	- 0.4	- 13.5	More attractive to both users and state
- Loop	- 0.4	- 12.9	More attractive to both users and state
<u>STIKINE</u>			
- Wrangell Road	- 3.5	+ 56.6	Users save \$0.06 per dollar of added state cost - does not meet demand
- Petersburg Road	- 3.1	+ 23.3	Users save \$0.13 per dollar of added state cost - does not meet demand
- Wrangell/ Ketchikan Road	-18.6 ³⁾	+194.2	Users save \$0.10 per dollar of added state cost - does not meet demand

1) As compared with 'Mainline Service Option - June 1980 Plan'.

2) Net present value - 20-year total.

3) Assuming existing pattern of demand.

TABLE 5.4

LONG-TERM SYSTEM OPTIONS -
 'REDUCED INVESTMENT' SCENARIOS
 ANALYSIS OF MONETARY IMPACTS

<u>Option</u>	<u>Change in User Costs¹⁾²⁾ (\$millions)</u>	<u>Change in Government Costs¹⁾²⁾ (\$millions)</u>	<u>Comments</u>
<u>LYNN</u>			
- Road	-73.1	+118.8	Users save \$0.62 per dollar of added government costs
- Shuttle	- 9.1	- 53.0	More attractive to both users and state
<u>SITKA</u>			
- Baranof	+ 3.6	- 14.2	Government saves \$3.9 per dollar of added user cost
- Rodman	+ 4.8	- 29.5	Government saves \$6.15 per dollar of added user cost
- Shuttle	-	- 72.3	Government saves, users indifferent between options
<u>PRINCE OF WALES</u>			
- Tolstoi Bay	+ 1.1	- 91.9	Government saves \$83.55 per dollar of added user cost
- Red Bay	+ 1.0	- 47.8	Government saves \$47.80 per dollar of added user cost
- Shuttle	+ 0.2	- 99.3	Government saves \$496.50 per dollar of added user cost
- Loop	+ 0.2	- 98.7	Government saves \$493.50 per dollar of added user cost

1) As compared with 'Mainline Service Option - June 1980 Plan'.

2) Net present value - 20-year total.

investment' scenarios, all options except the Lynn road offer government cost savings which more than exceed increases in user costs. In one instance, the Lynn shuttle, both government and users are better off financially than under the June 1980 Plan, while in a second instance, the Sitka shuttle case, user costs are the same as under the June 1980 Plan, but government costs are substantially lower. It would therefore appear that, in terms of monetary impacts on users and the State, it is possible to achieve substantial savings by meeting combined southern termini demand rather than by attempting to serve all of the demand generated at Seattle.

(It should be reiterated, however, that this hypothesis does not apply in the extreme case where all of the Seattle demand is served out of Prince Rupert. As indicated in the short-term 'Prince Rupert Terminus' option the Marine Highway is better off providing some service to Seattle in view of the higher revenue-earning capability of vessels on the Seattle route.)

The final step in the analysis was to integrate savings or increases in travel time into the comparison of user and government impacts. These changes in user travel time relative to the 'June 1980 Plan' option are shown, for the 'meet demand' scenarios, in the first column of Table 5.5. (Total travel time impacts were not calculated for the Wrangell-Ketchikan Road option since it was felt that the probable future pattern of demand would change in response to the significant service changes and that comparison, based on existing demand patterns, would be misleading.)

The table indicates that, on a system-wide basis, several of the system options generate travel time savings over and above those realized under the 'June 1980 Plan' option. The most significant savings arise under the two Lynn options, and in the Sitka shuttle case. Lesser travel time savings accrue under the four Prince of Wales service options, while the two Sitka road options and the Stikine corridor cases lead to overall increases in total system travel time.

The flow of these travel time impacts, however, is not uniform among the options. An assessment was carried out with regard to the distribution of time savings among the various system users which calculated the portion of

TABLE 5.5

LONG-TERM SYSTEM OPTIONS - 'MEET DEMAND' SCENARIOS
USER TRAVEL TIME IMPACTS AND REQUIRED VALUE OF TIME

<u>Option</u>	<u>Change in 1) Travel Time</u> (million hours)	<u>Required Total Time 2) Value</u> (\$millions)	<u>Required Hourly Time Value</u> (\$/h)
<u>LYNN</u>			
- Road	-15.3	115.4	> 7.54
- Shuttle	- 5.8	26.2	> 4.52
<u>SITKA</u>			
- Baranof	+ 0.2	60.0	negative
- Rodman	+ 0.6	45.1	negative
- Shuttle	- 4.0	16.4	> 4.10
<u>PRINCE OF WALES</u>			
- Tolstoi Bay	- 0.9	(9.7)	∅
- Red Bay	- 0.6	34.4	> 7.33
- Shuttle	- 2.4	(13.9)	∅
- Loop	- 0.7	(13.3)	∅
<u>STIKINE</u>			
- Wrangell Road	+ 1.9	53.1	negative
- Petersburg Road	+ 1.9	20.2	negative

1) Relative to 'June 1980 Plan' option.

2) Net total of user and government cost increases - brackets denote net cost savings.

total time savings (or increases) accruing to peak season traffic out of the southern termini versus the portion accruing to peak season internal traffic and to shoulder and low-season users.

The findings indicated a wide variance among options in the distribution of travel time impacts. In the Lynn road case, 79% of the travel time savings were 'internal'; i.e. accrued to peak internal traffic and to shoulder and low-season users, while 21% accrued at the southern termini. In the Lynn shuttle case, however, only 21% of the savings were realized internally; the balance accrued to traffic out of Seattle and Prince Rupert.

In the Sitka cases, the Baranof road option led to an increase in total system travel time of 0.2 million hours; however, 'internal users' realized net savings of 0.2 million hours while traffic out of the southern termini incurred losses of 0.4 million hours. In the Rodman Bay case, total system impacts represented an increase of 0.6 million hours in travel time, of which 33% (or a 0.2 million hour increase) accrued to internal users. In the Sitka shuttle case, however, 85% of travel time savings accrued internally.

In the Prince of Wales cases, the two new terminal options (Tolstoi Bay and Red Bay) resulted in relatively small system-wide travel savings. Approximately 90% of these savings accrued internally. In the high-speed shuttle option, approximately one-third of the benefits accrued internally (which, in terms of hours, is roughly equivalent to the internal time savings accruing under the new terminal options). In the high-speed loop option, however, virtually all of the 0.7 million hours saved accrued to traffic to and from the southern termini.

Finally, in the case of the two Stikine options, it was found that although system-wide time impacts represented an increase in total travel time of 1.9 million hours, this consisted of an increase of 2.5 million hours to peak traffic out of the southern termini, and a saving of 0.6 million hours to peak internal and shoulder and low season users.

Table 5.5 also shows the required value which would have to be assigned to travel time impacts (both in total and on an hourly basis) in order to offset the net monetary impacts of the system options. As described earlier, this represents an 'imputed value' approach to determining travel time value and provides a basis for subjective judgement as to whether total marginal benefits are likely to outweigh marginal costs.

The results of the travel time analysis suggest that under the 'meet demand' scenarios, three Prince of Wales options present definite advantages to both system users and the state government as compared with the June 1980 Plan. These are the Tolstoi Bay terminal and the two high-speed ferry options. In addition to providing net monetary savings (as described in Table 5.3), these options also generate savings in total system travel time over the planning period. Hence, no positive value needs to be assigned to the travel time savings in order for marginal benefits to offset marginal costs.

(If one were to assign a negative value to travel time savings, then these scenarios could theoretically appear less attractive. A negative time value would imply, however, that travellers found time savings to be a disadvantage and were deterred from using the system as a result of the improved travel times. While this may be arguable in a general sense, that is with reference, for example, to a tourist's preference for a leisurely trip, it was felt that within the range of time savings being considered for the system it was more likely that users would assign either zero value or some positive value to travel time savings.)

On the premise that travel time savings have some positive value, three other options also show potential advantages over the June 1980 Plan: the Sitka shuttle, the Lynn shuttle, and the Lynn road. Under the two shuttle cases, users would have to assign a value in excess of \$4.10 and \$4.52 per hour respectively to the travel time savings in order to equalize system benefits with costs while under the Lynn road option, users would have to assign a value above \$7.54 per hour to travel time.

In the remaining options, it is unlikely that the total benefits relative to the base case would outweigh the total costs. Travel time savings under the Red Bay option would only offset the monetary cost increases when the value of travel time savings exceeded \$57.33 per hour. In the other options (the Sitka road cases and the Stikine corridor options), both travel time and monetary cost would increase on a system-wide basis, and time savings would have to have a negative value in order to offset cost increases.

Table 5.6 presents the same type of analysis for the 'reduced investment' scenarios. As expected, in view of the smaller number of mainline vessels and hence lower service frequency, the travel time savings are less than under the 'meet demand' scenarios. Only two options, the Lynn road and the Sitka shuttle, show system-wide travel times which are lower than under the June 1980 Plan 'meet demand' scenario. The remaining options all lead to varying levels of increase in total user travel time.

In most cases, however, these travel time increases are offset by net savings in monetary costs (as described in Table 5.4). Only the Lynn road option leads to higher net monetary costs than in the base case.

Comparison of the travel time impacts and the monetary costs (required total time value) in Table 5.6 indicates that one option, the Sitka shuttle, shows definite advantages over the June 1980 Plan. This option yields a slight (0.7 million hours) decrease in total system travel time and provides a substantial net monetary saving relative to the base case. In addition, the Lynn shuttle and Prince of Wales shuttle also appear likely to be viable. In these cases, substantial cost savings are offset by small increases in travel time. These travel time increases would not outweigh the monetary benefits, however, as long as the value of these time increases is assumed to be less than \$310.50 per hour (for the Lynn shuttle), or less than \$247.75 per hour for the Prince of Wales shuttle case.

The remaining options, though still potentially viable, are less attractive than the above three cases since all result in either higher travel time increases and/or lower monetary savings. Among these options, the three remaining Prince of Wales cases are most likely to prove beneficial,