PRINCE WILLIAM SOUND/COPPER RIVER AREA
TRANSPORTATION PLAN

DRAFT

EVALUATION OF ALTERNATIVES TECHNICAL MEMORANDUM

Prepared for the

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EXECUTIVE SUMMARY

The preferred alternative for the Prince William Sound/Copper River Area Transportation Plan centers on the purchase of two new fast ferries, which would be deployed to serve Cordova, Whittier and Valdez with much greater frequency and convenience than is not provided. Not only would implementation of the preferred alternative provide more convenient and frequent service, it would do so while raising revenues significantly. Continuation of existing AMHS service in Prince William Sound is projected to cost about $6.3 million for the design year 2020 while revenues are projected to reach $3.4 million. In contrast, implementation of the preferred alternative is projected to cost about $6.1 million while generating revenues from $7 to $8.9 million for the 2020 design year.[1]

Described in this report are the results of the evaluation of (1) initial; and (2) final alternatives for the Prince William Sound/Copper River Area Transportation Plan. Each of the alternatives evaluated for this regional transportation plan is a marine alternative, although roadway and rail alternatives were at one point considered. The focus on marine transportation in this region stems from the area's demographic concentrations, challenging topography, and environmental sensitivity.[2]

Nine initial alternatives, including a baseline no-build alternative, were developed for initial analysis and evaluation. Three types of build alternatives were developed: (1) alternatives that rely solely on vessels already owned and operated by AMHS; (2) alternatives that involve the acquisition and operation of new high-powered and/or high-speed vessels, and (3) a single hybrid alternative that would combine existing and new vessels.[3] The nine initial alternatives were subjected to a scored evaluation comprising seven weighted Measures of Effectiveness (MOEs):

- Improves Intermodal Transportation
- Improves Travel Time
- Improves Service Convenience
- Exploits Backhaul Potential
- Health and Quality of Life

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1 Revenue projections for each alternative have been performed at a planning level. While they reflect the best estimates that can be developed given existing data, many uncertainties surround them. An earlier document, *Ferry Alternatives Revenue Analysis Technical Memorandum* (March 2000) should be referenced to gain an understanding of the revenue forecasts' assumptions, caveats, and limitations. Further, it must be noted that the operating cost estimates provided do not take into account the considerable systemwide costs borne by the AMHS, which include system management, risk management, and reservation system costs. As such, the actual differences between projected revenues and costs are much lower. Systemwide costs were not rolled into the alternative-specific operating cost estimates because of the difficulting in allocating such costs among specific service routes.

2 Although the State fulfills a critical role in providing the infrastructure for aviation, its ability to effect regional-scale aviation improvements is limited, given private air carriers' reliance on market conditions in setting their routing, prices, and service schedules. This is another factor in this plan's marine service emphasis.

3 Only one alternative besides the baseline would continue providing AMHS service to Seward. The rationale for focusing on the Prince William Sound ports of Cordova, Valdez and Whittier is three-fold: (1) Seward has a connection to Alaska's roadway network, in fact, several million dollars worth of improvements have been programmed for the Seward Highway. In contrast, the residents of Cordova have no surface transport alternative to AMHS service. (2) Marine service to Seward requires a vessel capable of operating on open ocean, whereas service within the Sound can be provided by smaller vessels; (3) the most promising build alternatives are based upon a "dayboat" concept, wherein all sailings are accomplished within a 12-hour service day. Given Seward's distance from the ports of Prince William Sound, dayboat operations, and the considerable operating savings they provide, would not be feasible.

- Regional Economic Development
- Environmental Readiness

The initial alternatives received weighted MOE scores ranging from 10 to 32. The second step in the initial evaluation was to relate these scores to two key variables: (1) operating and capital costs; and (2) projected demand. A value index incorporating MOE score, costs, and projected demand was thus developed. Value index scores for the initial alternatives ranged from a low of 2.4 to a high of 24.2. The highest ranking initial alternatives were those that rely on new high-powered and/or high-speed vessels operating on a "dayboat" service principle.[4]

The results of the initial evaluation were used in refining the most promising alternatives for consideration as final alternatives. Three final build alternatives were developed, along with the baseline no-build alternative. Several analyses were conducted to refine the initial alternatives:

- **Exploration of each alternative's "scalability,"** or ability to flex the level of service offered to the demand at particular times of year. Since operating costs are critical, it was important to determine where and when the greatest demand will occur (during the summer peak), to maximize the ability to gather revenue during periods of peak demand, while avoiding the cost of providing excess capacity when demand is much lower.
- **Revenue projections for each alternative**. These revenue projections take into account the improved amount and quality of service under the proposed final alternatives as well as the increase in travel demand that is anticipated in response to the opening of the Whittier Tunnel. 2020 revenue projections are also provided for the baseline no-build alternative.

FINAL ALTERNATIVES

The three build alternatives that were refined for final analysis can be summarized as follows:

Alternative 2f

Acquire one new high-speed vessel and one new high-powered conventional vessel. During the peak season (a 105-day period centered on July) the high-speed vessel is dedicated to service between Whittier and Valdez, where it makes two round trips per day. Meanwhile, the new high-powered conventional vessel makes one round trip per day between Cordova and Valdez. A timed transfer at Valdez is provided. During the off season, the high-powered conventional vessel is laid up or utilized elsewhere in the system, and the new high-speed vessel makes a loop among Cordova, Valdez and Whittier five out of seven days a week. The loop alternates between clockwise and counterclockwise operations.

This alternative, the only one to involve a conventional high-powered vessel, does not provide any direct peak-season linkage between Cordova and Whittier.

[4] Dayboat operations are defined for the purposes of this plan as round-trip routing that can be accomplished within the confines of a 12-hour service day. Fast ferry technology, which allows operating speeds more than double those of conventional vessels, makes dayboat operations possible Insofar as labor is the most expensive component of AMHS operating costs, dayboat operations, which are less expensive in this regard, offer significant operating savings over conventional vessel technology.

Alternative 2g

Acquire two new high-speed vessels. During the peak season, the first high-speed vessel is dedicated to service between Whittier and Valdez, where it makes two round trips per day. The other high-speed vessel makes alternating loops (one round trip per day) among the ports of Cordova, Valdez and Whittier. The off-season variant is the same as 2f.

Of the three build alternatives, 2g provides the most capacity between Whittier and Valdez and would generate the greatest revenue.

Alternative 2h

Acquire two new high-speed vessels. Each vessel makes daily loops among Cordova, Whittier, and Valdez, one operating in each direction. Off-season variant is the same as 2f.

Of the three build alternatives, 2h provides the greatest capacity between Cordova and Whittier. However, its revenue generation estimate is lower than that of Alternative 2g.

MOE scores, operating costs, and revenue estimates for each alternative are shown in Table ES-1.

Table ES-1
Summary Statistics for the Final Alternatives

Alternative	MOE Score	Operating Cost*	2020 Revenue Estimate	Surplus/Subsidy
Baseline	10	$6.3 M	$3.37 M	$2.97 M subsidy required
2f	35	$5.5 M	$7.34 M	$1.84 M ***surplus generated***
2g	38	$6.1 M	$8.92 M	$2.82 M ***surplus generated***
2h	38	$6.1 M	$7.74 M	$1.64 M ***surplus generated***

*Note that these operating cost estimates do not take into account the full costs of operating AMHS service. System management, shoreside facilities, risk management and reservation system costs, for instance, are not included. The reason for this omission is the difficulty in assigning systemwide costs to isolated elements of the AMHS, such as service between specified ports.

SELECTION OF A PREFERRED ALTERNATIVE

It is clear from the table above that all three build alternatives score much higher than the baseline. Not only are the build alternatives' MOE scores much higher, but they are also projected to produce revenue above and beyond their operating costs. This is in sharp contrast to the current situation, in which a sizable state subsidy is required. Given these characteristics, it is clear that a build alternative should be recommended. It is less clear *which* of the three build alternatives should be prioritized.

The distinction in MOE scores among the three build alternatives is modest. For this reason, a simple value index approach to analyzing the final alternatives was not taken. Rather, the approach was to acknowledge the trade-offs associated with each alternative. Two tradeoffs are most salient: port calls to Cordova and revenue generating capacity.

Alternative 2h would provide the most capacity to Cordova; but would rank second in terms of revenue generation. Meanwhile, Alternative 2g, which provides dedicated Valdez-Whittier service in the peak season, has the highest revenue projection.

Choosing between these alternatives involves a policy choice. However, the fact remains that either of these alternatives would be deployable if two new fast ferries were acquired. In essence, deploying either would require the same initial decision regarding capital resource allocation. The fact that both 2h and 2g would use the same combination of new vessels (two new fast ferries each), suggests that investing in 2h/2g equipment may enable the system to generate higher revenues than would be possible under 2f. This equipment could be described as more "fluid," or better allocated toward routes that may generate more revenue in the future.

In short, the differences between alternatives 2g and 2h are operational. As just noted, both would require the purchase and operation of two new fast ferries. In terms of selecting a preferred alternative, the most reasonable recommendation is as follows:

- Two new fast ferries should be acquired.
- The operational configuration adopted should balance the needs of particular communities with economic development and financial goals.

INTRODUCTION

Described in this technical memorandum is the evaluation process leading to the selection of a preferred alternative for the Prince William Sound/Copper River Area Transportation Plan. The development and evaluation of alternatives for this study occurred in two separate phases: (1) development and evaluation of initial alternatives; and (2) refinement of the most promising initial alternatives into final alternatives, a process which included more detailed operational, cost and revenue analyses.

INITIAL ALTERNATIVES DEVELOPMENT

The alternatives evaluated in this report have diverse origins, including the Prince William Sound/Copper River Area Transportation Plan goals and objectives;[5] the Advisory Committee's ongoing comments and guidance; the results of a survey administered to residents of Cordova, Chenega, and Tatitlek;[6] suggestions relayed by Statewide Planning Chief Jeff Ottesen based on his November 7, 1998, meeting with Prince William Sound area mayors; and the consultant team's analysis of existing and potential service. A list of potential transportation alternatives was first presented to the Prince William Sound/Copper River Area Transportation Advisory Committee in December 1998. At the Advisory Committee's suggestion, several additional marine alternatives, including one with a timed transfer at Valdez, were added to the list and subsequently developed. A Copper River Railroad alternative was initially considered by dropped from further consideration at an Advisory Committee meeting held on February 9, 1999, because the expected benefits were extremely low relative to cost.

Although initial research and analysis included both roadway and railroad projects, the focus of the initial and final alternatives in this transportation plan is on marine service. There are several reasons for this focus, chief among which is the study area's geography. The study area's principal communities lie along the coasts of Prince William Sound; as such, they can often be connected most directly, and with the least environmental impact, by sea. Another reason for this focus is the fact that the DOT&PF has more direct control over marine service than it does over aviation. While the State owns and operates the Alaska Marine Highway System, its ability to influence the aviation services offered by private airlines is extremely limited. Private airlines base the level and type of service they offer on market conditions. As such, the State's role in air transportation focuses on the provision of airport and air terminal facilities—their construction, maintenance, and operations. While this duty represents a significant expenditure of funding and effort, the state remains limited in the extent to which it can induce airlines to serve communities at all; much less dictate schedules, fares, or routes.

Ultimately, nine initial marine alternatives (including a baseline no-build alternative) were developed and carried forward for evaluation.[7] The initial alternatives fell into three broad categories: (1) alternatives that either reflect existing conditions or that involve alterations of service using existing AMHS vessels; (2) alternatives that provide service using new high-speed

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5 *Prince William Sound Copper River Area Transportation Plan Goals and Objectives* (July 1998).

6 The methodology and results of this survey were documented in an earlier deliverable, *Cordova, Chenega Bay and Tatitlek Travel Survey*, October 1998.

7 Full descriptions of the initial alternatives are contained in *Prince William Sound Copper River Area Transportation Plan Preliminary Alternatives Technical Memorandum* (February 1999).

and/or high-powered vessels; and (3) an alternative that would supplement use of an existing vessel with a new high-speed vessel.

SCORING OF THE INITIAL ALTERNATIVES

MOE Development and Refinement

These initial alternatives were then evaluated against a set of measures of effectiveness established earlier in the study process. The highest ranking initial alternatives, as measured by multiple criteria, including service levels, capacity, and operating and capital costs, were then amended and further developed, a process that resulted in the articulation of three final alternatives for comparison against one another and against the baseline no-build alternative. Recommendation of a preferred alternative for the Prince William Sound Transportation Plan falls out of this second evaluation step.

The measures of effectiveness used in this evaluation were first set forth in January 1999, and described in an earlier technical memorandum.[8] Prior to the evaluation of the initial and final alternatives, the criteria set forth in this document were refined to better reflect the nature of the alternatives that emerged as a result of the planning process. For instance, whereas the original document contained 14 separate measures of effectiveness, the consultant team found that these could be consolidated into seven MOEs, without any loss of specificity. One change, for instance, removed as a separate MOE "Would improvements reduce maintenance and operations (M&O) costs?" because M&O costs are accounted for more directly in calculating each alternative's value index, which relates the combined MOE score to capital and operating costs, as well as demand. Another MOE, "improves safety," was also dropped because none of the improvements would effect appreciable changes in safety—adherence to federally mandated safety standards is simply a condition of providing AMHS service. Other MOEs were adjusted to more accurately reflect the improvements in service that could be achieved through some of the proposed alternatives. For instance, whereas a 5 ranking for the original MOE #2, "Improves Travel Time," would require that "project provides significant travel time savings over existing service," this MOE was revised to read "Vessels operate at a higher speed, offering significant travel time savings." The final MOEs, weightings and scoring criteria are listed in Table 1.

[8] *Prince William Sound/Copper River Transportation Plan: Evaluation Process and Criteria Technical Memorandum* (January 1999).

Table 1
MOEs, Weighting, and Scoring Criteria for Alternatives Evaluation

		Scoring Criteria				
MOE	**Weight**	**(5)**	**(3)**	**(0)**	**(-3)**	**(-5)**
1. Improves Intermodal Transportation	2	Greatly improves the connection between modes, and provides an increase in service.	Moderately improves the connection between modes, may provide service during more weeks of the year, and provides an increase in service.	Does not improve the connection between modes, and does not provide marked increase in service.	Moderately decreases the connection between modes and decreases service.	Greatly decreases the connection between modes and decreases service.
2. Improves Travel Time	3	Vessels operate at a higher speed, offering significant travel time savings over existing service.	Vessels operate at a higher speed, offering moderate travel time savings over existing service.	Project has no effect on travel time.	Project has moderate adverse impact on travel time over existing service.	Project has serious adverse impact on travel time over existing service.
3. Improves Service Convenience	3	Project provides a significant improvement in transportation service convenience, as measured through the number of port calls.	Project provides a moderate improvement in transportation service convenience, as measured through the number of port calls.	Project has little to no effect on transportation service convenience.	Project provides a moderate degradation in transportation service convenience, as measured through the number of port calls.	Project provides a significant degradation in transportation service convenience, as measured through the number of port calls.
4. Exploits backhaul potential	2	Van-carrying capacity times service frequency suggests a significant increase in potential freight movement.	Van-carrying capacity times service frequency suggests a moderate increase in potential freight movement.	Project offers no opportunity to exploit backhaul potential over existing conditions.	Van-carrying capacity times service frequency suggests a moderate decrease in potential freight movement.	Van-carrying capacity times service frequency suggests a significant decrease in potential freight movement.
5. Health and Quality of Life.	5	This project provides a significant contribution to improved health or quality of life, by significantly improving service to a relatively large population in the region.	This project provides a moderate contribution to improved health or quality of life, by moderately improving service to a relatively large population in the region.	Project will not affect quality of life issues	Project causes moderate degradation to health or quality of life to a relatively large population in the region by reducing some service.	Project causes significant degradation to health or quality of life to a relatively large population in the region by reducing service.
6. Enhances regional economic development	4	Significant economic benefits; endorsed as an economic development project by local, borough, or state government.	Expanded capacity or new access specifically built to support regional or local industrial, commercial, or resource development.	Does not provide economic opportunities or benefits or provides non-crucial benefit to existing economic activity.	N/A	N/A
7. Environmental Readiness	2	Environmental approval likely with Categorical Exclusion or already complete.	Environmental approval likely with Environmental Assessment or draft documents circulated.	Environmental approval likely with Environmental Impact Statement.	Environmental approval extremely difficult; 50/50 chance.	Environmental approval unlikely.

Calculation of Value Index Scores

In order to relate the initial alternatives' benefits as measured by the MOEs, including travel time and convenience to their respective costs, a value index measurement was developed. Value index scores for each initial alternative were calculated by dividing weighted MOE scores by a metric capturing each alternative's capital and operating costs per unit served.[9] Costs per unit served were arrived at by dividing each alternative's costs by a travel demand estimate specifically tailored to that alternative. These travel demand estimates were reported in a separate technical memorandum, *Prince William Sound Copper River Area Travel Demand Forecasts*, (November 1999).

OPERATING AND CAPITAL COST ESTIMATES

Calculation of operating costs was relatively straightforward. These cost estimates take into account a number of variables, including the number and type of crew required, number of port calls, and number of hours that the crew is out. Operating costs for the no-build baseline alternative were based on historical data. Detail on the operating costs for each alternative is provided in *Prince William Sound/Copper River Area Transportation Plan Preliminary Alternatives Technical Memorandum* (February 1999).

The value index measurement also took into account capital costs, which was more complicated. Two different types of capital costs are associated with the initial alternatives: (1) vessel acquisition costs for new vessels, which are assumed for the purposes of this analysis to be incurred in a lump sum; and (2) capital costs for existing vessels that are projected to be incurred at various points in time. Projected capital cost estimates for existing AMHS vessels are documented in *Alaska Marine Highway System Vessel Refurbishment and Fleet Replacement Study* (The Glosten Associates, October 1998). This document sets forth the needed capital improvements for each AMHS vessel through the vessels' expected life, specified by year. For instance, the *Tustumena* is scheduled for reconditioning of her electrical power distribution systems, at an estimated cost of $250,000, in 2004 (Table 2)

[9] Although the use of a value index was useful in analyzing the initial alternatives, a similar approach was not used in analyzing the final alternatives, where the MOE scores were much closer, and where revenue estimates could be used to assess the final alternatives' need for subsidy or expected surplus revenues over operating costs.

Table 2.
Capital Improvement Costs by Ship and Year
(1999 Dollars)

YEAR	VESSEL		
	Tustumena	***Bartlett***	***Aurora***
2000		$276,000	$1,700,000
2001	$600,000		$2,922,000
2002			
2003	$4,440,000		$9,800,000
2004	$250,000	$2,640,000	$1,680,000
2005	$1,110,000		
2006	$3,684,000	$120,000	$2,000,000
2007	$300,000		$6,120,000
2008		$240,000	$240,000
2009	$360,000	$72,000	$180,000
2010	$300,000	$360,000	$1,510,000
2011	$14,400,000	$1,200,000	
2012	$8,592,000	$650,000	$132,000
2013			
2014	$2,580,000	$240,000	$240,000
2015	$300,000	$10,800,000	
2016			
2017		$240,000	$700,000
2018	$300,000	$1,200,000	$1,200,000
2019		$240,000	$1,920,000
2020	$1,800,000		$1,000,000

To make these capital outlays comparable financially, the net present value was calculated for each. This was done in two steps. The first step was to lay out all capital costs for each alternative for each year through the study period horizon of 2020. A capital recovery factor (CRF) was then calculated for each projected expenditure. The CRF is the annual loan payment for capital amount that would pay off capital at the end of the evaluation period (2020) where the loan interest rate equals the discount rate of 7 percent. The next step was to calculate the present value of that stream of annual loan payments through the end of the study period. The result of this analysis was a single value, a net present capital cost value for each initial alternative. Because federal sources typically provides about 80 percent of capital funding, a 20 percent value was used to reflect actual capital costs to the State.

DEMAND

Costs were also related to resident demand.[10] Demand estimates specific to each initial alternatives had been developed in an earlier report, *Prince William Sound/Copper River Area*

[10] At this point in the evaluation, it was thought more useful to use resident demand, as opposed to resident demand plus visitor demand in the calculation of cost per unit served. The reasoning behind this decision was two-fold. First, the primary mission of the AMHS is to provide basic transportation services—as opposed to accommodating tourist demand. Second, it had already been decided that the final alternatives would be subjected to an intensive revenue analysis, which would take into explicit account the revenues that could be generated by various means of configuring service to meet tourist demand. To

Transportation Plan Travel Demand Estimates Technical Memorandum (November 1999). These estimates were carried forward in this element of the value index score calculation. The element relating cost to demand was "cost per unit served"

$$\text{Cost Per Unit Served (CU)} = \frac{\text{Annual Operating Cost + (0.20 x Annual Capital Cost)}}{\text{AMHS Passenger Demand Forecast for Residents (2020 Base)}}$$

The Value Index Measurement Equation

Ultimately, the value index score was derived for each initial alternative by dividing its weighted MOE total by the corresponding cost per unit served. To highlight variation among the scores, all scores were multiplied by 100.

$$\text{Value Index Score} = \frac{\text{Total Weighted MOE Score (WT)}}{\text{Cost Per Unit Served (CU)}} \times 100$$

The following section of this report applies the MOE and value index methodologies just described to each of the initial alternatives (following a brief recap of each alternative).

INITIAL ALTERNATIVES EVALUATION

BRIEF RECAP OF THE INITIAL PWS ALTERNATIVES

An earlier document, *Initial Transportation System Alternatives* (October 1999)[11] described in considerable detail the initial alternatives that are evaluated herein. Reproduced below are highlights from that report for the reader's convenience. The original document should be referenced for detailed information on items such as schedule and operating cost breakdowns. Initial alternatives fall into three categories.

The alternatives in the first group, which includes the no-build baseline, all rely entirely on vessels already owned and operated by the AMHS. The alternatives in the second group (2a, 2b, 2c, 2d, and 2e) would each require the purchase of at least one additional vessel by AMHS. The alternatives constitute various combinations of new high-speed and new high-powered vessels. All of the alternatives in the second group represent a significant shift from current AMHS operations in that all of these alternatives are based on a dayboat concept wherein each vessels completes its sailings within the bounds of a 12-hour service day. This shift has several positive implications. First, dayboat operations are associated with lower overall operating costs. Second, dayboat operations make it possible to provide much more convenient service to area residents and visitors. Sailings can leave during the day on a regular, repeating schedule. Third, travel times are faster.

The third "group" comprises a single hybrid alternative, which would supplement existing AMHS vessels with a new high-speed vessel. Table 3 contains a synopsis of the initial alternatives. This table is followed by brief summaries of each initial alternative.

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count tourist demand twice, in essence, would have detracted from full assessment of the value of the various alternatives to Prince William Sound study area residents, who rely on AMHS service year round.

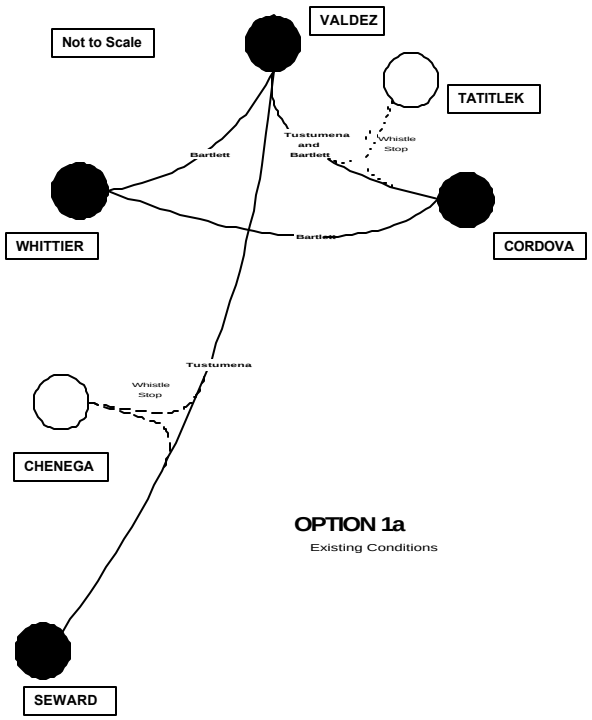
[11] *Prince William Sound/Copper River Study Area Transportation Plan: Initial Transportation System Alternatives Technical Memorandum*, Parsons Brinckerhoff, The Glosten Associates, HDR Alaska, and Northern Economics, October 1999.

Table 3.
Summary of Initial Alternatives

INITIAL ALTERNATIVES			
	Vessels	**Standard**	**Off-Season**
1a	*Tustumena* and *Bartlett*	Baseline no-build (Existing Conditions)	No off-season analysis performed
1b	*Aurora* replaces *Bartlett*	Existing Conditions, but Aurora replaces the *Bartlett*	No off-season analysis performed
1c.1	Existing vessels, but provide 11 service weeks per year, using *Bartlett*	Existing Conditions, but use *Bartlett* to provide 45 weeks of service v. current 34	No off-season analysis performed
1c.2	Existing vessels, but provide 11 service weeks per year, using *Aurora*	Existing Conditions, but use *Aurora* to provide 45 weeks of service vs. 34	No off-season analysis performed
2a	Two new vessels, high-powered or high-speed	New vessels homeported at WHT and CDV. Timed transfer at Valdez	No off-season analysis performed
2b	One new high-speed vessel	High triangle, could be homeported at CDV, VDA, or WHT	No off-season analysis performed
2c	One new high -speed vessel	Could be homeported at CDV, VDZ, or WHT. Loop service, alternate directions	No off-season analysis performed
2d	One new high -speed, one new high-powered	Hi-speed vessel makes 2 RTs WHT-VDZ. New high-powered vessel makes one RT CDV-VDZ. Daily VDZ timed transfer possible.	No off-season analysis performed
2e	One new high -speed, one new high-powered	Like 2d	During the off-season there is no service to Whittier; the only service provided is CDV-VDZ. Dropped because there is no connection CDV-WHT. This is the only alternative in the long list that is not evaluated.[12]
3a	One new high-speed vessel; *Bartlett* or *Aurora* to supplement	One new high-speed vessel to provide loop service, supplemented by *Aurora* or *Bartlett* six days a week during the summer WHT-VDZ (6/7) and CHG-WHT (1/7)	Off-season, could revert to existing service (via *Bartlett* or *Aurora*); or go to pure loop service.

[12] 2e is not evaluated because the Advisory Committee requested that it not be carried forward because it lacks a direct connection between Cordova and Whittier during the off-season.

Alternative 1a
Existing Conditions



Tustumena: Prince William Sound ports of Cordova and Valdez are served by the *Tustumena* with slightly less than weekly service during the summer and somewhat more frequent service (approximately twice weekly) during the winter. *Tustumena* connects to Seward on same frequency of service. *Tustumena* offers whistle-stop service to Tatitlek and Chenega.

Bartlett: The *Bartlett* serves the Prince William Sound ports of Cordova, Valdez, and Whittier with approximately daily service to Whittier and Valdez, and three times a week service to Cordova. *Bartlett* offers whistle-stop service to Tatitlek.

CONSIDERATIONS

- This alternative is included as a baseline against which other alternatives can be compared. One of its advantages is that the vessels used are already owned by the AMHS. However, it has several shortcomings, including the following:

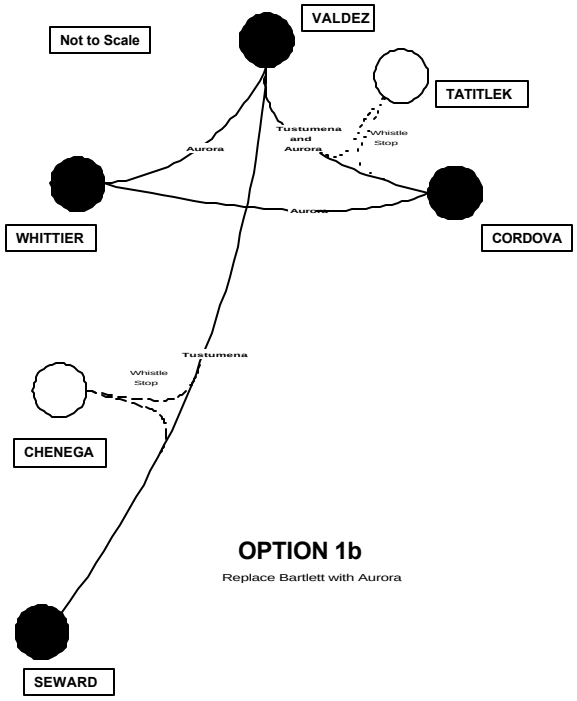
- Many capital improvements to the *Bartlett* are needed. Insofar as these improvements may cost up to 80 percent of the cost of replacement, it is worth considering, especially in the context of a 20-year plan, whether such a cost is justified, or whether needs would be better served by purchasing a new vessel or vessels.

- Existing capacity, particularly between Whittier and Valdez during the summer peak, is considered insufficient. The opening of the Whittier Tunnel will further increase demand.

- Existing schedules are inconvenient.[13]

[13] *Draft Cordova, Chenega Bay, and Tatitlek Ferry Use Survey*, prepared by Parsons Brinckerhoff and Northern Economics for the Alaska Department of Transportation and Public Facilities, October 1998.

Alternative 1b
Existing Conditions Except that *Bartlett* is Replaced by *Aurora*



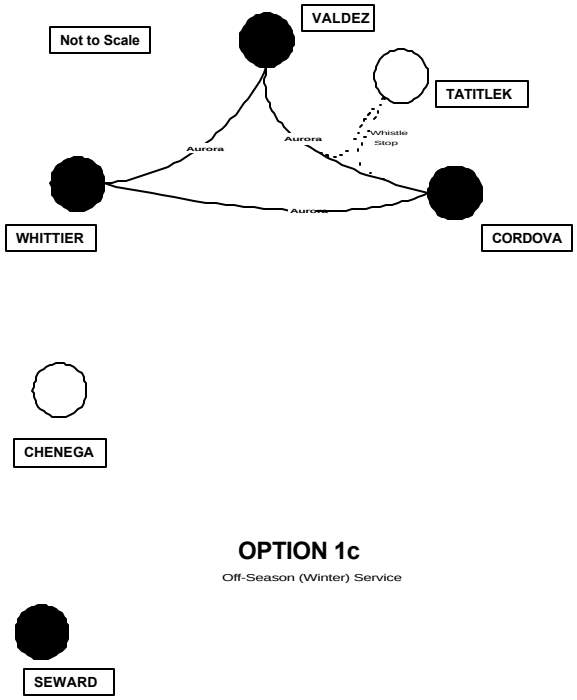
This alternative is similar to Alternative 1a (existing conditions) except that the *Bartlett* (Vehicle Capacity ≈ 41, Service Speed ≈ 13.6 kts.) would be replaced by the *Aurora* (Vehicle Capacity ≈ 44, Service Speed ≈ 14.5 kts.).

CONSIDERATIONS

- This alternative is presented because of the possibility that the *Aurora* may be released (surplused) from service in Southeast Alaska. Given the *Bartlett*'s need for expensive capital improvements, deploying the *Aurora* in Prince William Sound may be more cost-effective.

- The *Aurora* would also provide some improvement in service, insofar as it has slightly more capacity than the *Bartlett* and is somewhat faster.

Alternative 1c
45-Week Service Concept



Over the three-year period from 1996 to 1998 the *Bartlett* averaged 34 weeks of service annually (shown in Alternatives 1a and 1b). Expanding the *Bartlett's* service to 45 weeks, or the service of the *Aurora* acting as a replacement to the *Bartlett*, would compensate for eliminating *Tustumena* service to Prince William Sound, except that the Prince William Sound connection to Seward would be eliminated, and Chenega would not receive service. Option 1c.1 would use the *Bartlett*, while Option 1c.2 would use the *Aurora*.

CONSIDERATIONS

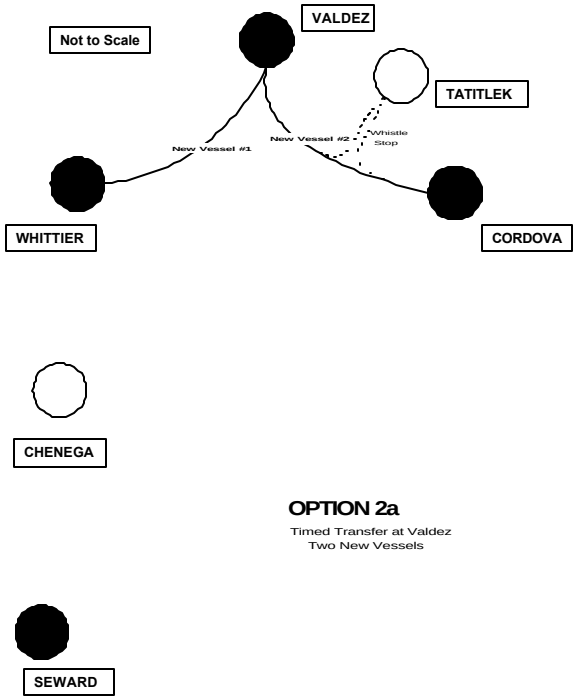
- This alternative would provide an increase in winter service levels by providing service to Whittier an additional 11 weeks per year. This would improve regional connectivity,

especially in light of the Whittier Access Project.

- This alternative provides additional capacity and service using existing AMHS vessels.

- While this alternative improves year-round access to Whittier (and, by extension, to the rest of the Alaskan roadway network) it does not address the anticipated increase in demand for Whittier service during the summer peak.

Alternative 2a
Timed Transfer at Valdez



Imposing the restriction that new services be dayboat services (for reasons of operating economics), this service would require two new vessels. Depending on the number of daily round trips, this service could be provided by two new high-powered conventional monohulls or two new high-speed vessels.[14]

The basic concept is that vessels are homeported at Whittier and Cordova. A voyage cycle begins with departures from both Whittier and Cordova, timed for near simultaneous arrival in Valdez. Traffic destined from Whittier to Cordova, or from Cordova to Whittier, changes vessels in Valdez. Vessels complete the round trip cycle by returning from Valdez to their respective homeports.

CONSIDERATIONS

- This alternative was considered at the request of the Prince William Sound/Copper River Study Area Advisory Committee.

- This alternative represents the only means by which a dayboat concept

[14] All analyses are based on the assumption of a 365-day a year service schedule. A more refined analysis would have to take into account the period each year during which a vessel would be out of service for maintenance.

could be achieved using conventional vessels (as opposed to "fast-ferry" technology).

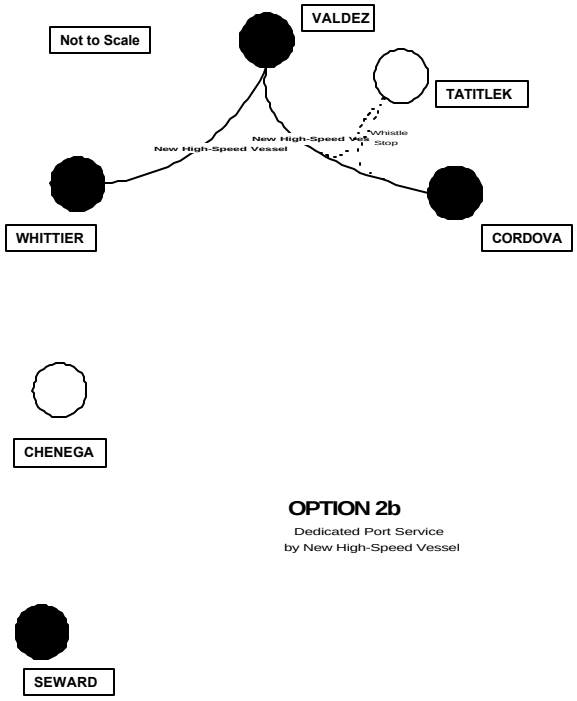
- Although this alternative is cost competitive with fast ferries, its service quality is not as high. Demand elasticity is a related issue; with fast ferries, it is possible that more riders would be attracted by the shorter travel times.

Although traffic demand and minimum speed required on the Whittier–Valdez segment differ slightly from Cordova–Valdez requirements, this service would be provided by two identical vessels, due to management considerations and potential cost savings from series production.

Analysis indicates that the timed transfer option is not cost competitive at low demand levels because it requires two vessels. At higher demand levels, where multiple vessels might be required for the other options as well, it still has higher operating costs. Weighted travel times[15] are similar to those expected from the dedicated port service option. However, passengers and vehicles bound for Cordova from Whittier, or vice versa, must disembark and re-board the second vessel in Valdez. This inconvenience could be allayed by exchanging crews, rather than passengers, at Valdez.

[15] Weighted travel time is the sum of travel time for each of the six directional origin-destination pairs, each multiplied by its relative historical passenger traffic volume.

Alternative 2b
Dedicated Port Service by a New High-Speed Vessel



A new high-speed vessel would sail daily from a homeport located at Whittier, Valdez, or Cordova. The vessel would operate as a dayboat, returning to its homeport within the confines of a 12- or 16-hour service day (with start-up and shut-down periods provided at the beginning and end of the service day).

For a Whittier homeport, the daily service order would be: W-V-C-V-W.

For a Cordova homeport, the daily service order would be: C-V-W-V-C.

For a Valdez homeport, the daily service order would be either: V-W-V-C-V or V-C-V-W-V.

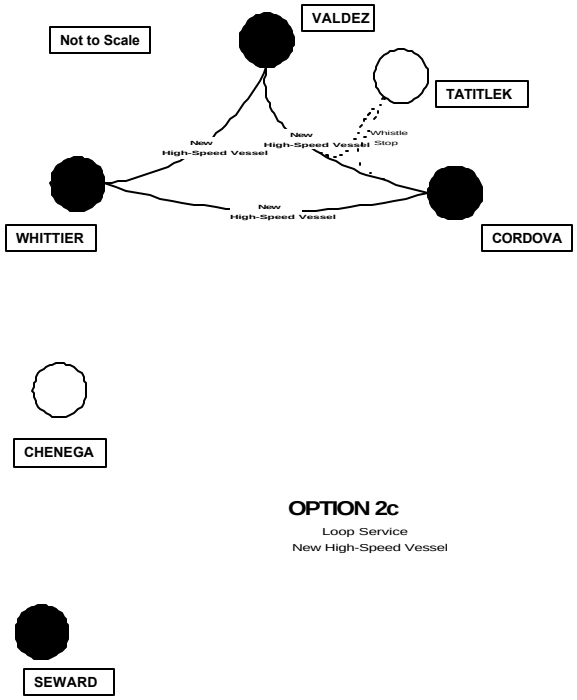
The new high-speed vessel would provide whistle-stop service to Tatitlek.

CONSIDERATIONS

- Initial analysis indicates that this alternative performs well in terms of both service and cost.
- A disadvantage is that Cordova and Whittier are not linked directly.
- Cordova, Whittier, and Valdez are all served every day, on a consistent schedule.

This alternative is generally superior to the other high-speed options in terms of acquisition cost, operating cost and 20-year life cycle cost. The choice of homeport does not influence the results. Dedicated port service also provides better service than the loop service. The weighted travel times are lower than those for loop service because dedicated port service provides no direct connection between Whittier and Cordova, the link with historically lowest passenger demand. At higher demand levels, the timed transfer option provides shorter travel times than dedicated port service, but at a much higher cost.

Alternative 2c
Loop Service by a New High-Speed Vessel



A new high-speed vessel would sail daily from a homeport located at Whittier, Valdez, or Cordova. The vessel would operate as a dayboat, returning to its homeport within the confines of a 12- to 16-hour service day (with start-up and shut-down periods provided at the beginning and end of the service day).

For a Whittier homeport, the daily service order would be either: W-V-C-W or W-C-V-W.

For a Cordova homeport, the daily service order would be either: C-V-W-C or C-W-V-C.

For a Valdez homeport, the daily service order would be either: V-W-C-V or V-C-W-V.

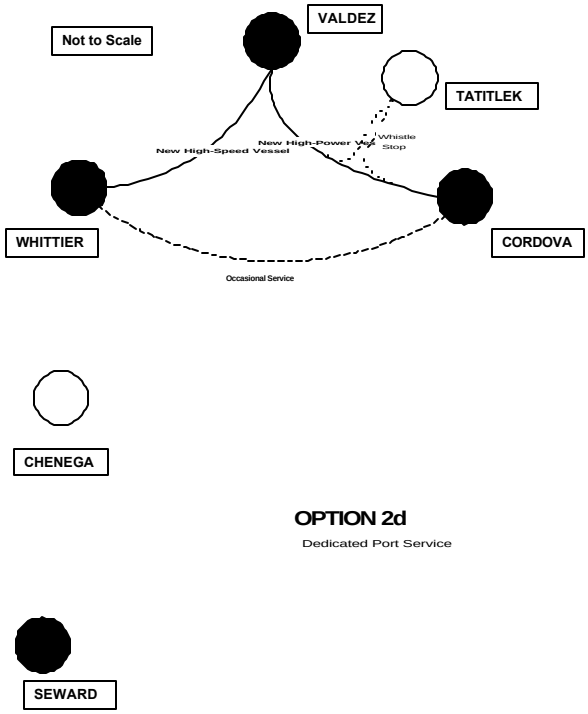
Service orders could be altered on different days.

CONSIDERATIONS

- Unlike Alternative 2b, Cordova is linked directly with Whittier.
- A disadvantage is that an overnight layover would be required for that route without alternating service.
- The new high-speed vessel would provide whistle-stop service to Tatitlek.

Loop service was evaluated based on the assumption of service direction alternating day to day. Since loop service cannot serve one origin-destination pair in one direction, an overnight layover would be required for that route without alternating service. For example, if the vessel were homeported in Whittier, and operated daily clockwise service, passengers travelling from Cordova to Valdez would have to overnight in Whittier *en route* to Valdez. Alternating service directions would mean that those passengers could simply wait until the next day for direct same-day service. At lower demand levels (ADT = 100) weighted travel times are considerably higher than those provided by the dedicated port service alternative. At an ADT of 250, at which point two vessels would be required, travel times would improve markedly, since one vessel would operate in each loop direction.

Alternative 2d
Dedicated Port Service by Two New Vessels



Again imposing the restriction that new service be based on the dayboat concept (for reasons of operating economics), this plan would require two new vessels: a new high-powered conventional monohull and a new high-speed vessel.

The new high-powered monohull would make a daily round trip between Cordova and Valdez. The vessel would operate as a dayboat, completing a round trip within a 12-hour service day. A new high-speed vessel would make two roundtrips per day between Valdez and Whittier. This vessel would also operate as a dayboat, either with one crew shift within the constraints of a 12-hour service day, or with two crew shifts and a mid-day crew change, within a 16-hour service day.

Both vessel schedules could be arranged for a single daily transfer at Valdez.

CONSIDERATIONS

- This option would require a conventional monohull vessel with a service speed of at least 15.2 knots for the Cordova-Valdez service. A service speed of 15.2 knots would be adequate for a daily round trip, including a whistle stop at Tatitlek, within the constraints of a 12-hour service day, inclusive of morning startup, loading and unloading, and evening shutdown.

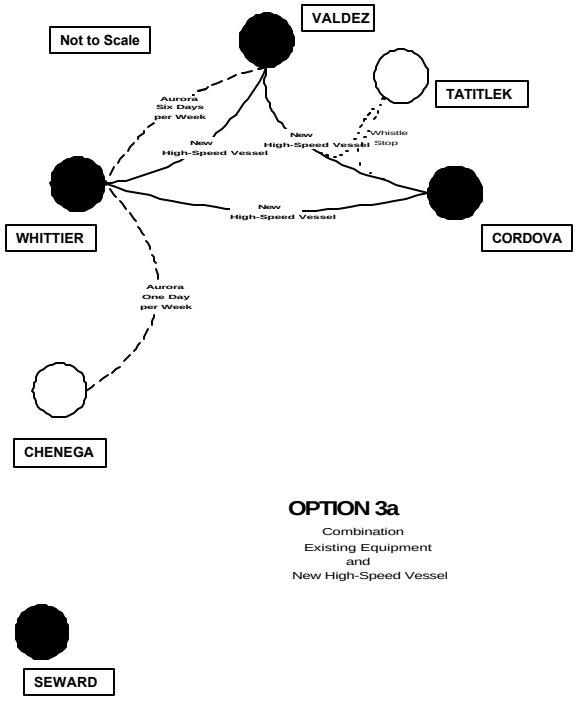
- The Valdez-Whittier service would require a high-speed vessel. A service speed of 36.8 knots would be required to accomplish two round trips in a 12-hour day; 25.0 knots in a 16-hour day. One crew shift could operate the vessel within a 12-hour service day. If the 16-hour service day were selected, then two crew shifts would be required with a crew change at midday. Out of season, this vessel could also be used

to provide a dayboat service between Cordova and Whittier, where a speed of 31.2 knots would be required for a 12-hour day (and where no comparable 16-hour service day option exists since there is no opportunity for a mid-day crew change at a homeport).

Alternative 2e
Dedicated Port Service by Two New Vessels

2e is similar to 2d except that during the off-season, there is no service to Whittier; the only service provided is from Cordova to Valdez. This alternative was dropped at the Prince William Sound/Copper River Area Advisory Committee's request, due to its lack of a direct connection between Cordova and Whittier during the off-season.

Alternative 3a
Combination of Existing Equipment and New High-Speed Vessel



This alternative would combine a new high-speed service such as that described as Alternative 2c (loop service) with service by an existing vessel, such as the *Aurora* or *Bartlett*.

Under this alternative, the *Aurora* or *Bartlett* would provide supplemental service six days a week between Whittier and Valdez during the summer season, and would provide service between Chenega and Whittier one day a week.

Off-season variants on this alternative would be to revert to: *i*) Alternatives 1a or 1b (existing service or existing service with the *Aurora* assuming the *Bartlett's* current role); *ii*) Alternative 1c (*Aurora* only); or *iii*) a pure version of Alternative 2c (loop service) with no supplemental service from the *Aurora* (or *Bartlett*).

CONSIDERATIONS

- This configuration represents the "do-everything" scenario.
- It provides high capacity and two port calls per day on the Whittier origin-

destination pair, except Chenega, which is served once a week.

- This alternative's overriding disadvantage is its very high cost.

MOE SCORING AND VALUE INDEX CALCULATIONS

Each of the initial alternatives just described was scored on each of seven weighted Measures of Effectiveness (MOE). The results of this scoring are contained in Table 4. Table 5 contains the cost and demand data used in calculating each initial alternative's value index score.

Table 4.
MOE Scoring of Initial Alternatives

	MOE 1		MOE 2		MOE 3		MOE 4		MOE 5		MOE 6		MOE 7		
	Improves Intermodal Transportation		**Improves Travel Time**		**Improves Service Convenience**		**Exploits Backhaul Potential**		**Health and Quality of Life**		**Enhances Regional Economic Development**		**Environmental Readiness**		**Total Weighted MOE Score (WT)**
	Score	Weight	Score	Weight	Score	Weight	Score	Weight	Score	Weight	Score	Weight	Score	Weight	
Alternative 1a – Baseline	0	0	0	0	0	0	0	0	0	0	0	0	5	10	10
Alternative 1b – Replace *Bartlett* with *Aurora*	0	0	0	0	0	0	0	0	0	0	0	0	5	10	10
Alternative 1c – 45-Week Service *(Bartlett)*	1	2	0	0	0	0	0	0	-1	-5	0	0	5	10	7
Alternative 1c – 45-Week Service (Aurora)	1	2	0	0	0	0	0	0	-1	-5	0	0	5	10	7
Alternative 2a – Timed Transfer at Valdez	3	6	3	9	4	12	0	0	-1	-5	1	4	2	4	30
Alternative 2b – Dedicated Port Service by New High-Speed Vessel	2	4	3	9	4	12	0	0	-1	-5	1	4	2	4	28
Alternative 2c – Loop Service by New High-Speed Vessel	3	6	3	9	3	9	-1	-2	-1	-5	1	4	2	4	25
Alternative 2d – Dedicated Port Service by Two New Vessels	3	6	2	6	5	15	1	2	-1	-5	1	4	2	4	32
Alternative 3a – Combination of Existing Equipment and New High-Speed Vessel	1	2	2	6	3	9	2	4	0	0	1	4	2	4	29

Table 5.
Value Index Calculations for Initial Alternatives

	Total Weighted MOE Score (WT)	Total Capital Cost	PV of Total Capital Cost	State Share (20%) of Total Capital Cost	Annual Operating Cost	PV of Annual Operating Cost (through 2020)	Annual Resident Demand Estimate	Resident Demand Estimate (through 2020)	Cost per Unit of Resident Demand (CU)	Value Index Score (WT/CU)* 100	RANK
Alternative 1a – Baseline	10	$28,995,695	$12,822,799	$2,564,560	$6,340,000	$68,697,243	19,341	386,827	$184	5.4	6
Alternative 1b – Replace *Bartlett* with *Aurora*	10	$42,061,695	$25,237,312	$5,047,462	$8,460,000	$91,668,561	19,342	386,836	$250	4.0	7
Alternative 1c – 45-Week Service *(Bartlett)*	7	$57,294,000	$26,702,941	$5,340,588	$5,600,000	$60,678,953	16,769	335,386	$197	3.6	8
Alternative 1c – 45-Week Service (Aurora)	7	$70,360,000	$39,117,455	$7,823,491	$8,160,000	$88,417,903	16,769	335,386	$287	2.4	9
Alternative 2a – Timed Transfer at Valdez	30	$84,700,000	$69,140,430	$13,828,086	$16,560,000	$160,958,387	36,558	731,160	$239	12.5	5
Alternative 2b – Dedicated Port Service by New High-Speed Vessel	28	$37,800,000	$30,856,060	$6,171,212	$7,660,000	$80,613,555	36,558	731,160	$119	**23.6**	**2**
Alternative 2c – Loop Service by New High-Speed Vessel	25	$45,500,000	$37,141,553	$7,428,311	$8,100,000	$84,585,659	29,603	592,063	$155	**16.1**	**3**
Alternative 2d – Dedicated Port Service by Two New Vessels	32	$71,900,000	$58,691,817	$11,738,363	$11,100,000	$111,668,187	46,626	932,529	$132	**24.2**	**1**
Alternative 3a – Combination of Existing Equipment and New High-Speed Vessel	29	$89,902,000	$66,257,653	$13,251,531	$14,100,000	$138,750,714	38,806	776,127	$196	14.8	4

SELECTION OF ALTERNATIVES FOR FINAL ANALYSIS

Systematically comparing the effectiveness of each initial alternative to cost per unit served is useful in establishing several points:

- The three highest ranking alternatives—2d, 2b, and 2c—are all based on a service concept that would replace conventional AMHS vessels with new fast-ferry technology. The lowest ranking alternatives are those that attempt to improve service in Prince William Sound by redeploying existing vessels or by reconfiguring service schedules without adding new higher-speed vessels.

- The baseline no-build alternative in fact entails significant capital costs because of needed capital improvements for existing vessels, which are decades old.

- Replacing the *Bartlett* with the *Aurora* as a means of improving service in Prince William Sound provides no advantages in terms of benefit relative to cost. In fact, this alternative scores below the baseline no-build alternative.

- While 3a, which would supplement an existing vessel with service by a new high-speed vessel scores higher than alternatives that have no new vessels, it does not score as high as do alternatives with two new vessels. Both capital and operating costs for this alternative are quite high.

CONCLUSION

The results of the evaluation of the initial alternatives indicate that those alternatives that would serve the study area with some combination of high-speed and high-powered new vessels should be carried forward for further analysis and evaluation at a more detailed level. The "Do Nothing" alternative will also be carried forward for baseline comparison. The refinements performed to develop the initial alternatives into final alternatives include the following analyses:

- More sophisticated demand projections that take into account (1) the improved quality and convenience of service achievable through implementation of the dayboat service concept; and (2) seasonal peaking.

- Determination of each alternative's "scalability," or ability to flex its level of service according to demand by season.

- Estimation of each alternative's revenue-generating capacity, including the baseline no-build alternative.

EVALUATION OF THE FINAL ALTERNATIVES

DESCRIPTION OF THE FINAL ALTERNATIVES

The initial alternatives that proved most promising were subjected to additional analyses and refinement. The results of these refinements are reflected in the final alternatives' service concepts and operating costs.

A major distinction between the initial and final alternatives is that the final alternatives contain separate peak and off-peak service concepts. (Although, to be precise, it must be mentioned that each of the final alternatives shares a common off-peak service concept). The final alternatives differ in terms of how peak season service is configured. The rationale for separating service into these periods is to capture tourist traffic during the peak while providing a level of service in line with demand for the rest of the year. In so doing, operating cost estimates can be reduced compared to the initial alternatives. Revenue estimates developed by Northern Economics were also provided for each of the final alternatives as well as for the baseline no-build alternative.

The final alternatives are related to the initial alternatives as follows (the final alternatives are also summarized in Table 6 and described in more detail in the next section of this report):

- Alternative 2f is essentially a refinement of Alternative 2a. Each involves two new vessels, and in each alternative, a timed transfer is made in Valdez. Alternative 2f does not provide peak-season direct links between Cordova and Whittier. The number of Whittier-Valdez trips for 2f is equal to the number for 2g.

- Alternative 2g, which entails two new high-speed vessels, combines elements of 2c and 2d. What it has in common with 2c is the fact that one of the high-speed vessels makes a loop of the three Prince William Sound ports of Whittier, Cordova, and Valdez. The loop's direction alternates from circuit to circuit. What it has in common with 2d is that it provides for dedicated port service between Whittier and Valdez during the peak, which is provided by the other high-speed vessel.

- Alternative 2h, which also entails two new high-speed vessels, represents an enhanced version of Alternative 2c, which provides loop service with one new high-speed vessel. Alternative 2h essentially doubles the loop service provided under 2c. Each of the two new high-speed vessels makes a loop of the three PWS ports of Whittier, Cordova, and Valdez daily. One vessel sails clockwise, the other sails counterclockwise. As in Alternatives 2f and 2g, the off-peak service pattern is to provide alternating loop service five days a week. Of the three final alternatives, 2h provides the greatest number of peak-season direct links between Cordova and Whittier. However, it also provides the least peak-season capacity between Whittier and Valdez.

- Each of the final alternatives (excepting the baseline no-build alternative) shares a common off-season service concept. Off-season, only one of the high-speed ferries is used in Prince William Sound; it provides alternating direction loop service five days a week. The other high-speed ferry is used in Southeast during the off-season in order to substitute in for the Southeast ferry during maintenance periods. The peak season is assumed to be a 105-day period centered on July.

- In terms of service concept and configuration, the baseline no-build alternative remains unchanged; it continues to reflect existing conditions.

Table 6.
Summary of Final Alternatives

	Vessels	Peak-Season Service Summary	Off-Season Variant
Baseline No-Build	*Tustumena* plus *Bartlett*	Existing Conditions	Existing Conditions
2f	One new high-speed vessel and one new high-powered vessel	One new high-speed vessel, which serves V-W with 2 RTs/day; one new high-powered conventional vessel, which makes one V-C RT/day	One vessel makes alternating direction loop among Cordova, Whittier and Valdez 5/7 days/week
2g	Two new high-speed vessels	Two new high-speed vessels; one runs 2 RTs/day V-W; the other makes alternating direction loops among Cordova, Whittier and Valdez	Same as 2f
2h	Two new high-speed vessels	Two new high-speed vessels; one each running a loop among Cordova, Whittier and Valdez. One runs clockwise, the other counterclockwise	Same as 2f

Baseline No-Build Alternative

In Prince William Sound, the Bartlett serves Cordova, Valdez and Whittier. The Tustumena provides primary service to Seldovia, Homer, Kodiak, the Alaska Peninsula and the Aleutian Chain. Tustumena's route system also connects Prince William Sound with Seward. The Tustumena provides primary service to Prince William Sound only during periods when the Bartlett is in layup. Connections to the statewide road system are made at Valdez, Seward and Homer.

Compared to the build alternatives, the level of service provided under existing conditions is much lower--in terms of both capacity and convenience. For instance, whereas 27 Cordova to Whittier sailings are available under existing conditions, this number would increase to between 93 to 198 sailings under the build alternatives. Convenience is also an issue. Currently, vessels sail at shifting days of the week and times of day, and often it is necessary to leave or arrive at a port in the middle of the night.

Costs. Annualized capital costs for this alternative over the study period horizon (through 2020) are estimated at $432,000. Annual operating costs run $6.3 million.

Alternative 2f

Peak Season. One high-speed ferry (clone of Southeast FVF) operating in Valdez-Whittier dedicated port service during the summer (two round trips per day) and one high-powered conventional vessel operating in Cordova-Valdez dedicated port service in summer (one round trip per day).

Off-Peak. During the off season, the high-powered conventional vessel would be laid up, and the high-speed ferry would revert to 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.

Costs. Acquisition costs for this alternative are estimated at $53.8 million, and annualized capital costs (through 2020 at 7%) are estimated at $850,000. Annual operating costs are estimated at $6.3 million.

Considerations. During the peak season, this alternative provides a timed transfer at Valdez for Cordova travelers destined for Whittier, but no direct link between Cordova and Whittier. During the off-peak season, however, a direct link between these ports is provided. This is the only build alternative that involves a new high-powered vessel.

Alternative 2g

Peak Season. Two high-speed ferries (clones of the Southeast FVF) operating with one FVF in a dedicated port service between Valdez and Whittier (two round trips per day during the high-season) and the other FVF in an 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.

Off-Peak. In the off-season the FVF dedicated port service between Valdez and Whittier would be shut down and the FVF providing that service would be available to relieve fast vehicle ferries in the Southeast Alaska system while they undergo annual maintenance.

Costs. Acquisition costs for this alternative are estimated at $68.8 million; annualized capital costs (through 2020 at 7%) are estimated at $1.1 million. Annual operating costs are estimated at $6.1 million.

Considerations. This alternative provides the most high-season capacity between Whittier and Valdez; as a consequence, it also has the highest revenue projections.

Alternative 2h

Peak Season. Two high-speed ferries (clones of the Southeast FVF), one operating in daily C-W-V-C loop service and the other in daily C-V-W-C counterloop service during the high-season.

Off-Peak. Same as 2f.

Costs. Acquisition costs for this alternative are estimated at $68.8 million; annualized capital costs (through 2020 at 7%) are estimated at $1.1 million. Annual operating costs are estimated at $6.1 million.

Considerations. This alternative provides the most high-season direct connections between Whittier and Cordova.

KEY OPERATIONAL COMPARISONS

Tables 7 through 11 provide cost, service, and operational details on the final alternatives, including the baseline. Table 7 summarizes the capital and operating costs for each alternative broken down by service element. This table specifies what portion of the alternatives' operational costs are associated with each service element. For instance, this table shows that

dedicated port service between Valdez and Whittier during the peak season is estimated to cost $1.6 million per year to operate. Meanwhile, dedicated port service between Cordova and Valdez is estimated to cost $1 million per year to operate.

Table 8 lists other key service and operational aspects of each alternative, including car capacity, service day hours, days of vessel service, and port calls to Cordova. Port calls to Cordova are of particular interest because of the study area ports to be served under the build alternatives, only Cordovans lack a surface transportation alternative to the AMHS. Also of interest in this table is the contrast in service speeds between existing conditions and the build alternatives. Whereas vessel speeds in the baseline no-build alternative are 12 knots/hour for the *Bartlett* and 13.3 knots/hour for the *Tustumena*, they are higher for the new high-powered vessel proposed in alternative 2f (15.2 knots/hour) and much higher for the new high-speed vessel proposed in each of the build alternatives (around 32 knots/hour).

Table 9 provides a comparison in terms of the number of trip segments per alternative by specified origin and destination pair. Alternative 2h provides the greatest number of direct connections between Cordova and Whittier—nearly eight times more than under the baseline no-build alternative. Alternative 2g, meanwhile, provides the greatest number of direct connections, and hence capacity, between Valdez and Whittier, the chief peak-season visitor route.

Tables 10 and 11 depict the increases in vehicle-carrying capacity achievable through implementation of the build alternatives. Table 10 lists the raw vehicle capacity by segment and alternative, and Table 11 lists ratios of vehicle-carrying capacity under the build alternatives to the baseline no-build.

Table 7.
Final Alternatives Key Summary Statistics

Alt	Service Description	Daily RTs/Vessel	Vessels in Local System	Vessel Type	Car Capacity	Service Day Length	Annual Op. Cost $ million	2020 Revenue Projection $ million	2020 Revenues minus Operating Costs
1a	Existing Conditions	NA	2	*Bartlett*	29	24	$4.20 M		
				Tustumena	36	24	$2.10 M		
							$6.30 M	**$3.37**	**-$2.97 M**
2f	Dedicated Port: (V-W) (High Season)	2	1	New High-Speed	34	12	$1.6 M		
	Dedicated Port: (C-V) (High Season)	1	1	New High-Power	34	12	$1.0 M		
	Off-season	1	1	New High-Speed	34	12	$2.9 M		
			2				**$5.5 M**	**$7.34**	**$1.84 M**
2g	Dedicated Port (V-W) (High Season)	2	1	New High-Speed	34	12	$1.6 M		
	Daily Counter Loop (e.g., C-V-W-C) 105 days per year (High Season)	1	1	New High-Speed	34	12	$1.6 M		
	Off-season	1	1	New High-Speed	34	12	$2.9 M		
			2				**$6.1 M**	**$8.92**	**$2.82 M**
2h	Daily Loop (e.g., C-W-V-C) 105 days per year (High Season)	1	1	New High-Speed	34	12	$1.6 M		
	Daily Counter Loop (e.g., C-V-W-C) 105 days per year (High Season)	1	1	New High-Speed	34	12	$1.6 M		
	Off-season	1	1	New High-Speed	34	12	$2.9 M		
			2				**$6.1 M**	**$7.74**	**$1.64 M**

*Note that these operating cost estimates do not take into account the full costs of operating AMHS service. System management, shoreside facilities, risk management and reservation system costs, for instance, are not included. The reason for this omission is the difficulty in assigning systemwide costs to isolated elements of the AMHS, such as service between specified ports.

Table 8.
Key Comparisons Among Final Alternatives

Alt	Service Concept	Daily RTs per vessel	No. of Vessels in Local System	Vessel Type	Nominal Vessel Car Capacity	Nominal Length of Service Day	Annual Vessel Service Days	Service Speed (knots)	Annual Op. Cost	Acquis. Cost	20 Yr. Life Cycle Cost	Annual Cordova Port Calls
1a	Existing Service	NA	2	*Bartlett*	29	24	238	12.0	$4.20 M	$27.27 M	$99.14 M	98
				Tustumena	36	24	--	13.3	$2.10 M	$10.72 M	$34.52 M	58
								SUM	**$6.3 M**	**$37.99M**	**$133.66 M**	**156**
2f	Dedicated Port: (V-W) (High Season Only)	2	1	New High-Speed	34	12	105	32.3	$1.6 M	$34.4 M	$52.5 M	0
	Dedicated Port: (C-V) (High Season Only)	1	1	New High-Power	34	12	105	15.2	$1.0 M	$19.4 M	$30.7 M	105
	Off-Season Element Alternating Loop (e.g., C-V-W-C; C-W-V-C) 186 days over 37 week off season (5/7 days a week)	1	1	New High-Speed	34	12	186	30.8	$2.9 M	---	$32.9 M	186
								SUM	**$5.5 M**	**$53.8 M**	**$116.1 M**	**291**

Notes regarding Alternative 1a, Existing Conditions Baseline:

Annual Operating Costs for M/V Bartlett based on average for 1996-19992); Annual Operating Costs for M/V Tustumena based on average for 1996-1999 pro-rated to PWS by operating hours; Acquisition Costs for M/V Bartlett are present value (1999 dollars) for capital improvements for 2000-2020; Acquisition Costs for M/V Tustumena are present value (1999 dollars) for capital improvements for 2000-2020 pro-rated to PWS by operating hours; Life Cycle Costs are base on an annual discount rate of 7.0%

Table 8.
(continued)

Alt	Service Concept	Daily RTs per vessel	No. of Vessels in Local System	Vessel Type	Nominal Vessel Car Capacity	Nominal Length of Service Day	Annual Vessel Service Days	Service Speed (knots)	Annual Op. Cost	Acquis. Cost	20 Yr. Life Cycle Cost	Annual Cordova Port Calls
2g	Dedicated Port: (V-W) (High Season Only)	2	1	New High-Speed	34	12	105	32.3	$1.6 M	$34.4 M	$52.5 M	0
	Daily Loop (e.g., C-W-V-C) (High Season Only)	1	1	New High-Speed	34	12	105	30.8	$1.6 M	$34.4 M	$63.7 M	105
	Off-Season Element Alternating Loop (e.g., C-V-W-C; C-W-V-C) 186 days over 37 week off season (5/7 days a week)	1	1	New High-Speed	34	12	186	30.8	$2.9 M	---	$32.9 M	186
								SUM	**$6.1 M**	**$68.8 M**	**$149.1 M**	**291**
2h	Daily Loop (e.g., C-W-V-C) (High Season Only)	1	1	New High-Speed	34	12	105	30.8	$1.6 M	$34.4 M	$63.7 M	105
	Daily Counter Loop (e.g., C-V-W-C) 105 days per year (High Season Only)	1	1	New High-Speed	34	12	105	30.8	$1.6 M	$34.4 M	$63.7 M	105
	Off-Season Element Alternating Loop (e.g., C-V-W-C; C-W-V-C) 186 days over 37 week off season (5/7 days a week)	1	1	New High-Speed	34	12	186	30.8	$2.9 M	---	$32.9 M	186
			2					**SUM**	**$6.1 M**	**$68.8 M**	**$160.3 M**	**396**

Notes regarding Alternatives 2f, 2g, and 2h:

Reduced Staffing Based on Dayboat Service and 150 Person Life Rafts, and Off-Season Service Reduction; High season is presumed to last 105 days centered on July; Alternative 2f (Rev.) port service provides a timed transfer between Cordova and Whittier in the high season; Alternative 2f (Rev.) loop service provides a direct connection between Cordova and Whittier in the off-season if home port is Cordova; Alternatives 2g and 2h presume that one PWS high-speed vessel relieves SATP high-speed vessels for annual maintenance in the off-season; In Alternatives 2g and 2h, despite the fact that one PWS high-speed vessel is presumed to relieve SATP high-speed vessels for annual maintenance; in the off-season, the full acquisition cost of both PWS high-speed vessels are charged to acquisition and life-cycle costs; If these costs were pro-rated a reduction of approximately $23.6 M would be credited to PWS acquisition and life-cycle cost; Alternative 2h provides direct connection between Cordova and Whittier; Life Cycle Costs are base on an annual discount rate of 7.0%.

TABLE 9.
Trip Segments for Final Alternatives

	High Season						Annual					
FROM:	**Cordova**	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**	**Cordova**	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**
TO:	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**	**Cordova**	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**	**Cordova**
1a	12	40	21	20	39	11	27	90	82	79	89	26
2f	0	210	105	105	210	0	93	303	198	198	303	93
2g	53	262	53	53	262	53	146	355	146	146	355	146
2h	105	105	105	105	105	105	198	198	198	198	198	198

Notes: In Alternative 1a the high season trips are estimated on the assumption that only the Bartlett operates in PWS during the high season and that the total annual Bartlett trips may be pro-rated to high season on the basis of 105 high-season operating days to238 total annual operating days

TABLE 10.
Vehicle Capacity by Trip Segments for Final Alternatives

	High Season						Annual					
FROM:	**Cordova**	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**	**Cordova**	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**
TO:	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**	**Cordova**	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**	**Cordova**
1a	348	1160	609	580	1131	319	783	2610	2616	2522	2581	754
2f	0	7140	3570	3570	7140	0	3162	10302	6732	6732	10302	3162
2g	1802	8908	1802	1802	8908	1802	4964	12070	4964	4964	12070	4964
2h	3570	3570	3570	3570	3570	3570	6732	6732	6732	6732	6732	6732

Notes: Alaska standard vehicles are 20 foot long and weigh 6000 pounds each. In Alternative 1a the nominal vehicle capacity of *Bartlett* is 29 and nominal vehicle capacity of *Tustumena* is 36. In Alternatives 2f (Rev.), 2g, and 2h the nominal vehicle capacity of fast vehicle ferries is 34.

TABLE 11.
Ratio of Vehicle Capacities by Trip Segments
Relative to the Baseline No-Build Alternative

	High Season						Annual					
FROM:	**Cordova**	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**	**Cordova**	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**
TO:	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**	**Cordova**	**Whittier**	**Valdez**	**Cordova**	**Valdez**	**Whittier**	**Cordova**
1a	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2f	0.00	6.16	5.86	6.16	6.31	0.00	4.04	3.95	2.57	2.67	3.99	4.19
2g	5.18	7.68	2.96	3.11	7.88	5.65	6.34	4.62	1.90	1.97	4.68	6.58
2h	10.26	3.08	5.86	6.16	3.16	11.19	8.60	2.58	2.57	2.67	2.61	8.93

SCORING OF THE FINAL ALTERNATIVES

With the information from the previous tables in mind, each of the alternatives was subjected to the same MOE scoring process as was conducted for the initial alternatives. The results of this scoring are contained in Table 12.

Table 12.
MOE Scores for Final Alternatives

ALTERNATIVE	MOE 1		MOE 2		MOE 3	
	Improves Intermodal Transportation	Weighted Score Weight = 2	Improves Travel Time	Weighted Score Weight = 3	Improves Service Convenience	Weighted Score Weight = 3
Existing Conditions	0	0	0	0	0	0
Alternative 2f	4	8	3	9	4	12
Alternative 2g	4	8	4	12	5	15
Alternative 2h	4	8	4	12	5	15

ALTERNATIVE	MOE 4		MOE 5		MOE 6		MOE 7		TOTAL
	Exploits Backhaul Potential	Weighted Score Weight = 2	Health and Quality of Life	Weighted Score Weight = 5	Enhances Regional Economic Develop	Weighted Score Weight = 4	Envmtl Readiness	Weighted Score Weight = 2	
Existing Conditions	0	0	0	0	0	0	5	10	**10**
Alternative 2f	1	2	-1	-2	1	4	1	2	**35**
Alternative 2g	1	2	-1	-5	1	4	1	2	**38**
Alternative 2h	1	2	-1	-5	1	4	1	2	**38**

DISCUSSION

Although each of the build alternatives scored significantly higher than existing conditions (existing conditions scored 10 compared to scores from 35 to 38 for the build alternatives), there is little difference between the build alternatives in terms of MOE scores alone. All of the build alternatives provide significantly higher levels of service to all study area ports, and all provide much more convenient service insofar as sailings can be scheduled at consistent, convenient times of day compared to existing conditions. In terms of clarifying the distinctions between build alternatives it is helpful to consider the specific tradeoffs associated with each build alternative. Port calls to Cordova and revenue generation estimates are the build alternatives' most salient distinguishing characteristics.

Port Calls to Cordova

A chief distinction among the build alternatives is in terms of the number of port calls provided to Cordova, as well as the number of trips between pairs of ports provided under each. These distinctions, along with other service characteristics that capture each alternative's utility to study area port (Cordova, Whittier and Valdez) were used by Northern Economics to compute a "Service Index." These service index values were used in developing revenue forecasts for each final alternative.[16]

The service index measurement is useful in assessing the utility of each alternative by community. While it is clear that each of the build alternatives would provide significantly improved ferry service overall, what constitutes improved service varies by community. Further, definitions of what constitutes good service may vary within the same community.[17] One person may indicate that "good service" reduces travel time, while another may think that "good service" means frequent and regularly scheduled sailings. The service index developed by Northern Economics takes both these dimensions into account. The service index developed quantifies four different aspects of ferry service and combines them into a single measure.[18] The four attributes are summarized below.

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[16] 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: (1) Major structural changes to travel patterns that would occur with the PWS/CR ferry alternatives; (2) Insufficiency of data to precisely measure SIE.

[17] 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.

[18] 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.

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

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.

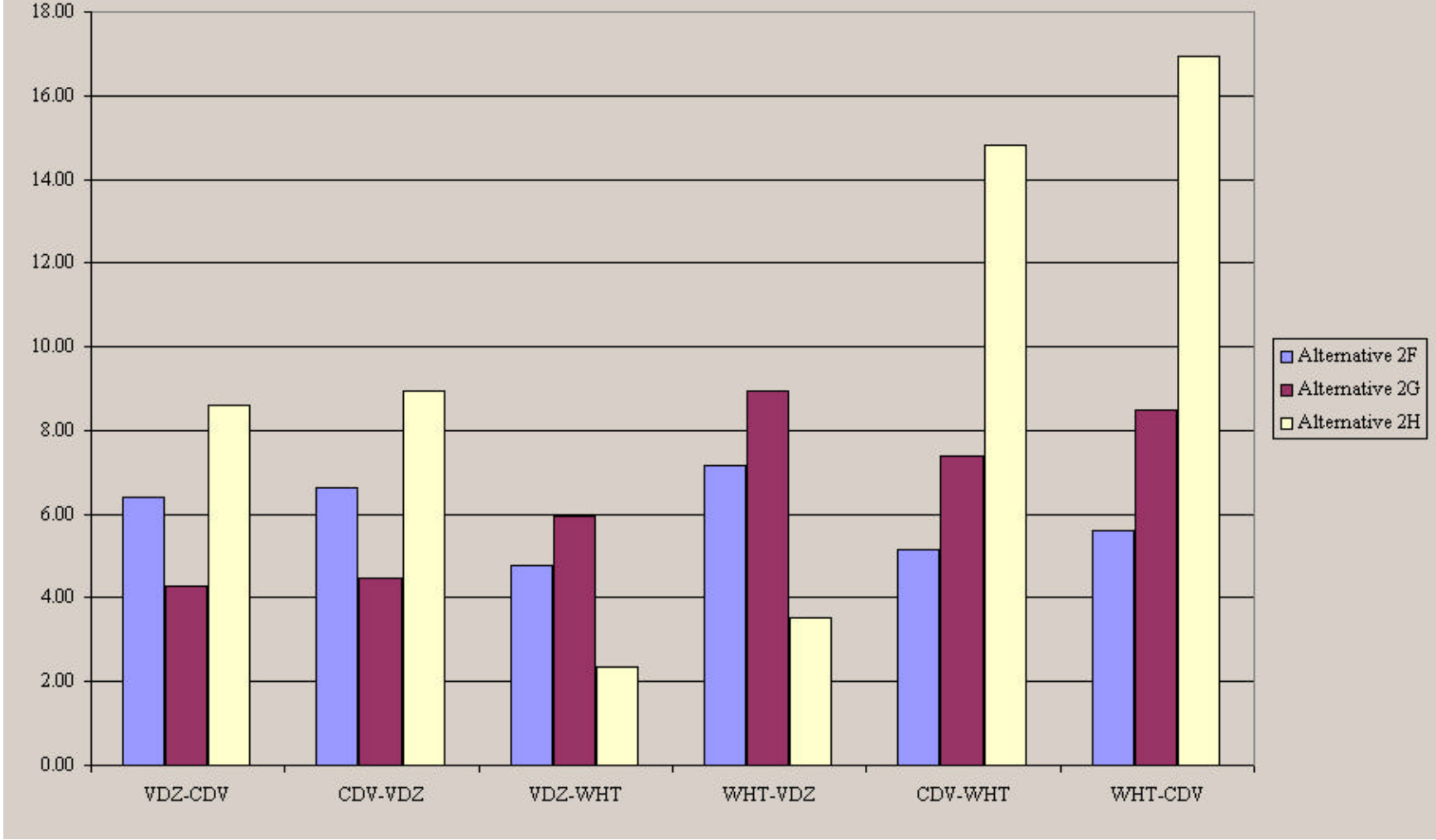
2. **Total departures.** Total departures are defined as the number of departures in the period from a specific port of origin to a specific destination. The higher the number of departures, the higher the overall service level, if all other attributes are held constant.

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.

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.

The service value index figure computed for each alternative is useful not only as a tool in projecting revenues, it is also useful in assessing each alternative's utility to respective communities. In fact, these service index values can be graphed. As can be seen in figure 1, Alternative 2g provides the highest level of service between Valdez and Whittier. Meanwhile, Alternative 2h provides the highest level of service between Cordova and Whittier. Clearly, various service configurations involve tradeoffs among the alternatives in terms of the level of service experienced by a given community. The revenue analysis also conducted as part of this study helps to determine the financial aspects of these tradeoffs.

Figure 1.
Service Indices for Final Alternatives



REVENUE ESTIMATES FOR THE FINAL ALTERNATIVES

Northern Economics has developed revenue estimates for each of the build alternatives and for the baseline no-build alternative. The methodology used in developing these estimates, as well as several important caveats regarding the level of confidence with which they should be used, is described in a report contained in Appendix A, "Ferry Alternatives Revenue Analysis Technical Memorandum," (March 2000) and in an addendum to this report, "Prince William Sound Ferry Alternatives Revenue and Ridership Forecast 1997-2020 (May 2000). The resulting revenue projections by year and alternative are contained in Table 13.

The most notable aspect of the revenue estimates is that implementing any of the build alternatives is expected to much increase AMHS revenues. Whereas 2020 revenues under existing conditions are forecast to reach $3.4 million total, the revenue estimates for Alternatives 2f, 2g, and 2h, respectively, are: $7.3 million, $8.9 million, and $7.7 million.

Table 13.
Estimated Annual Revenue by Rider Type, 1997–2020

		Revenue ($Millions)		
Alternative	**Year**	**Passenger**	**Vehicle**	**Total**
Current System	1997 [b]	1.5	0.7	**2.2**
	2005	2.1	1.0	**3.0**
	2010	2.1	1.0	**3.1**
	2015	2.2	1.1	**3.3**
	2020	2.3	1.1	**3.4**
2f	1997 [a]	3.7	1.6	**5.3**
	2005	4.8	2.1	**6.9**
	2010	4.9	2.2	**7.1**
	2015	5.0	2.2	**7.2**
	2020	5.1	2.3	**7.3**
2g	1997 [a]	4.2	1.8	**6.0**
	2005	5.7	2.5	**8.2**
	2010	5.9	2.6	**8.4**
	2015	6.1	2.6	**8.7**
	2020	6.2	2.7	**8.9**
2h	1997 [a]	3.2	1.4	**4.6**
	2005	4.6	2.1	**6.7**
	2010	4.9	2.2	**7.0**
	2015	5.1	2.3	**7.4**
	2020	5.4	2.4	**7.7**

[a] Actual revenue

[b] Estimate of revenue that might have accrued if the alternative had been in place

The primary reason that revenue forecasts for the build alternatives are so much higher than for the no-build is that capacity is constrained under existing conditions. At the same time, increases in tourism and the opening of the Whittier Tunnel are both expected to contribute to much increased demand for ferry travel in Prince William Sound. Implementing a build

alternative would allow the AMHS to capture these projected increases in demand. However, even current levels of demand during the peak period cannot be met given the existing level of service capacity.

Figure 2 illustrates this concept. The shaded area represents projected 2020 demand, whereas the lines below that crest reflect the portion of projected demand that could be met under the existing AMHS service configuration. The solid line reflecting the lowest level of demand depicts actual 1997 data; the other lines reflect projected demand that could be met in future years under existing AMHS service. What this figure shows is that under the existing service configuration, the AMHS would be able to meet projected rises in demand during the shoulder season, but not during the peak, because capacity is already constrained during the peak, which occurs in July. Figures 3, 4 and 5 depict this same demand projection, but indicate how much of that demand could be captured via the capacity specified in each of the build alternatives: 2f, 2g and 2h, respectively.

Ridership figures provided in Figures 2 through 5 are representative of passenger volumes that may be expected on the PWS ferry system under the given alternatives. Constraints imposed on ridership are primarily a function of passenger vehicle constraints on the ferries. That is, most passengers on the PWS ferry system elect to (or would elect to) take their personal vehicle on the ferry for transit to and from the ferry terminals. Actual ridership is constrained because of the limited capacity of the ferries to handle vehicles.

In addition to limited ferry capacity, anecdotal evidence suggests that passenger (and vehicle) bookings are further constrained by “no-shows”. AMHS currently does not overbook ridership similar to airline strategies and ridership is hindered accordingly. In addition, vehicle space on the ferry system is calculated using fixed vehicle sizes. (It is also important to note that potential riders make vehicle reservations by means of the telephone and the internet. Some of these potential riders tend to overestimate their vehicle length.) These coefficients may be larger than the actual vehicle size. This would tend to restrict the number of vehicles on the ferry system to a greater extent than what can actually be accommodated

Figure 2.
Estimated Monthly Ridership
Under Existing Service Configuration
1997–2020

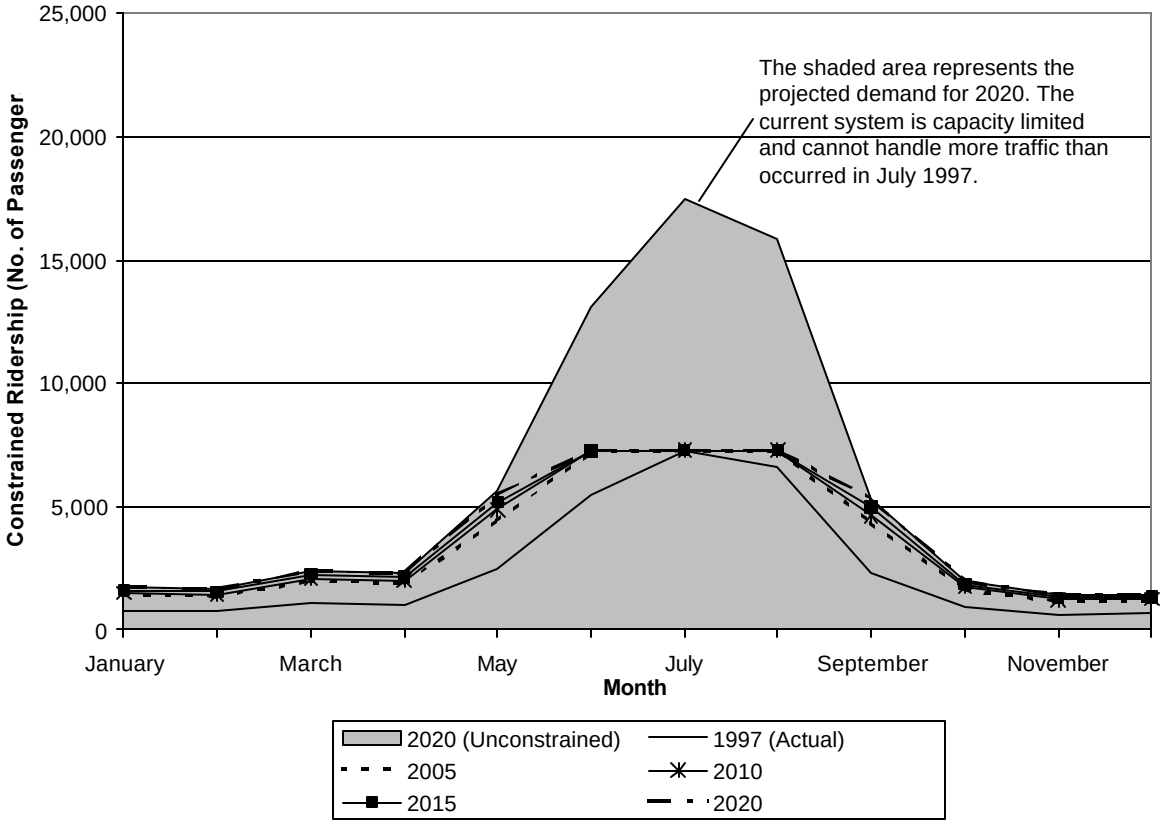


Figure 3.
Estimated Monthly Ridership for Alternative 2f, 1997-2020

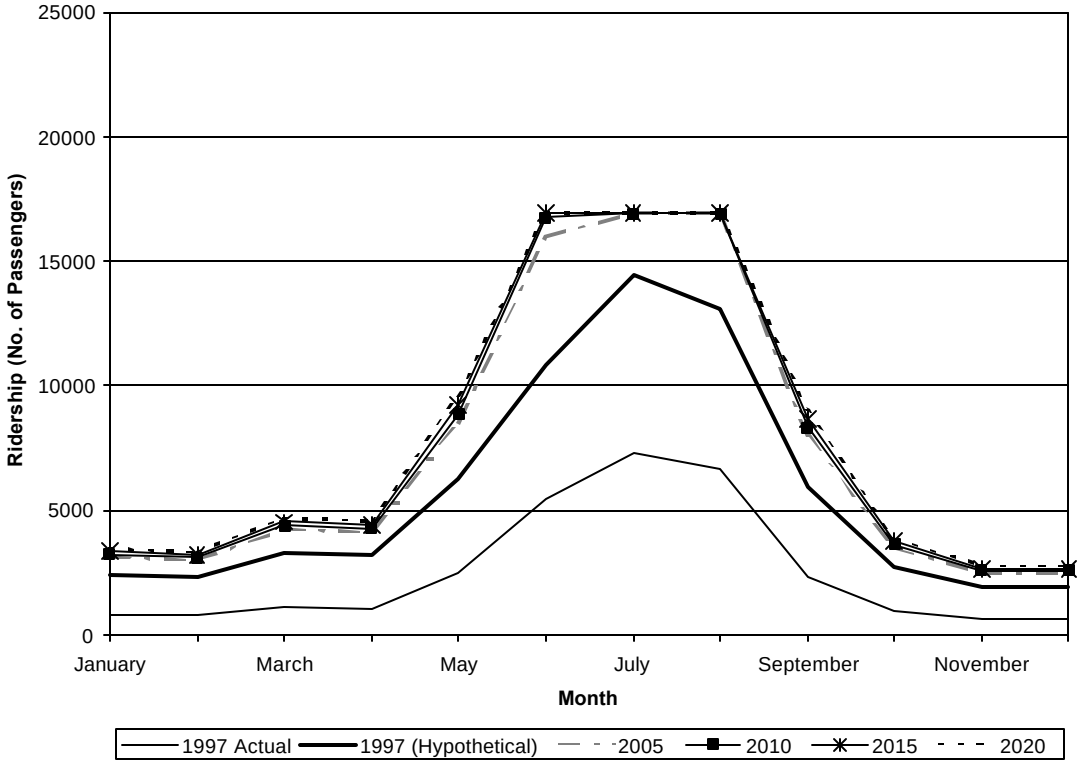


Figure 4
Estimated Monthly Ridership for Alternative 2g, 1997–2020

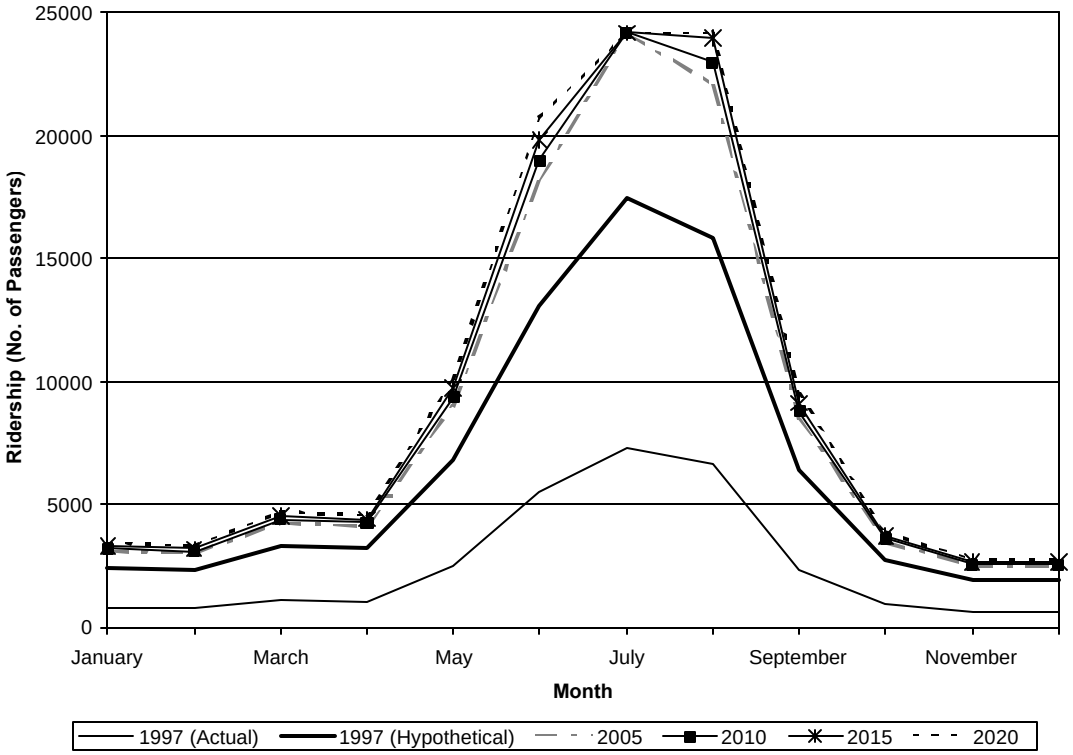


Figure 5.
Estimated Monthly Ridership for Alternative 2h, 1997–2020

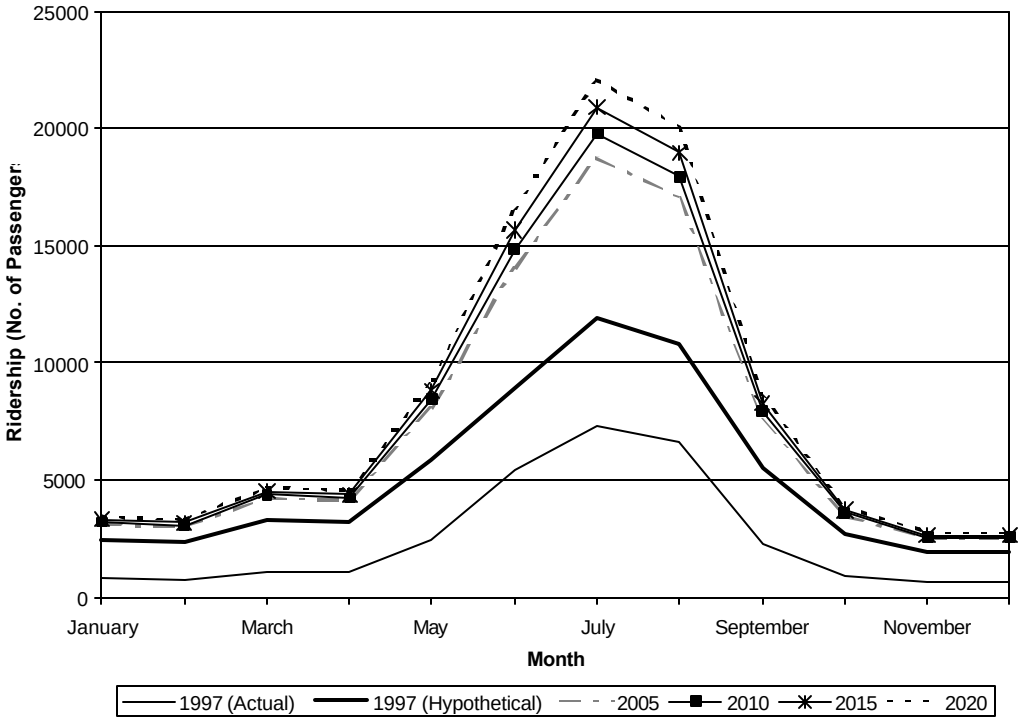


Table 14 relates operating costs to projected revenues.[19] Under the baseline no-build alternative, an revenues minus operating costs are estimated at -$2.97 million per year. Revenues minus operating costs for Alternative 2f are estimated at +$1.84 million; at + $2.82 million for Alternative 2g; and at + $1.64 million for Alternative 2h. These values are graphed in figure 6.

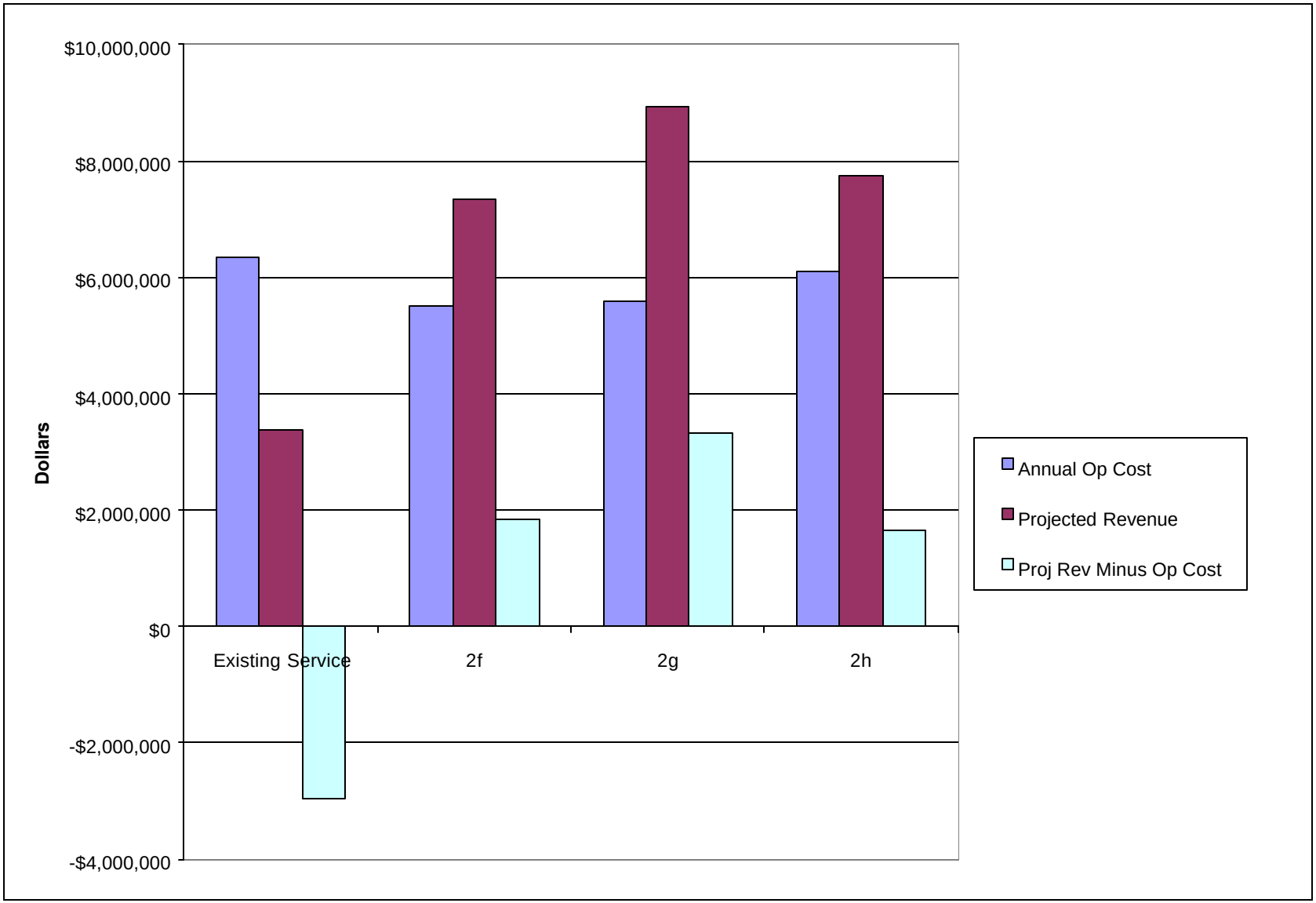
[19] As noted elsewhere in this report, these operating cost estimates do not take into account the full costs of operating AMHS service. System management, shoreside facilities, risk management and reservation system costs, for instance, are not included. The reason for this omission is the difficulty in assigning systemwide costs to isolated elements of the AMHS, such as service between specified ports.

Table 14.
Operating Cost, Capital Cost, Revenue and MOE Comparison, Final Alternatives

Alternative	Annual Op Cost $ mil	Total Cap Cost $ mil	Annualized Capital Cost $	Projected Revenue $ mil	Subsidy Required $ mil	Revenue Surplus Over Operating Costs $ mil[1]	MOE Score
No Build	$6.34	$39.0	$431,933	$3.37	$2.97	--	10
2f	$5.5	$53.8	$849,817	$7.34	--	$1.84	35
2g	$6.1	$63.8	$1,086,755	$8.92	--	$2.82	38
2h	$6.1	$63.8	$1,086,755	$7.74	--	$1.64	38

*Note that these operating cost estimates do not take into account the full costs of operating AMHS service. System management, shoreside facilities, risk management and reservation system costs, for instance, are not included. The reason for this omission is the difficulty in assigning systemwide costs to isolated elements of the AMHS, such as service between specified ports.

Figure 6.
Final Alternatives: Operating Costs v. Revenue Forecasts



SELECTION OF A PREFERRED ALTERNATIVE

The results of this analysis clearly point to selection of one of the three build alternatives, each of which would produce a much higher level of service to both residents and visitors while producing revenues that are projected (at a planning level) to substantially exceed operating costs.

Further, it is clear that Alternatives 2h and 2g are superior, in terms of both MOE score and revenue forecasts than Alternative 2f. In addition, the fact that both 2h and 2g would use the same combination of new vessels (two new fast ferries each), suggest that investing in 2h/2g equipment may enable the system to generate higher revenues than would be possible under 2f. This equipment could be described as more "fluid," or better allocated toward routes that may generate more revenue in the future. For example, passenger routing preference may change in the future due to the combined effects of many factors. Equipment that can be adapted to a wide variety of routing options would be better able to serve its constituency and capture revenues as conditions shift.

In essence, the differences between alternatives 2g and 2h are operational. As just noted, both would require the purchase and operation of two new fast ferries. In terms of selecting a preferred alternative, it seems most reasonable to conclude the following:

- Two new fast ferries should be acquired.
- The service configuration governing the deployment of these new vessels should balance the AMHS mission to provide basic transportation with opportunities to recoup costs and foster economic development. These decisions, which must take into account a multitude of factors beyond engineering concerns and demand estimates, are more appropriately made at the policy level.