

**PRINCE WILLIAM SOUND/COPPER RIVER AREA
TRANSPORTATION PLAN**

**FERRY ALTERNATIVES REVENUE
ANALYSIS
TECHNICAL MEMORANDUM**

DRAFT

prepared for the

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INTRODUCTION

This memorandum has been prepared by Northern Economics, Inc. to address three interrelated issues regarding the proposed alternatives for ferry service in the Prince William Sound/Copper River (PWS/CR) Area Transportation Plan:

- Will the alternatives be able to generate required operating revenues?
- Can AMHS meet its revenue goals with lower fares on the proposed alternatives?
- Which alternative is likely to generate the highest ridership?

These issues are discussed along with the alternatives, methodology, and conclusions in Sections 1 through 6 of this memorandum.

ORGANIZATION

- Section 1: Three alternatives to the current AMHS ferry system in the PWS/CR region have been developed and proposed for the PWS/CR Area Transportation Plan. These alternatives are described in this section.
- Section 2: In order to understand the impacts of new marine service alternative, it is first necessary to thoroughly understand the existing system. Ferry service and traffic in 1997 represents the base case against which alternative systems will be compared in Section 2. As such, this section documents 1997 AMHS service and provides traffic and revenue estimates.

To determine whether the alternatives will be able to generate revenues to cover 60 percent of AMHS operating costs, Northern Economics used three independent sets of evidence:

- 1) projections from population and tourism growth combined with additional travel to the PWS/CR region resulting from Whittier tunnel operations;
- 2) surveys of PWS/CR residents;
- 3) results derived from the application of a ferry service index model.

The following sections in this memorandum highlight each of these analysis techniques.

- Section 3: This section summarizes the level of ferry traffic that could be expected in the PWS/CR region in the years 2005 and 2020 if traffic (as observed in 1997) were permitted to grow along with population and visitation to the PWS/CR area.
- Section 4: This section summarizes a survey of residents in Valdez and Cordova to determine how area residents would respond to the proposed alternatives and to various ticket price levels.
- Section 5: This section describes the expansion and adaptation of a service index (SI) and service index elasticity (SIE) model that was originally developed for analysis of ferry alternatives in Lynn Canal. This expanded, adapted model is used herein to quantify service improvements and to provide projections of ridership on ferry alternatives developed as part of the PWS/CR Area Transportation Plan.
- Section 6: This section details conclusions drawn from the analysis with specific focus on the three interrelated issues that form the core of the inquiry: (1) whether the alternatives will be able to generate required operating revenues; (2) whether AMHS will be able to meet its revenue needs with lower fares on the proposed alternatives; and (3) which of the three alternatives is likely to generate the highest ridership level.

1. DESCRIPTION OF THE PROPOSED ALTERNATIVES

Three alternatives to the current AMHS ferry system in the PWS/CR region have been developed and proposed for the PWS/CR Area Transportation Plan. Each alternative would use two ferries during the peak season—defined as the 105-day period between Memorial Day and Labor Day. Each of the alternatives employs at least one high-speed ferry, and all offer identical service during the off-season. The alternatives differ in the specifications of the second peak-season vessel, and in the routing and scheduling of ferries during the peak season.

All three alternatives appear to offer vastly superior service to the PWS/CR region when compared with the current system – the number of peak-season port calls would increase by 250 percent, while the number of vehicles the ferries can move during the peak season would increase by more than 300 percent. During the off-season the number of port calls and total vehicle capacity under the alternatives would increase by 175 percent compared to current service. In addition to increasing the number of trips and passenger and vehicle capacity, each of the alternatives would also increase the convenience of service. Each of the alternatives would operate with all sailings occurring during a 12-hour period (for example, from 7 a.m. to 7 p.m.). Finally, the alternatives would improve service by reducing the average travel time between ports – the high-speed ferries travel at least twice as fast as the existing ferries.

The alternatives were designed such that their operating costs will be less than or equal to operating costs under the current system. Operating costs under existing service are estimated at \$6.3 million per year. Currently AMHS is required to cover 60 percent of its operating costs with revenues – 40 percent of operating costs are supplied by government subsidies. If a service can generate the required 60 percent of its operating cost from revenue, it is “breaking even” from the perspective of AMHS. The primary objective of this analysis is to determine whether the alternatives can cover 60 percent of their operating costs. Given that all alternatives offer significant improvements in service with fewer operating costs, the prospects for meeting the 60 percent revenue requirement are much higher than under the current system.

SPECIFICATIONS FOR ALTERNATIVES

The preferred alternatives for the peak season for this project can be summarized as follows:

1. **Alternative 1A:** Current service (no change). This alternative comprises service by the *M/V Bartlett* and *M/V Tustumena* on a schedule similar to that of 1997. Acquisition (capital) costs considered for this alternative are the capital improvements identified for the *Bartlett* and the *Tustumena* to occur between the years 2000 and 2020. Because the *Tustumena* operates in the PWS/CR region only about 27.5 percent of the time, the capital costs for the *Tustumena* have been pro-rated to the PWS/CR area, and operating expenses are only those incurred in serving the PWS/CR region.
2. **Alternative 2F:** One high-speed ferry (a clone of new ferries developed for the Southeast Alaska Transportation Plan) operating in Valdez-Whittier (V-W), with dedicated port service during summer (two round-trips per day) and one high-powered conventional vessel operating in Cordova-Valdez (C-V), with dedicated port service in summer (one round-trip per day).
3. **Alternative 2G:** Two high-speed ferries operating, with one in a dedicated port service between Valdez and Whittier (V-W) (two round-trips per day during the high season) and the other in an alternating loop/counter-loop service for Cordova-Whittier-Valdez-Cordova

(C–W–V–C/C–V–W–C), with one full circuit per service day, operating approximately 5 out of 7 days a week.

4. **Alternative 2H:** Two high-speed ferries (clones of the new ferries developed for the Southeast Alaska Transportation Plan), one operating in daily C–W–V–C loop service and the other in daily C–V–W–C counter-loop service during the peak season.

Each alternative has the same off-season service. One FVF would provide alternating C–W–V–C and C–V–W–C loop and counter-loop service (one circuit per service day), operating approximately 5 out of 7 days a week.

In the course of assessing the alternatives, it was determined that Alternative 2G should be revised so that the high-speed ferry running the loop and counter-loop service would operate every day during the 105-day peak season. This change makes Alternatives 2G and 2H more directly comparable. The change also increases annual operating costs for Alternative 2G from \$5.6 million to \$6.1 million, still \$0.2 million less than the estimated operating cost of the existing service (Alternative 1a). Table 1 summarizes the alternatives and estimated costs for the peak season.

Table 1
Description of Prince William Sound Ferry Alternatives
for the Peak Season

Description of Alternative During Peak Season from Memorial to Labor Day	Vessel	Speed (Knots)	Cost (\$Millions)		
			Single Vessel Acquisition	Total Vessel Acquisition	Annual Operat- ing
Alternative 1a: Existing Service	<i>Bartlett</i>	12.0	27.3	38.0	6.3
	<i>Tustumena</i>	13.3	10.7		
Alternative 2F: Dedicated service for both Valdez and Cordova	New High-Speed Ferry	32.3	34.4	53.8	5.5
	New High-Power Ferry	15.2	19.4		
Alternative 2G: Dedicated service for Valdez, loop service for Cordova	New High-Speed Ferry	32.3	34.4	68.8	6.1
	New High-Speed Ferry	30.8	34.4		
Alternative 2H: Daily loop and counter-loop service originating at Cordova	New High-Speed Ferry	30.8	34.4	68.8	6.1
	New High-Speed Ferry	30.8	34.4		

Note: Off-season service provisions during the off-season under alternatives 2F, 2G, and 2H are identical. One high-speed ferry operating at 30.3 knots would provide loop and counter-loop originating from Cordova 5 out of 7 days.

Table 2-Table 4 show average travel times between origin-destination pairs (O-D pairs) under the alternatives during the peak season. Table 5 shows average travel times during the off-season. (The off-season system is identical for each alternative.) The only real difference among the alternatives in terms of travel times is in Alternative 2F. Travel times to and from Cordova during the peak season are almost twice as long under Alternative 2F than under the other peak season alternatives. Furthermore, under Alternative 2F, it would take almost twice as long to travel to and from Cordova during the peak season than during the off-season. In addition, the ferry used to

service Cordova under Alternative 2F is 20 percent faster than either the *Bartlett* or the *Tustumena*.

Table 6-8 show the number of trips between O-D pairs under the alternatives during the peak season. Table 9 shows the number of trips during the off-season. The number of trips between O-D pairs during the peak season, perhaps more than any other measure, demonstrates the differences among the alternatives. Alternative 2G provides more trips between Valdez and Whittier than do the other alternatives. Alternative 2H provides more trips between Cordova and Whittier than the other alternatives, but 50 fewer trips between Valdez and Whittier. Compared with the current system, the number of total trips under the alternatives would increase by 250 percent during the peak season and by 175 percent during the off-season.

**Table 2
Alternative 2F Peak-Season Travel Times**

Port of Origin	Destination Port (Average trip time in hours)		
	Valdez	Cordova	Whittier
Valdez		6.0	3.5
Cordova	6.0		11.2
Whittier	3.5	11.2	

Notes:

1. Travel times include 1/2-hour pre-boarding wait time, 15-minute embarkation and disembarkation time at each port call, and 3 minutes for speeding up and slowing down.
2. Travel times between Cordova and Whittier reflect the weighted average of direct sailings and sailings that stop in Valdez.

**Table 4
Alternative 2H Peak-Season Travel Times**

Port of Origin	Destination Port (Average trip time in hours)		
	Valdez	Cordova	Whittier
Valdez		3.5	3.6
Cordova	3.5		5.4
Whittier	3.6	5.4	

Notes:

1. Travel times include 1/2-hour pre-boarding wait time, 15-minute embarkation and disembarkation time at each port call, and 3 minutes for speeding up and slowing down.
2. Travel times between Cordova and Whittier reflect the weighted average of direct sailings and sailings that stop in Valdez.

**Table 3
Alternative 2G Peak-Season Travel Times**

Port of Origin	Destination Port (Average trip time in hours)		
	Valdez	Cordova	Whittier
Valdez		3.5	3.5
Cordova	3.5		5.4
Whittier	3.5	5.4	

Notes:

1. Travel times include 1/2-hour pre-boarding wait time, 15-minute embarkation and disembarkation time at each port call, and 3 minutes for speeding up and slowing down.
2. Travel times between Cordova and Whittier reflect the weighted average of direct sailings and sailings that stop in Valdez.

**Table 5
Off-Season Travel Times, All Alternatives**

Port of Origin	Destination Port (Average trip time in hours)		
	Valdez	Cordova	Whittier
Valdez		3.5	3.6
Cordova	3.5		5.4
Whittier	3.6	5.4	

Notes:

1. Off-season service is identical under all three alternatives.
2. Travel times include 1/2-hour pre-boarding wait time, 15-minute embarkation and disembarkation time at each port call, and 3 minutes for speeding up and slowing down.
3. Travel times between Cordova and Whittier reflect the weighted average of direct sailings and sailings that stop in Valdez.

Table 6
Alternative 2F Peak-Season Trips

Port of Origin	Destination Port (Number of trips during the season)		
	Valdez	Cordova	Whittier
Valdez		105	210
Cordova	105		105
Whittier	210	105	

Table 7
Alternative 2G Peak-Season Trips

Port of Origin	Destination Port (Number of trips during the season)		
	Valdez	Cordova	Whittier
Valdez		53	263
Cordova	53		105
Whittier	263	105	

Table 8
Alternative 2H Peak-Season Trips

Port of Origin	Destination Port (Number of trips during the season)		
	Valdez	Cordova	Whittier
Valdez		105	105
Cordova	105		210
Whittier	105	210	

Table 9
Off-Season Trips, All Alternatives

Port of Origin	Destination Port (Number of trips during the season)		
	Valdez	Cordova	Whittier
Valdez		93	93
Cordova	93		186
Whittier	93	186	

Note: Off-season service is identical under all three alternatives.

2. 1997 FERRY TRAFFIC AND REVENUE

This section summarizes 1997 ferry service in the PWS/CR region. Based on estimates of operating costs as part of this project, and passenger and vehicle traffic counts from AMHS, 1997 ferry service in the PWS/CR region recouped only 35 percent of total operating costs. AMHS ferries are expected by the state to generate enough revenue to cover 60 percent of operating costs, with the remaining 40 percent covered by transportation subsidies. For PWS/CR ferry service to generate enough revenues to cover 60 percent of operating costs, passenger and vehicle traffic will need to increase by 70 percent (assuming current ticket prices). Unfortunately, PWS/CR ferry service in 1997 was operating at or near capacity during the 105-day peak season between Memorial Day and Labor Day. To generate more revenue, higher passenger and vehicle volumes would need to be generated in the off-season when tourists in the area few and when service to Whittier is cut. Alternatively, AMHS could raise prices during the peak season. However, this would be very unpopular with residents.

The PWS/CR Area Transportation Plan proposes alternatives to existing ferry service. To understand the alternatives' impacts it is necessary to have a thorough understanding of existing system. Ferry service and traffic in 1997 represents the base case against which alternative systems will be compared. This section documents AMHS service that occurred in 1997, and provides estimates of traffic and revenue.¹

In 1997, ferry service in the PWS/CR region was provided by two AMHS vessels: the *Bartlett* and the *Tustumena*. The *Bartlett* is 193 feet long, with capacity for 29 vehicles (20' lengths), and 190 passengers. She operates at a service speed of 13.6 knots. The *Bartlett* is currently based in Cordova, and between February and September 1997 made 299 sailings between Cordova, Valdez, and Whittier. Whistle-stop service is also provided to Tatitlek.

The *Tustumena* is 296 feet long, with capacity for 36 vehicles (20-foot lengths) and 210 passengers. She operates at a service speed of 13.5 knots. The *Tustumena* operates exclusively between Homer, Kodiak, and Unalaska between April and August, but makes trips into the PWS/CR region providing service between Seward, Cordova, and Valdez in the winter and fall. The *Tustumena* also provides whistle stop service to Chenega Bay. In January, October, November, and December, the *Tustumena* is the only ferry operating in the PWS/CR region.

Table 10 and Table 11 show the number of passengers and vehicles that rode the *Bartlett* and the *Tustumena* in 1997. AMHS ferry services in the PWS/CR region during 1997 generated a total of 30,044 passenger trips and 8,738 vehicle trips. The tables do not include the 351 passenger trips and 63 vehicles that embarked or disembarked at Tatitlek and Chenega Bay.

¹ The data are taken from the 1997 *Traffic Volume Report* prepared by AMHS. The 1997 *Traffic Volume Report* can be found on the Internet at <http://www.dot.state.ak.us/external/amhs/info/general/stats/97tvr/index.html>.

**Table 10
PWS/CR AMHS Passengers, 1997**

Port of Origin	Port of Destination				1997 Total
	Valdez	Cordova	Whittier	Seward	
Valdez		4,291	8,763	1,051	14,105
Cordova	4,359		920	95	5,374
Whittier	8,265	1,128			9,393
Seward	1,077	95			1,172
PWS/CR Total	13,701	5,514	9,683	1,146	30,044

**Table 11
PWS/CR AMHS Vehicles, 1997**

Port of Origin	Port of Destination				1997 Total
	Valdez	Cordova	Whittier	Seward	
Valdez		1,376	2,357	323	4,056
Cordova	1,298		286	120	1,704
Whittier	2,178	345			2,523
Seward	347	108			455
PWS/CR Total	3,823	1,829	2,643	443	8,738

Source: Traffic data contained or implied in Tables 1 through 12 are based on information in the 1997 Traffic Volume Report prepared by AMHS and available on the Internet at <http://www.dot.state.ak.us/external/amhs/info/general/stats/97tvr/index.html>.

The alternatives proposed in the PWS/CR Area Transportation Plan would eliminate service between Seward and Valdez, and Cordova. Based on information from surveys of PWS/CR residents, travel to Seward is an alternative to travel to Whittier – in both cases the final destination is likely to be Anchorage or the Kenai Peninsula. Therefore, the remainder of this analysis adjusts the 1997 traffic by moving traffic to and from Seward to Whittier. Table 12 and Table 13 show the adjusted passenger and vehicle traffic in the PWS/CR region after removing Seward from the tables. Table 14 and Table 15 show the estimated passenger and vehicle traffic in the PWS/CR region during the 105-day peak season between Memorial Day and Labor Day. Table 16 and Table 17 show the estimated passenger and vehicle traffic in the PWS/CR region during the off-season. The peak season in 1997 accounted for approximately 67 percent of the passenger traffic and 64 percent of vehicle traffic.

**Table 12
Adjusted PWS/CR AMHS Passengers, 1997**

Port of Origin	Destination Port			1997 Total
	Valdez	Cordova	Whittier	
Valdez		4,291	9,814	14,105
Cordova	4,359		1,015	5,374
Whittier	9,342	1,223		10,565
PWS/CR Total	13,701	5,514	10,829	30,044

Note: PWS/CR travel to and from Seward has been added to Whittier

**Table 13
Adjusted PWS/CR AMHS Vehicles, 1997**

Port of Origin	Destination Port			1997 Total
	Valdez	Cordova	Whittier	
Valdez		1,376	2,680	4,056
Cordova	1,298		406	1,704
Whittier	2,525	453		2,978
PWS/CR Total	3,823	1,829	3,086	8,738

Note: PWS/CR travel to and from Seward has been added to Whittier.

Table 14
Adjusted PWS/CR AMHS Peak-Season
Passengers, 1997

Port of Origin	Destination Port			Peak Season Total
	Valdez	Cordova	Whittier	
Valdez		2,855	6,529	9,384
Cordova	2,900		675	3,575
Whittier	6,215	814		7,029
PWS/CR Total	9,115	3,668	7,204	19,988

Note: PWS/CR travel to and from Seward has been added to Whittier.

Table 15
Adjusted PWS/CR AMHS Peak-Season Vehi-
cles, 1997

Port of Origin	Destination Port			Peak Season Total
	Valdez	Cordova	Whittier	
Valdez		880	1,715	2,595
Cordova	830		260	1,090
Whittier	1,615	290		1,905
PWS/CR Total	2,446	1,170	1,974	5,590

Note: PWS/CR travel to and from Seward has been added to Whittier.

Table 16
Adjusted PWS/CR AMHS Off-Season
Passengers, 1997

Port of Origin	Destination Port			Off-Season Total
	Valdez	Cordova	Whittier	
Valdez		1,436	3,285	4,721
Cordova	1,459		340	1,799
Whittier	3,127	409		3,536
PWS/CR Total	4,586	1,846	3,625	10,056

Note: PWS/CR travel to and from Seward has been added to Whittier.

Table 17
Adjusted PWS/CR AMHS Off-Season Vehi-
cles, 1997

Port of Origin	Destination Port			Off-Season Total
	Valdez	Cordova	Whittier	
Valdez		496	965	1,461
Cordova	468		146	614
Whittier	910	163		1,073
PWS/CR Total	1,377	659	1,112	3,148

Note: PWS/CR travel to and from Seward has been added to Whittier.

Passenger and vehicle tariffs listed on the AMHS Internet site were applied to 1997 traffic to estimate 1997 revenues for AMHS service in the PWS/CR region. The 19-foot vehicle tariff was used for all vehicles, and the standard adult fare was applied to all passengers. No adjustments were made for off-season discounts for drivers or other passenger discounts. Table 18 shows total revenue for 1997. Table 19 shows the estimated revenue for the 1997 peak season.

Table 18
Adjusted PWS/CR AMHS Revenue, 1997

Port of Origin	Destination Port			1997 Total
	Valdez	Cordova	Whittier	
Valdez		233,306	797,012	1,030,318
Cordova	229,418		93,380	322,798
Whittier	756,461	109,439		865,900
PWS/CR Total	985,879	342,745	890,392	2,219,016

Notes:

1. Revenue involving PWS/CR travel to and from Seward has been added to Whittier totals.
2. The standard adult fare was used for all passengers
3. The 19-foot vehicle tariff was used for all vehicles.

Table 19
Adjusted PWS/CR AMHS Peak Season Revenue, 1997

Port of Origin	Destination Port			Peak-Season Total
	Valdez	Cordova	Whittier	
Valdez		152,547	524,425	676,972
Cordova	150,111		61,244	211,355
Whittier	497,784	71,826		569,609
PWS/CR Total	647,895	224,372	585,669	1,457,937

Notes:

1. Revenue involving PWS/CR travel to and from Seward has been added to Whittier totals.
2. The standard adult fare was used for all passengers.
3. The 19-foot vehicle tariff was used for all vehicles.

Project operating costs estimated 1997 operating costs for PWS/CR ferry service were \$6.3 million. Therefore, ferry service in the PWS/CR region would have to generate revenues of \$3.78 million to cover 60 percent of operating costs. As such, passenger and vehicle volumes in the PWS/CR region need to increase by 70 percent if the system is to generate breakeven revenues. Table 20 and Table 21 show the passenger and vehicle volumes that would be necessary to generate this level of revenue.

Table 20
Current System (Required Revenue) Passengers

Port of Origin	Destination Port			Total
	Valdez	Cordova	Whittier	
Valdez		7,310	16,718	24,027
Cordova	7,425		1,729	9,154
Whittier	15,914	2,083		17,997
PWS/CR Total	23,339	9,393	18,447	51,179

Note: Required revenue passengers were calculated by multiplying all 1997 passengers by 170.3 percent. This estimate ignores the fact that the current system is constrained by capacity during the peak season.

Table 21
Current System (Required Revenue) Vehicles

Port of Origin	Destination Port			Total
	Valdez	Cordova	Whittier	
Valdez		2,344	4,565	6,909
Cordova	2,211		692	2,903
Whittier	4,301	772		5,073
PWS/CR Total	6,512	3,116	5,257	14,885

Note: Required revenue vehicles were calculated by multiplying all 1997 passengers by 170.3 percent. This estimate ignores the fact that the current system is constrained by capacity during the peak season.

3. GROWTH IN DEMAND FOR PRINCE WILLIAM SOUND FERRY TRAVEL, 1997-2020

This section summarizes the volume of ferry traffic that could be expected in the PWS/CR region in the years 2005 and 2020 if traffic (as observed in 1997) were permitted to grow commensurate with population and visitation to the PWS/CR area. Due to vessel size and sailing schedules, AMHS ferries in the PWS/CR region operate at capacity during the summer season and will continue to be capacity-constrained until new vessels are introduced or until service frequency is increased. This section shows the traffic volumes that could be reached if such changes allowed ridership to keep pace with growth in demand. Growth in ridership is expected to come from normal population growth, growth in tourism, and changes in travel patterns generated by the opening of the vehicle tunnel to Whittier from Portage.

The analysis described in this section concludes that if ferry traffic grows in proportion to conservative estimates of these important determinants of travel demand, then based on 1997 traffic, there would be nearly 52,000 ferry passengers in 2005 – volumes sufficient to cover 60 percent of operating costs (if operating costs are \$6.3 million or less).

The analysis does not imply that the existing system can generate sufficient revenues to cover 60 percent of operation costs by the year 2005. Under the existing ferry system there is no room for growth during the peak season, when much of the new demand would occur. Instead, the analysis of growth factors in this section implies that if additional capacity becomes available with the alternative ferry systems proposed in the PWS/CR Area Transportation Plan, then it is likely that the AMHS would be able to generate sufficient revenues. This conclusion assumes that the alternatives are no more expensive to operate than the existing system. Additionally, the growth factors discussed in this section do not include additional ferry traffic that might be generated because of the improved service levels that would occur with the alternatives. Additional traffic that may be induced because of improved service levels is considered in the Section 6 of this memorandum.

BACKGROUND

AMHS passenger data from 1997 show that the total number of passengers disembarking ferries in PWS/CR communities ranged from approximately 1,100 to almost 14,000 over an entire year, depending on the community. Table 22 shows the actual AMHS figures for embarking and disembarking passengers in the PWS/CR region in 1997.²

Summer months (including all of May and all of September) are also shown in Table 22. In Section 2 of this memorandum, which provides detail on 1997 ferry traffic volumes, the peak season is defined as the 105-day period between Memorial Day and Labor Day. The different definitions of summer and peak season account for the variation in the numbers in this section and the numbers in the Section 2.

This memorandum focuses on the major communities of the PWS/CR area since it is those communities that account for a majority of travel and that will be most affected by the proposed ferry system alternatives. (Taking into consideration other communities in South-central Alaska with ferry service, such as Kodiak and Homer, has a negligible affect on the total passenger num-

² These numbers are taken directly from the *1997 Traffic Volume Report* prepared by AMHS and available on the Internet at <http://www.dot.state.ak.us/external/amhs/info/general/stats/97tvr/index.html>.

bers shown in Table 22. There is some ferry traffic from Seward to Kodiak during the summer season. However, this route is not related to the alternatives being considered for the PWS/CR region.)

**Table 22
AMHS Ferry Passenger Traffic in Prince William Sound, 1997**

1997 Total Passenger Traffic						
		Destination Port				Total Embarking
		Valdez	Cordova	Whittier	Seward	
Port of Origin	Valdez		4,291	8,763	1,051	14,105
	Cordova	4,359		920	95	5,374
	Whittier	8,265	1,128		0	9,393
	Seward	1,077	95	0		1,172
Total Disembarking		13,701	5,514	9,683	1,146	30,044
Summer 1997—May through September						
		Destination Port				Total Embarking
		Valdez	Cordova	Whittier	Seward	
Port of Origin	Valdez		2,055	8,763	1,033	11,851
	Cordova	2,287		920	9	3,216
	Whittier	8,265	1,128		0	9,393
	Seward	1,055	19	0		1,074
Total Disembarking		11,607	3,202	9,683	1,042	25,534
Winter 1997—January through April and October through December						
		Destination Port				Total Embarking
		Valdez	Cordova	Whittier	Seward	
Port of Origin	Valdez		2236	NA	18	2,254
	Cordova	2072		NA	86	2,158
	Whittier	NA	NA		NA	NA
	Seward	22	76	NA		98
Total Disembarking		2,094	2,312	NA	104	4,510

NA = Not applicable; no ferry service to Whittier from January through April and from October through December

RESIDENT AND VISITOR SHARES

For this analysis, ferry passengers in the PWS/CR region were divided into two groups: residents of PWS/CR communities and visitors. Visitors include tourists from out-of-state, as well as residents of Anchorage and other parts of Alaska.

Northern Economics conducted a survey specifically for this project to determine the average number of trips residents of PWS/CR communities make within the Sound.³ In particular, Northern Economics asked about the number of ferry trips made to specific communities in the PWS/CR region. Earlier survey research showed the number of trips made by the same population using modes other than AMHS ferries (other modes included air taxi service, private boats,

³ Additional details concerning the February 2000 survey of Cordova residents and Valdez are in Section 5.

and others).⁴ Table 23 shows the results of this research and the split in ferry ridership between PWS/CR residents and visitors. The numbers of resident trips were taken directly from the survey results. The percentages of total trips represented by these survey numbers were subtracted from 100 percent to derive estimated percentages for visitors.

**Table 23
Percent of Ferry Ridership by Residents and Visitors**

Port of Origin	Percent of Total Ridership	
	Residents	Visitors
Summer		
Valdez	5.6	94.4
Cordova	55.8	54.2
Whittier	0.5	99.5
Seward	45.2	NA
Winter		
Valdez	44.5	55.5
Cordova	82.6	17.4
Whittier	NA	NA
Seward	93.4	^a

^a Surveys were not conducted in Seward.

NA = Not applicable; no ferry service to Whittier from January through April and from October through December.

Surveys were not conducted in Seward because the ferry alternatives considered in the PWS/CR Area Transportation Plan do not serve Seward directly. Still, passenger volumes to and from Seward need to be considered because they could affect the total passenger volume traveling in the PWS/CR area. Ferry travel in the PWS/CR region by Seward residents is expected to be small, with an average of 0.5 trips per household in summer (the same as in Valdez) and 0.1 trips per household in winter.

PROJECTED TRAFFIC LEVELS

Future traffic on AMHS ferries will depend on a variety of factors, including population, income, ferry ticket prices, and changes in service levels. This section presents forecasts that are based on expected growth rates in population (households) and visitor travel in the PWS/CR area, the influence of infrastructure changes such as the opening of the Whittier vehicle tunnel, and other factors. The effects of price changes and alternative ferry schedules are discussed separately.

Forecasts are presented first for residents and visitors, by season and port of origin. However, observed traffic patterns suggest that the number of passengers embarking ferries in the PWS/CR communities is roughly the same as the number of passengers disembarking in those communities. These forecasts have been refined to show total potential ridership by month, and then expected ridership as constrained by ferry capacity.

⁴ Northern Economics conducted a survey in October 1998 to help determine general travel patterns of PWS/CR residents (Parsons Brinckerhoff in association with Northern Economics. *Cordova, Chenega Bay, and Tatitlek Ferry Use Survey*. Prepared for the Alaska Department of Transportation and Public Facilities.)

Population Growth

The University of Alaska Anchorage Institute for Social and Economic Research (ISER) has prepared population forecasts for communities throughout Alaska. These forecasts were the basis of an earlier study in the PWS/CR Area Transportation Plan *Travel Demand Forecasts Technical Memorandum (Revised Draft)*, November 1999. Table 24 shows the average annual growth rates for the low, base, and high growth scenarios for the Cordova/Valdez area and for the Kenai Peninsula.

Table 24
Population Growth Rates

Area	Growth Rate (Percent)		
	Low Growth	Base Case	High Growth
Cordova/Valdez	0.7	1.23	2.26
Seward (Kenai Peninsula)	1.7	2.9	5.3

Source: Parsons Brinckerhoff, *Travel Demand Forecasts Technical Memorandum (Revised Draft)*, November 1999.

Visitors to PWS/CR

Table 25 shows the average annual growth rates used in that report for visitors, under the low, base, and high growth scenarios.

Table 25
Growth Rates in Number of Visitors to the Prince William Sound Area

Growth Rate (Percent)		
Low Growth	Base Case	High Growth
1.5	3.5	7.0

Source: Christopher Beck and Associates, *Prince William Sound/Copper River Area Tourism Growth Projection*, February 1999.

Infrastructure Changes – The Whittier Vehicle Tunnel

Table 26 shows the expected influence of the Whittier vehicle tunnel on ferry ridership in the PWS/CR area. The numbers in this table show the one-time jump in demand that is expected to occur with the opening of the tunnel in 2000.

Table 26
One-Time Increase in Ferry Traffic When Whittier Vehicle Tunnel Opens

Community	Number of Passengers by Growth Scenario		
	Low Growth	Base Case	High Growth
Valdez	10,000	20,000	30,000
Cordova	2,000	6,000	12,000
Whittier	10,000	20,000	30,000
Seward	None	None	None

Source: Christopher Beck and Associates, *Prince William Sound/Copper River Area Tourism Growth Projection*, February 1999.

Total Potential Ridership, by Season

Actual AMHS ridership will depend on vessel size and other factors. No attempt has been made here to account for such factors. The estimates shown in this subsection show the number of individuals that could be expected to use the ferry for travel in the PWS/CR area if space were available on the ferry. Estimates are based on current service levels and prices and represent simple projections based on recorded 1997 passenger volumes. Higher passenger volumes could be expected with improved service or lower prices.

Table 27–Table 29 show potential low, base, and high growth scenario passenger volumes based on the observed ridership in 1997, growth rates shown in Table 24 and Table 25, and the one-time “tunnel-effect” numbers in Table 26. Tunnel-effect numbers are partitioned by season and by passenger type – resident and visitor – according to the percentages shown in Table 23. That is, the relative portion of residents and visitors that comprise the one-time jump in demand with the opening of the tunnel is assumed to be the same as the relative portions observed in 1997, and to occur in 2000. Numbers in Table 27–

Table 29 do not reflect possible changes in ticket prices or service levels, and are not limited by ferry capacity.⁵

The one-time jump figures shown in Table 26 include some allowance for year-round ferry service in Whittier. The numbers in Tables 27–29 divide the one-time jump in demand (the tunnel effect) in Whittier between summer and winter, with 85 percent of the increase assumed to occur in summer and 15 percent assumed to occur in winter. This summer-winter split is the same as observed in Valdez. It is also assumed that the Whittier winter passengers comprise a source of unmet demand until winter ferry service is available in Whittier.

⁵ To the extent that demand for ferry service exceeded observed passenger volumes in 1997 (due to capacity constraints), the numbers in Table 27 - Table 29 are conservative, and more passengers could be expected to use the PWS/CR ferries, given the opportunity.

Table 27
Estimated Ferry Traffic: Low-Growth Scenario

Port of Origin	Number of Passengers					
	1997		2005		2010	
	Residents	Visitors	Residents	Visitors	Residents	Visitors
Summer						
Valdez	654	10,954	1,185	20,952	1,227	22,571
Cordova	1,786	1,416	2,559	2,149	2,650	2,315
Whittier	45	9,638	89	19,971	92	21,515
Seward	485	589	556	663	604	714
Total	2,970	22,597	4,389	43,735	4,573	47,115
Winter						
Valdez	915	1,179	1,659	2,255	1,718	2,430
Cordova	1,909	403	2,736	611	2,833	658
Whittier	No Service	No Service	7	1,608	8	1,733
Seward	97	7	111	8	121	8
Total	2,921	1,589	4,513	4,482	4,680	4,829
Total						
Annual Total	5,891	24,186	8,902	48,217	9,253	51,944

Table 28
Estimated Ferry Traffic: Base Case

Port of Origin	Number of Passengers					
	1997		2005		2010	
	Residents	Visitors	Residents	Visitors	Residents	Visitors
Summer						
Valdez	654	10,954	1,735	33,414	1,844	39,685
Cordova	1,786	1,416	4,035	3,696	4,289	4,389
Whittier	45	9,638	134	32,788	143	38,941
Seward	485	589	610	775	704	920
Total	2,970	22,597	6,514	70,673	6,980	83,935
Winter						
Valdez	915	1,179	2,429	3,597	2,582	4,272
Cordova	1,909	403	4,314	1,051	4,586	1,248
Whittier	No Service	No Service	15	3,546	16	4,212
Seward	97	7	122	9	141	11
Total	2,921	1,589	6,880	8,203	7,325	9,743
Total						
Annual Total	5,891	24,186	13,394	78,876	14,305	93,678

Table 29
Estimated Ferry Traffic: High-Growth Scenario

Port of Origin	Number of Passengers					
	1997		2005		2010	
	Residents	Visitors	Residents	Visitors	Residents	Visitors
Summer						
Valdez	654	10,954	2,382	52,459	2,663	73,576
Cordova	1,786	1,416	6,481	6,757	7,247	9,477
Whittier	45	9,638	187	52,158	209	73,154
Seward	485	589	734	1,011	950	1,418
Total	2,970	22,597	9,784	112,385	11,069	157,625
Winter						
Valdez	915	1,179	3,334	5,647	3,728	7,920
Cordova	1,909	403	6,930	1,921	7,749	2,694
Whittier	No Service	No Service	24	6,282	26	8,811
Seward	97	7	147	12	190	17
Total	2,921	1,589	10,435	13,862	11,693	19,442
Total						
Annual Total	5,891	24,186	20,219	126,247	22,762	177,067

Total Potential Ridership, by Month

Table 30 shows distribution of ridership by month, based on observed traffic patterns.⁶ Calculations showed that passenger volumes in recent years have been capacity-constrained (vessels have been operating at capacity) during the summer season. The distribution by month to some extent reflects vessel capacity and sailing schedules; as such, it does not necessarily reflect monthly demand. Under the current system, vessels operate at capacity during June, July, and August, and relatively less service is offered during winter.

⁶ Numbers in Table 30 were taken from the *Travel Demand Forecasts Technical Memorandum* (prepared by Parsons Brinckerhoff for the Prince William Sound/Copper River Area Transportation Plan) and based on ridership data from AMHS.

Table 30
Distribution of Passengers by Month and Port of Origin

Month	Percent of Annual Passenger Traffic			
	Valdez	Cordova	Whittier	Seward
January	2.10	5.55	1.9	1.00
February	2.10	4.95	1.85	1.00
March	3.00	7.80	2.55	1.00
April	3.00	6.95	2.45	1.15
May	7.60	10.30	7.80	7.90
June	19.40	11.95	20.00	18.40
July	26.15	14.70	26.75	26.50
August	23.50	14.85	24.25	21.10
September	7.55	8.30	7.20	9.95
October	2.40	5.85	2.10	5.80
November	1.60	4.30	1.55	3.45
December	1.60	4.50	1.60	2.75

Source: Parsons Brinckerhoff, *Travel Demand Forecasts Technical Memorandum(Revised Draft)*, November 1999.

Note: The distribution by month to some extent reflects vessel capacity and sailing schedules and do not necessarily reflect monthly demand. Under the current system vessels operate at capacity during June, July, and August, and relatively less service is offered during winter.

Baseline Figures and Estimates of Future Demand

Table 31 shows ridership by month and port of origin, based on data from 1997. The monthly estimates incorporate annual data from Table 22 and distribute the ridership by month using the percentages in Table 30. Table 32 shows potential ridership in 2005, by month and port of origin, using the low-growth scenario figures for population growth, visitor levels, and tunnel effects.

Table 31
PWS/CR Ferry Passenger Traffic by Month and Port of Origin, 1997

Month	Number of Passengers by Month				
	Valdez	Cordova	Whittier	Seward	PWS/CR Total
January	288	306	184	12	790
February	288	273	179	12	752
March	411	430	247	12	1,100
April	411	383	237	14	1,045
May	1,041	568	755	93	2,457
June	2,658	659	1,937	217	5,471
July	3,583	811	2,590	312	7,296
August	3,220	819	2,348	249	6,636
September	1,035	458	697	117	2,307
October	329	323	203	68	923
November	219	237	150	41	647
December	219	248	155	32	654
Total	13,702	5,515	9,682	1,179	30,078

Table 32
PWS/CR Ferry Passenger Traffic by Month and Port of Origin
Low Growth Scenario, 2005

Month	Number of Passengers by Month				
	Valdez	Cordova	Whittier	Seward	PWS/CR Total
January	547	447	412	13	1,419
February	547	399	401	13	1,360
March	782	628	553	13	1,976
April	782	560	531	15	1,888
May	1,980	830	1,691	106	4,607
June	5,054	963	4,335	246	10,598
July	6,812	1,184	5,798	355	14,149
August	6,122	1,196	5,256	282	12,856
September	1,967	669	1,561	133	4,330
October	625	471	455	78	1,629
November	417	346	336	46	1,145
December	417	362	347	37	1,163
Total	26,052	8,055	21,676	1,337	57,120

Estimates of ferry traffic in other years could be provided, and estimates could be based on higher growth rates. However, providing other tables could give a false sense of precision and may not be necessary. If the proposed ferry alternatives are implemented in 2005, the system will operate at capacity based on these low-growth figures. Figures based on the base case or high-growth scenario rates would suggest greater passenger demand, but the expected outcome would be the same. The proposed system will operate at capacity, regardless of the alternative chosen.

Changes in Ticket Prices and Changes in Ridership

Surveys of residents in Valdez and Cordova revealed how ferry travelers would respond to changes in ticket prices. In particular, survey respondents indicated that with a 25 percent decrease in price, residents who currently use the ferry would travel 15 percent more (take 15 more trips). This response suggests a price elasticity of -0.6 , a figure that is consistent with estimates of price elasticity for AMHS ferry riders by Erickson in 1993.⁷

In addition to more trips by residents who currently use the ferry (defined as those who rode the ferry last year), a decrease in price would result in more trips by visitors and by residents who have not been using the ferry. That is, lower prices will cause current system users to take more trips and will induce travel by those not currently using the system.

No data are available that show how visitors might respond to price changes. The most plausible assumption is that visitors would be less sensitive than residents to price changes. Visitors include fishers who need to travel for work and tourists visiting the PWS/CR area. These passengers would be less likely to change their travel plans in response to changes in ferry prices.

Assuming, therefore, that price elasticity of demand for visitors is approximately -0.4 , the weighted average price elasticity for all PWS/CR area ferry passengers would be approximately -0.6 . Residents who would travel at a lower price are much more sensitive to price changes and have a much lower price elasticity of demand (significantly less than -1.0). However, the number of visitor passengers exceeds the number of resident passengers, bringing the weighted average closer to -0.6 . Table 33 shows potential ridership in 2005 by month and port of origin, assuming an average price elasticity of -0.6 for all passengers. Figures are based on a 25 percent decrease in price and a 15 percent increase in the number of trips. Figures are also based on the low growth rates for population and visitor levels, as well as tunnel effects.

⁷ Erickson and Associates. *Long-Range AMHS Business Planning Analysis*. Prepared for the Alaska Marine Highway System, Alaska Department of Transportation and Public Facilities. Juneau, Alaska. 1993.

Table 33
Estimated Ridership in 2005
with a 25 Percent Decrease in Ticket Prices

Month	Number of Passengers by Month				
	Valdez	Cordova	Whittier	Seward	PWS/CR Total
January	629	514	474	15	1,632
February	629	459	461	15	1,564
March	899	722	636	15	2,272
April	899	644	611	17	2,171
May	2,277	955	1,945	122	5,299
June	5,812	1,107	4,985	283	12,187
July	7,834	1,362	6,668	408	16,272
August	7,040	1,375	6,044	324	14,783
September	2,262	769	1,795	153	4,979
October	719	542	523	90	1,874
November	480	398	386	53	1,317
December	480	416	399	43	1,338
Total	29,960	9,263	24,927	1,538	65,688

Note: In addition to price effects, figures are based on low growth rates for population and visitorship, and tunnel effects.

4. SURVEY OF RESIDENTS OF CORDOVA AND VALDEZ

In February 2000, Northern Economics conducted a survey of residents in Valdez and Cordova to determine how area residents would respond to the proposed alternatives and to changes in ticket prices. A total of 82 households in Cordova and 60 households in Valdez were surveyed. Respondents were asked how many trips they currently make on the PWS/CR ferry system during summer and winter, how many trips they make on each route, and their final destination. To estimate the number of trips that would be made at various price levels, Northern Economics asked respondents how the number of trips they make on the existing PWS/CR ferry system would change at specific decreases in fares for each season.

Survey results showed that resident ridership would increase significantly if one of the alternatives was implemented. Residents who rode the ferry in 1999 said they would ride more than twice as often if their preferred alternative were put in place. In addition, residents who have not used the ferry in recent years said they would start using the ferry if their preferred alternative were put in place. This induced ridership would increase resident traffic by more than 100 percent. Survey results also showed that AMHS could expect a significant increase in ridership from residents with a decrease in ticket prices. These findings suggest that AMHS will be able to meet its revenue requirements with one of the proposed alternatives.

Estimates of the price elasticity of demand were derived from the survey responses. Knowledge of price elasticity of demand allowed Northern Economics to estimate ridership at different fare rates during each season. The elasticity response was measured for induced ridership (persons who currently do not ride the ferry but would with a lower price) and increased ridership by those persons who currently ride the ferry.

- Sensitivity to price changes was less for persons who currently ride the ferry than for persons that do not ride the ferry. Survey results indicated that current riders will increase their ridership by about 6 percent if there is a 10 percent drop in price. In other words, current riders exhibit a price elasticity of demand of -0.6 . This result is comparable to elasticity of demand for current riders derived by Erickson in 1993.⁸
- PWS/CR residents that currently do not ride the ferry appeared to be more sensitive to price changes. Our survey was not extensive enough to yield good estimates of price elasticity for non-riders, but on average, non-riders would ride the ferry with a smaller price reduction than would be required to induce an additional trip from current riders.
- In general, Valdez residents are more likely than Cordova residents to be non-riders. On average, Valdez residents were more responsive than Cordova households to changes in price. This higher responsiveness is likely attributable to the road travel alternative, which is more accessible to Valdez residents – Cordova residents must take the ferry to Valdez before using the road. It appears that Valdez residents traveling to Anchorage can reach their destination faster and cheaper by road than with the current ferry system and the rail-only tunnel from Whittier to Portage. A possible explanation for Valdez residents choosing to travel to Anchorage by ferry (through Whittier) may be that some prefer not to drive, particularly during winter. The largest response by Valdez households to changes in price was from persons who currently do not ride the ferry but who would with a decrease in price.

⁸ Erickson and Associates. *Long-Range AMHS Business Planning Analysis*. Prepared for the Alaska Marine Highway System, Alaska Department of Transportation and Public Facilities. Juneau, Alaska. 1993.

- Although responses to changes in ferry price level were not as significant for Cordova residents as for Valdez residents, Cordova households did indicate that there would be significant change in ridership with changes in price level. As with Valdez residents, the largest changes in ridership resulting from changes in price would come from persons who currently do not ride the ferries.

Following questions on price changes under the existing system, the proposed ferry service alternatives were outlined. All respondents were asked which alternative they preferred and the number of trips they would make on that preferred alternative. Conclusions from responses are summarized below.

- A change in ferry service levels will induce additional ferry traffic – current ferry users will increase their ridership, and persons who do not currently use the AMHS system will begin to ride the ferries. Both Cordova and Valdez indicated significant increases in ridership levels for their preferred alternative over the current ferry service, although the communities preferred different alternatives for service during the peak season.

- 53 percent of Valdez residents preferred Alternative 2G, which was described as follows:

One high-speed ferry would run directly between Valdez or Cordova and Whittier. On alternate days this ferry would run from Valdez to Cordova, then on to Whittier, returning directly to Cordova. The other ferry, also a high-speed ferry, would make two round-trips daily between Valdez and Whittier.

- 65 percent of Cordova residents preferred Alternative 2H, which was described as follows:

Two high-speed ferries would start and end each day in Cordova. One would go first to Whittier and then back through Valdez to Cordova. The other would go first to Valdez and then on to Whittier, returning directly to Cordova.

- 21 percent of Valdez residents chose Alternative 2H, while 24 percent of Cordova residents preferred Alternative 2G.

- Only 4 percent of Cordova residents and 19 percent of Valdez residents preferred Alternative 2F, which was described as follows:

One standard-speed ferry will make 1 round-trip daily between Cordova and Valdez – travel time is expected to be 5 hours and 45 minutes one-way. One high-speed ferry will make 2 round-trips between Valdez and Whittier every day – one-way travel time is expected to be 3 hours and 15 minutes. It will be possible to travel between Cordova and Whittier in 10 hours.

The survey asked residents how many additional trips they would make during the peak season if their preferred alternative were implemented.

- Overall, respondents indicated they would take 114 percent more trips during the peak-season than they take with the current system. The survey was not extensive enough to differentiate response rates between the different alternatives.

The survey also asked residents how many additional trips they would take during the off-season if the alternative off-season service were implemented.

- Respondents indicated they would take 223 percent more trips than they currently take during the off-season.

5. ESTIMATE OF RIDERSHIP USING THE SERVICE INDEX MODEL

All three of the proposed alternatives ferry alternatives in PWS/CR Area Transportation Plan offer significantly improved service. Improved service will almost certainly result in higher passenger and vehicle traffic and revenues. Increased traffic will come from two primary sources: 1) existing travel demand that is not being met because of the current system’s inadequate capacity; and 2) induced or new travel demand that arises as ferry users decide to take additional trips or shift travel modes to take advantage of improved ferry service.

Northern Economics adapted a service index (SI) and service index elasticity (SIE) model that was originally developed for analysis of ferry alternatives in Lynn Canal to quantify service improvements and to provide projections of ridership on the PWS/CR ferry alternatives.⁹ While the model results cannot be guaranteed, they project that any of the alternatives under consideration would be able to generate enough revenue during the peak season to cover 60 percent of annual operating costs. In other words, the model results indicate that the systems offer a large enough improvement in service that any of the alternative systems could “break even” if no revenue were generated during the off-season. If projections of off-season revenue are included, it is possible that any of the alternative systems could cover 100 percent or more of operating costs. These findings indicate that AMHS could lower ticket prices by 40 percent or more and still generate required revenues.

The SI model used for these projections is relatively untested, and demand response to service improvements (the SIE) was based on responses to actual service improvements that occurred in Lynn Canal in 1998. Responses to service improvements in the PWS/CR region are likely to vary from responses in Lynn Canal – not only because of geographic differences, but also because of difference in the existing and proposed services levels in the PWS/CR region. These caveats notwithstanding, there is ample evidence that ferry riders in PW/CR will react positively to improved service.

⁹The concepts of SI and service index elasticity (SIE) are useful tools that can be applied to the ferry alternatives in the PWS/CR region. However, the concepts are Northern Economics innovations that to our knowledge have not been tested by the economics and transportation community at large. Therefore, the results should not be used outside the context of the current application: specifically, to provide an indication of the potential of new ferry systems to generate required operating revenues.

Northern Economics developed the SI and SIE concepts in a February 1999 study of alternatives to improve access to Juneau conducted for the Glostien Associates and ADOT&PF (*Break-even Demand on Alternative Ferry Systems in Lynn Canal*). The study compared ridership and ferry service in Lynn Canal (Juneau, Haines, and Skagway) during summer 1997 to ridership and service in the same area and period in 1998. In 1997 service consisted of mainline ferries that stopped in Juneau 3 or 4 times a week on the way from Bellingham or Prince Rupert, B.C., to Skagway. In 1998 AMHS augmented the 1997 service with the *MV Malaspina*, which provided round-trip service on a daily basis in Lynn Canal.

Using the SI formula, $SI = \frac{\text{Capacity Index} + \text{Departure Index}}{\text{Travel Time Index} + \text{Departure Time Index}}$,

it was estimated that service in the area had improved by 72 percent while ridership increased by 32 percent, even though tariffs were 30 percent higher on the *MV Malaspina* than on the regular mainline ferries.

SIE is a measure of the response of riders to responses in service and is calculated as the ratio of ridership percentage increase to service index percentage increase. The SIE for the change in service in Lynn Canal was estimated to be 44 percent (32 percent ÷ 72 percent).

Three recent surveys of PWS/CR ferry riders have indicated that the number of ferry trips will increase with higher levels of service. As noted in Section 4, PWS/CR residents indicated that they would nearly triple the number of trips they take if their preferred alternative were implemented. In addition, population and tourism in the PWS/CR region, and improved vehicle access to Whittier – primary drivers of ferry travel in the PWS/CR region – are expected to contribute additional demand. These factors combined support the conclusion that any of the ferry alternatives proposed in the PWS/CR Area Transportation Plan not only can generate the required revenues, but can do so with reduced prices.

THE SERVICE INDEX MODEL

The ferry system alternatives that are under review in the PWS/CR Area Transportation Plan represent significant improvements over existing AMHS service in the area. However, "service" means different things to different people. One person may indicate that "good service" reduces travel time, while another may think that "good service" means frequent and regularly scheduled sailings. To compare the service attributes of the options, Northern Economics developed an SI that quantifies four different aspects of ferry service and combines them into a single measure.¹⁰ The four attributes are described below.

1. **Nominal car capacity.** Nominal car capacity measures the ferry’s ability to carry vehicles. The measure is defined as the nominal 20-foot vehicle capacity of vessels on the route, multiplied by the number of vessel departures. The higher the capacity, the higher the overall service level, if all other attributes are held constant.
2. **Total departures.** Total departures are defined as the number of departures in the period from a specific port of origin to a specific destination. The higher the number of departures, the higher the overall service level, if all other attributes are held constant.
3. **Total travel time.** Total travel time measures the average total time spent in transit, and includes a) time spent driving to the ferry terminal, b) time spent waiting to embark, c) time spent in embarkation, d) total transit time for the ferry, d) time spent in disembarkation, and e) time spent driving from the terminal to the destination community. In general, the longer the total travel time, the lower the overall service level, if all other attributes are held constant.

¹⁰ The SI for a given alternative was calculated by combining the separate attribute measures into a ratio, with the capacity and departure indexes in the numerator and the travel time and departure time indexes in the denominator. Each measure was standardized (or indexed) by calculating its ratio compared with the same measure from the 1997 ferry service—1997 is considered the base case. If the capacity under a given ferry alternative is 2 times the capacity in the base case, then the capacity index will equal 2.

Similarly, if the number of departures increases by 50 percent over 1997 departures (the base case), the departure index will equal 1.5. Indexing the attribute measures to base-case levels has the effect of giving each attribute equal weighting. After each attribute index was estimated, the overall SI was calculated as follows.

$$SI = \frac{\text{Capacity Index} + \text{Departure Index}}{\text{Travel Time Index} + \text{Departure Time Index}}$$

4. **Departure time.** The departure time index is the average of scores assigned to the departure times for the system during the year. Each departure during the year was given a score of 1 or 2. All departures on a regularly scheduled daily service were assigned a score of 1. Sailings on an irregular schedule were assigned a score of 1 if the entire trip could be completed between 7 a.m. or after 9 p.m. If the traveler must embark or disembark before 7 a.m. or after 9 p.m., then the sailing was assigned a score of 2. If the average departure time score decreases, then the overall service level increases, if all other attributes remain constant.

Estimating SIs for the current and alternative ferry systems in the PWS/CR region is a straightforward process of measuring the service attributes. However, in comparison with the existing system, the proposed alternatives place much greater emphasis on service between Cordova and Whittier and much less emphasis on service between Cordova and Valdez. Since almost all existing traffic from Cordova goes to Valdez, the SI model is likely to give higher ratings to alternatives that provide better service between Cordova and Valdez and lower ratings to alternatives that recognize the expressed desire of Cordova residents to have better service to Whittier. In other words, the SI model works better when comparing service enhancements that mirror existing travel patterns than it does when looking at service changes that may alter existing travel patterns.

The SI model provides a useful indicator of service improvements and the order of magnitude of passenger responses to service improvements. However, the model should not be the sole basis used to determine whether the PWS/CR ferry alternatives will meet required revenues to cover operating costs, because of two factors:

- Major structural changes to travel patterns that would occur with the PWS/CR ferry alternatives
- Insufficiency of data to precisely measure SIE

Tables 34–37 show the SIs for each O-D pair under the 3 peak-season alternatives (2F, 2G, and 2H) and the off-season alternative. The SIs reflect the change in service under the alternative compared to the service offered in the current system. Thus Table 34 shows that Alternative 2F would increase service between Cordova and Valdez by a factor of 6.64. In other words, the SI model estimates that service under Alternative 2F from Cordova to Valdez would improve by 664 percent over the current system. Alternative 2G provides a smaller improvement in service from Cordova to Valdez, but a relatively greater improvement in service between Cordova and Whittier. Service between Cordova and Whittier is highest under Alternative 2H, with nearly 15 times the service level offered under the current system. Since Cordova residents have indicated that their primary final destination when taking the ferry is Anchorage, it is reasonably clear that they will prefer Alternative 2H. For Valdez residents, it appears that Alternative 2G offers better service to Whittier than the other alternatives.

Table 34
Alternative 2F Peak-Season Service Index

Port of Origin	Destination Port		
	Valdez	Cordova	Whittier
Valdez		6.39	4.77
Cordova	6.64		5.17
Whittier	7.18	5.62	

Note: The SI for each o-d pair shows the multiple of the SI for the o-d pair during the peak season in 1997.

Table 36
Alternative 2H Peak-Season Service Index

Port of Origin	Destination Port		
	Valdez	Cordova	Whittier
Valdez		8.60	2.36
Cordova	8.93		14.81
Whittier	3.53	16.93	

Note: The SI for each o-d pair shows the multiple of the SI for the o-d pair during the peak season in 1997.

Table 35
Alternative 2G Peak-Season Service Index

Port of Origin	Destination Port		
	Valdez	Cordova	Whittier
Valdez		4.30	5.96
Cordova	4.47		7.40
Whittier	8.95	8.47	

Note: The SI for each o-d pair shows the multiple of the SI for the o-d pair during the peak season in 1997.

Table 37
Off-Season Service Index, All Alternatives

Port of Origin	Destination Port		
	Valdez	Cordova	Whittier
Valdez		1.88	8.98
Cordova	1.91		13.77
Whittier	5.94	16.14	

Note: Off-season service is identical under all three alternatives.

Table 37 shows the SI matrix for the proposed alternative for off-season service. Service to Whittier from both Valdez and Cordova is vastly improved, while off-season service between Cordova and Valdez is improved but does not quite double the SI. While the Cordova to Valdez indexes are relatively small compared to peak-season services, it is also the case in surveys that relatively few Cordova residents or Valdez indicated the desire for frequent travel to the other community. Most residents of both communities have indicated Anchorage as their primary travel destination.

Once the SIs for each alternative were calculated, it was relatively straightforward to estimate the change in passenger traffic, if an estimate of the response to SI changes (the service index elasticity or SIE) is available. The formula for estimating traffic under the alternative is Current Traffic \times SI \times SIE. As indicated above, an SIE of 0.44 was calculated for the improved service in Lynn Canal based on actual passenger responses to service changes in 1998. Vehicle traffic can then be estimated using the convention that the ratio of passengers to vehicles is constant. Once we have estimates of passenger and vehicle traffic, we can then estimate total revenue by multiplying the standard fares for passengers and vehicle.

Tables 38-40 contain the results of the SI model and show estimated peak-season revenue by O-D pair under the three alternatives. Table 41 shows estimated off-season revenue. Off-season service, and therefore revenue estimates, are identical under each of the three alternatives. The tables indicate that, based on the Northern Economics' SI Model, all three alternatives are likely to generate required operating revenues. Alternatives 2F and 2G are estimated to meet AMHS revenue requirements during the peak-season, while off-season revenue is needed to bring Alternative 2H up to the \$3.66 million required to cover 60 percent of operating costs.

Table 38
Alternative 2F Peak-Season Revenue

Port of Origin	Destination Port			Total
	Valdez	Cordova	Whittier	
Valdez		429,150	1,101,674	1,530,824
Cordova	438,540		139,449	577,989
Whittier	1,572,964	177,588		1,750,552
PWS/CR	2,011,505	606,737	1,241,123	3,859,365
Total				

Note: Alternative 2F must generate \$3.36 million to meet revenue requirements.

Table 39
Alternative 2G Peak-Season Revenue

Port of Origin	Destination Port			Total
	Valdez	Cordova	Whittier	
Valdez		288,721	1,374,155	1,662,876
Cordova	295,039		199,528	494,567
Whittier	1,959,903	267,576		2,227,479
PWS/CR	2,254,942	556,297	1,573,683	4,384,922
Total				

Note: Alternative 2G must generate \$3.66 million to meet revenue requirements.

Table 40
Alternative 2H Peak-Season Revenue

Port of Origin	Destination Port			Total
	Valdez	Cordova	Whittier	
Valdez		577,442	545,012	1,122,454
Cordova	590,078		399,056	989,134
Whittier	774,037	535,152		1,309,190
PWS/CR	1,364,115	1,112,595	944,067	3,420,777
Total				

Note: Alternative 2H must generate \$3.66 million to meet revenue requirements.

Table 41
Off-Season Revenue, All Alternatives

Port of Origin	Destination Port			Total
	Valdez	Cordova	Whittier	
Valdez		66,857	1,077,297	1,144,153
Cordova	66,806		194,674	261,480
Whittier	676,468	267,041		943,508
PWS/CR	743,274	333,898	1,271,970	2,349,142
Total				

Caveats and Sensitivity Analysis

It should be reiterated that these revenue estimates are intended to provide general guidance to decision makers. We believe that the model results provide sufficient indication that any of the alternative ferry systems can generate the required operating revenues. Our relative level of certainty is enhanced because of other demand factors (population and tourism growth and survey results) that also point to increases in ferry ridership. However, there is a significant amount of uncertainty in the model as well as the parameters. The SI Model has not been thoroughly tested in the real world. In addition the SIE was estimated for changes in Lynn Canal – its applicability to the PWS/CR region is as yet unknown. Furthermore, given the likely change in travel patterns expected to occur because of the Whittier tunnel and the fact that the current traffic is constrained by capacity, it is uncertain that current system traffic counts in the PWS/CR region, which normally would be considered very reliable data, are directly applicable to projections of future traffic.

Because the response to changes in service is based on 1998 data from Lynn Canal, a sensitivity analysis was conducted to determine whether the alternatives could generate required operating revenues under a more conservative SIE. The model indicates that all of the alternatives could generate required operating revenues even if the SIE (the response to changes in service) were as low as 0.28. In other words, even if PWS/CR sound ferry riders are one-third less responsive to changes in service as ferry riders in Lynn Canal, the model indicates that the alternatives could generate required operating revenues.

One of the greatest concerns with application of the SI Model in the PWS/CR region is that current AMHS travel patterns do not reflect the travel patterns that are likely to emerge under the alternative. On the basis of survey of Cordova residents, Northern Economics believes that there is sufficient evidence that residents from Cordova will forego travelling to Valdez by ferry and then by road to Anchorage, particularly if travel times on the ferry and costs on the ferry from Cordova to Whittier are significantly reduced. Alternative 2H and, to a lesser degree, Alternative 2G, recognize this and significantly increase service between Cordova and Whittier. Alternative 2F, on the other hand, would do relatively little to improve service between Cordova and Whittier – the relatively small service improvement between Cordova and Whittier (Table 34) is reflected in the relatively low revenue that would be generated (Table 38) for those links.

The SI Model does not predict shifts in travel patterns to the extent that other evidence indicates they are likely to occur. This shortcoming of the model occurs because of reliance on current system O–D pair travel data in the formula to project O–D pair travel under the alternatives. Recall that the formula used to estimate the travel between each O–D pair using the SI Model is Current Traffic \times SI \times SIE. This formula is applied to each O–D pair, and therefore the existing travel patterns continue to be reflected in the projected outcomes. In other words, since current travel between Cordova and Whittier is relatively low, multiplying that travel by a relatively large SI and SIE will still result in relatively low projections of travel. While the SI Model accurately projects that any of the three alternatives will be able to generate required operating revenues, it is believed that the projected revenues for Alternative 2F are relatively higher than they are likely to be when compared to the other two alternatives. Additionally it is believed that projected revenues for Alternative 2H are relatively lower than they would be if the model were better able to handle changes in travel patterns.

Given these shortcomings in the SI model's ability to handle changes in travel patterns, it is not recommended that its results be used as the sole indicator of a single preferred alternative. Rather the model results should be used simply as another indication that the any of the alternatives proposed under the PWS/CR Area Transportation Plan are likely to generate required operating revenues. Final determination of a single preferred alternative should reflect the preferences of the region's residents and policymakers.

6. CONCLUSIONS

ISSUES OF THIS ANALYSIS

As mentioned, three interrelated issues have been identified with regard to the three proposed alternatives for ferry service in the PWS/CR region. These issues and the conclusions suggested by the foregoing analysis are summarized below.

Will the alternatives be able to generate required operating revenues?

The study of existing ridership, projected population and tourism growth, projected changes resulting from the opening of the vehicle tunnel to Whittier, and service improvements associated with the proposed alternatives indicated that any of the three proposed alternatives will be able to generate required operating revenues. This conclusion incorporates the convention that required revenues are equal to 60 percent of operating costs.

Can AMHS meet its revenue goals with lower prices on the proposed alternatives?

The analysis of the proposed service alternatives and behavior of ferry passengers indicated the following:

- AMHS could lower ticket prices by approximately 30 percent and still meet revenue requirements.
- Alternatively, AMHS could keep prices higher and cover a greater percentage of annual operating costs – perhaps even as much as 100 percent.
- AMHS could implement changes in pricing policies that might encourage more resident travel. Such changes might include season passes, or deeper discounts during the off-season.

Which alternative is likely to generate the highest ridership?

The analysis of the proposed service alternatives and behavior of ferry passengers indicated the following:

- Alternatives that maximize cross-Sound travel opportunities (Alternatives 2G and 2H) will be superior to the alternative that focuses on travel between Cordova and Valdez (Alternative 2F).¹¹
- There does not appear to be a clear economic difference between alternatives 2G and 2H – both use essentially the same vessels, have the same operating costs, and, overall, appear to offer similar levels of service.
- Survey results show that Valdez residents prefer Alternative 2G, while Cordova residents prefer Alternative 2H.

¹¹ A complete description of the alternatives in the next section.

After studying factors expected to influence future demand for ferry services in the PWS/CR region, Northern Economics concluded that the ferry system alternatives are likely to generate sufficient revenues to cover 60 percent of operating costs. The following list is an overview of the factors considered and illustrates how those factors support the conclusions.

1. In 1997, which was defined as the base year, AMHS ferries in the PWS/CR region generated approximately \$2.2 million in revenue. To cover 60 percent of annual operating costs (estimated by Glosten at \$6.3 million) revenue in the current system needs to increase by 70 percent, to \$3.78 million.
2. Ridership on the current system in the PWS/CR region is constrained by capacity during summer, with 67 percent of ridership estimated to occur during the 105 days from Memorial Day through Labor Day. Actual demand during the peak season on the current system is unknown, but is likely to be higher than current ridership levels because of the constraints of the current system.
3. Travel patterns and travel destinations in South-central Alaska are likely to shift toward the PWS/CR region with the opening of the vehicle tunnel from Portage to Whittier. In a recent memorandum for this project, *Travel Forecast Technical Memorandum (Revised Draft)*, November 1999, it was concluded that the tunnel opening will induce demand for additional trips across the PWS/CR region.
4. Demand for ferry services is likely to grow in the future, regardless of the system that is in place. Demand for ferry services in the PWS/CR region consists of three general components:
 - Residents of Cordova, Valdez, and Tatitlek, with minimal demand from residents of Whittier;
 - Alaskan residents outside the PWS/CR region that travel to the PWS/CR area on a regular basis;
 - Tourists and other infrequent visitors.

Low, medium, and high growth scenarios developed in the *Travel Forecast Technical Memorandum (Revised Draft)*, November 1999 show significantly higher levels of demand. In the low case, estimated tourism and population growth is expected to increase demand by a total of 90 percent between 1997 and 2005 and by 380 percent by 2020. High-case estimates show increases of 100 percent by 2005 and 500 percent by 2020. These estimates are conservative insofar as they do not include increased travel associated with service improvements or possible price reductions.

5. Survey information indicated that residents of Cordova, Tatitlek, and Valdez will be very responsive to service improvements in the PWS/CR ferry system. Respondents indicated that their primary travel destination is Anchorage. If ferry service to and from Whittier improves, particularly with the opening of the vehicle tunnel to Portage, travelers are likely to switch from driving the road between Valdez and Anchorage to using the ferry.
6. The proposed alternatives all offer significantly higher capacity and service levels than are now available under existing study area AMHS service. At the same time, each of these alternatives reduces operating costs relative to existing service. Less significant service improvements in Lynn Canal in 1998 increased travel on the ferry system by 32 percent, even though fares on the improved service were 30 percent higher. More significant service improvements in the PWS/CR region without a fare increase are likely to increase ferry travel by more than 32 percent. Residents of Valdez and Cordova indicated in the survey conducted for this analysis that their ridership would increase by approximately 170 percent if their preferred alternative were implemented.

7. A Northern Economics service index (SI) model that quantifies levels of ferry service indicates that overall service levels in the peak season will increase by approximately 550 to 730 percent under the proposed alternatives. The SI model was originally developed for use in an analysis of alternative ferry systems in Lynn Canal. In that study, a service increase of 70 percent generated a 32 percent increase in ridership. If that same response rate, or service index elasticity (SIE), is applied to the PWS/CR region, then peak-season ridership would increase by 200 to 350 percent. The off-season SI is estimated to increase by 650 percent under the alternative systems – generating a 280 percent increase in ridership if the Lynn Canal SIE is applied. While it is uncertain whether PWS/CR riders will respond at the same rate as riders in Lynn Canal, the SI model indicates the likelihood for significant increases in ridership. These increases do not take into account increases in demand that would be associated with population and tourism growth.
8. Capacity increases under all three alternatives are such that if the system runs at 67 percent capacity during the peak season and prices remain the same, all three alternative systems would generate the required operating revenues or higher revenues, even if off-season revenue falls to zero. If off-season revenues remain at current levels, then under the alternatives the ferries would need to run at only 45 to 55 percent capacity for the system to generate required operating revenues at current fares.
9. With the combined increases in demand associated with the tunnel, population and tourism growth, and proposed service improvements, ferries under the proposed alternatives are likely to run at or near capacity during the peak season. If the ferries run at capacity during the peak season, peak-season revenue will exceed operating revenue requirements by more than 30 percent. Therefore, price reductions of 30 percent or more may be possible, while still achieving required revenues.