

San Juan Ferries Reservation Program Feasibility Study

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16. ABSTRACT There is a growing need to manage traffic growth impacts on the WSF San Juan Island service routes. Vessel and terminal capacities have nearly reached their maximum capacities. Unless terminal expansions occur to add multiple docking slips at several terminals, vessel service capacity cannot be expanded to keep pace with the growth in traffic demand. The "San Juan County Transportation Policy Plan" adopted in 1989 does not recommend physical expansion alternatives for meeting traffic growth. Instead, it recommends non-physical alternatives, including establishment of a reservation system "that will enable residents to obtain assured ferry space". A reservation system would be a means of controlling traffic demand to fit available service capacity. This report presents a proposal for use of a reservation system to manage ferry traffic access to the San Juan Islands and to offer island resident priority access to available capacity within the limitations of current state law. This proposal was not accepted by the island residents when presented during the Spring of 1991.					
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SAN JUAN FERRIES RESERVATION PROGRAM FEASIBILITY STUDY

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INTRODUCTION

Ferry traffic on the San Juan Island routes of the Washington State Ferry System has shown a consistent pattern of growth over the last several decades—a pattern which has been accentuated in recent years. Between 1975 and 1990, vehicle traffic almost doubled, and during the last four years, it has grown at an annual rate of 6.2 percent. Underlying this growth are two long-term phenomena: (1) steady growth of the resident population on the San Juan Islands and (2) increasing popularity of the islands as a destination for recreational trips, particularly from the population centers of Western Washington.

Growth of ferry traffic in recent years has not been accompanied by a corresponding increase in ferry system capacity. During the peak summer months, for instance, the number of ferry runs was about the same in 1990 as it was in 1975. As a consequence, the "level of service"¹ has declined manifested by more ferry runs departing with full loads of vehicles, longer wait times by ferry users (vehicles are accommodated on a first-come, first-served basis), and probably most serious of all, an increasing concern about the possibility of being left on the dock when the last ferry run of the day departs.

Among the options available to resolve—or at least mitigate—the problem, the more effective ones have been ruled out or are unfeasible. Solutions which have a major physical impact such as bridges or additional ferry slips are strongly opposed by residents of the islands; adding vessels, even if the funding were available, would be inefficient because terminal capacity is a limiting factor. Measures to restrict demand, assuming an equitable method could be devised, would probably not be acceptable to all users.

Among the few remaining options, there is some support for establishing a reservation system for the island routes. While this option does not resolve the basic problem—that is, excess demand and insufficient capacity, it does provide a more rational procedure for allocating the available capacity. Based on experience elsewhere, it is evident that the benefits of a reservation system outweigh the negative effects not only to the users but also to the operators of the ferry service.

1 Level of service is a technical term based on the relationship between travel demand and transportation system capacity. Its use here does not imply deficiencies in ferry operation.

Purpose of the Study

The purpose of this study is to develop the information needed to make an initial decision regarding the feasibility of establishing a reservation system on the San Juan Island routes of the Washington State Ferry system. To accomplish this objective, the study includes the following elements and tasks:

- Community involvement activities designed to provide an initial expression of attitudes and concerns by interested citizens on San Juan, Orcas, and Lopez Islands.
- An on-board survey to acquire additional information on characteristics of ferry users.
- A review of methods and procedures used to operate reservation systems on comparable ferry routes elsewhere.
- Development of a conceptual design of a reservation system including a description of attributes and procedures and of the software and hardware requirements.
- An evaluation of the impact of the reservation program on ferry users and on ferry system operations; estimates of net additional personnel requirements and operating costs.

Previous Planning

The desirability of having a reservation system for traffic on the San Juan Island service has been the subject of investigation and concern for at least 15 years. Two of these planning efforts deserve mention because of their relevance to the current investigation.

Reservation Feasibility Study - 1976

In 1976, WSF commissioned an examination of the feasibility of a reservation program for the San Juan Island group of the ferry system. This study investigated reservation systems operated by a representative group of transportation carriers—marine and air—to obtain information on techniques, procedures, and cost factors. Using this information, software and hardware components were described in conceptual terms for both a

manual and an automated system. Along with the conceptual description of design components, the report discusses key policy and procedural issues that need to be considered irrespective of whether the system is manual or automated.

While the initial thinking appeared to be one of copying components of the manual systems, detailed analysis of the data management and personnel requirements indicated that a manual system would not be a feasible long-term methodology for the WSF. A further consideration was that the state-of-the-art in computer and communications technology was at a point where its application to such uses as reservation programs for transportation carriers could produce immense increases in efficiency and cost effectiveness. Realizing this, the report proceeded to identify the components of an automated system in outline form and recommended that WSF undertake "the development of an automated reservation system for the San Juan Island group" to be tied in with data collection functions. It also recommended that the system be designed to operate in a manual fashion for the first year.

While the recommendations of this study did not result in an implementation program, the information provided in the report has served as a resource for WSF staff and the community advisory groups to continue informal consideration of a reservation system and of the key issues involved in system design.

San Juan County Transportation Policy Plan

In 1989, the county adopted a transportation policy plan which articulates the county's goals and general policies for all transportation modes and services, including the ferry system. The policy plan recognizes WSF as the chief provider of marine transportation services and facilities and an essential part of the transportation system within San Juan County.

The plan identifies several goals and/or policies which directly affect options available to the state for improving the transportation system connecting the San Juan Islands to the state highway network. It also addresses the acceptability of a reservation system as a means of improving ferry service. The relevant goals and policies may be summarized as follows:

- Bridges and tunnels between islands and from the mainland are inconsistent with the goals of the plan and are not acceptable transportation alternatives.
- Marine terminal facilities and connecting roads have significant physical constraints which affect changes in marine facilities and services. Thus, operational and/or scheduling changes are to be preferred rather than expanding terminal facilities.
- WSF is encouraged to establish a reservation system that will enable residents to obtain assured ferry space and seek resident-priority loading on ferries if a reservation system proves ineffective.

The plan does not discuss the potential role that public transportation services on the islands might have in reducing vehicle demand on the ferry system, nor does it indicate any specific role for public transportation now or in the future.

WSF Policy Considerations

This investigation of the feasibility of developing a reservation system for the San Juan Island Ferry routes does not proceed from a policy of WSF or the Washington State Transportation Commission. Aspects of the study which impinge upon policy issues are, therefore, not to be construed as reflecting on existing policy or as suggestions for new policies.

EXISTING CONDITIONS

This section describes existing conditions of ferry service and operations, vehicle traffic trends, and traffic characteristics on the San Juan Islands ferry routes. The discussion of these factors is directed, in particular, to the aspects that are relevant to the design and operation of a reservation system.

Routes and Service

Ferry service on the San Juan Islands group consists of two sets of routes: (1) The domestic routes connecting Anacortes with the four island terminals, Lopez, Shaw, Orcas and Friday Harbor, and (2) the international routes between Anacortes and Sidney, B.C., with stops at one or more island terminals. All service to and from the mainland is through the Anacortes terminal. Scheduling is complex; some runs stop at all the island terminals, some at two or three terminals, and a few runs are direct between Anacortes and Friday Harbor. During the summer of 1990, one of the vessels was assigned to circulate among the island terminals only.

Prior to the summer of 1990, four different schedules were used during the year to accommodate the seasonal fluctuation in ridership experienced on these routes and the maintenance requirements of the vessels. Because of the high proportion of recreational traffic, the seasonal variation is extreme with the August traffic being almost three times as great as the February traffic. To meet the peak summer demand, the maximum amount of service is provided, within the limits imposed by: (1) the number and capacity of ferry vessels that can be allocated from the WSF fleet to the San Juan Island routes, (2) the logistics of ferry operation including the time required for loading and unloading at the island terminals, and (3) crew operating regulations. To accommodate the increase in travel demand on weekends compared to weekdays, additional ferry runs are scheduled during those days.

Hours of operation are from 6:00 a.m. to about 11:00 p.m. The hours of operation are about the same throughout the year as these hours can be maintained with two shift crew staffing.

Overall, the amount of ferry service provided during the summer season, particularly on weekends, is near the capacity constraints imposed by the route structure and

the existing facilities at the terminals. The difficulties and the time consuming nature of vehicle unloading and loading procedures at the island terminals are described later in this section. Additional ferry vessels, even if they were available for assignment from the WSF fleet, could not be used efficiently. Additional runs, early morning and late night, would not be cost effective because there is limited user demand at these hours and because any lengthening of the daily operating time would require a third shift or the payment of overtime.

Ferry boat specifications, route lengths, and running times are the key elements that determine the level of service on a route or group of routes. Vessel specifications for the ferry boats currently assigned full time or for part of the year on the San Juan Island routes are shown in Table 1. Route lengths and running times are shown in Table 2.

Table 1. Vessels Assigned to San Juan Routes

Vessel	Class	Year Built/ Reconditioned	Speed	Auto Capacity
Elwha	Super	1967/-	17	160
Kaleetan	Super	1967/-	17	160
Evergreen State	Evergreen State	1954/1989	13	100
Tillikum	Evergreen State	1959/-	13	100
Nisqually	Steel Electric	1927/1987	12	75

Table 2. Route Lengths and Running Times - San Juan Routes

Route	Miles	Crossing Time ¹
Anacortes - Lopez	10.8	40 min.
Anacortes - Orcas	14.3	60 min.
Anacortes - Friday Harbor via Lopez	18.2	60 min.
Anacortes - Friday Harbor via Lopez, Shaw, and Orcas	22.2	72 min.
Anacortes - Sidney, B.C. via Orcas	36.7	120 min.
Anacortes - Sidney, B.C. via Friday Harbor	39.9	130 min.

¹ Does not include load and unload times.

Ferry Terminals

Six terminals are part of the San Juan Islands route structure. The major terminal is at Anacortes, which provides the mainland connection to the system. Over the years, improvements have been made to the Anacortes Terminal to provide the capacity necessary to accommodate the growth in vehicle and passenger traffic. The terminal has two, two-lane loading slips, overhead passenger loading, an ample vehicle holding area, four toll booths, and an adequate supply of parking within walking distance of the waiting room. In addition, it has a secured holding area for vehicles from the Sidney, B.C., runs as they clear customs. With all tollbooths in operation, vehicles can be processed and queued with little back-up at all times except for peak summer days. Some queuing of vehicles on the access road outside the toll booths occurs during peak periods, but it is not yet a matter of concern.

The four terminals on the islands are constrained by topography and the desire of local residents to restrain terminal development to the minimum facilities necessary to meet operating needs and safety. All of the terminals have only one single-lane loading ramp which must be shared by vehicles, pedestrians, and bicycles. At both Friday Harbor and Orcas, there are holding areas with capacity about equal to that of a super class ferry. On Sunday afternoons this is often inadequate, and vehicles must queue on the access road(s) to the holding areas. At both of these terminals, there are traffic conflicts for both loading and unloading traffic in the vicinity of the loading ramps. There is no public transportation on the islands, and all walk-on traffic must access the loading area by walking to and from the parking lots or by being picked up or dropped off.

At both Lopez and Shaw, parking is inadequate to accommodate both park-and-ride ferry patrons and pick-up and drop-off traffic.

When the one-point toll collection program was instituted several years ago, there was no longer a need for toll booths at the island terminals. The toll booth at Lopez was transferred physically to the Anacortes Terminal, and the booth at Orcas was closed. Because of constraints in the layout of the existing holding area, there was not a toll booth at Friday Harbor.

The possibility of relocating the Friday Harbor Terminal has been investigated, but the most feasible alternate site is some distance from the location of the existing terminal in

the Friday Harbor business district. Its development would require a large capital expenditure and have a significant long-term impact on land use in the general area.

Parking at the terminals is needed for both short-term and long-term demand. Short-term parking is used by ferry travelers at the terminal which is on the home end of the trip. Long-term parking is needed to store "second" vehicles at the terminal which is the away-from-home end of the trip. Both long and short-term parking supply appears to be adequate at Anacortes, where there are 500 spaces within about 300 feet of the ferry slip and an additional 400 spaces about one-quarter mile away. Parking space on the islands is less than adequate especially for short-term parking. The addition of parking space is impeded by high cost and opposition based on its environmental impacts.

Pertinent information concerning the terminal facilities serving the San Juan Island routes is presented in Table 3.

Table 3. Terminal Facilities

Location	Owned By WSF	Loading Ramps		Vehicle Holding Area Capacity	Toll Booths ¹	Overhead Loading
		No. of Ramps	No. of Lanes			
Anacortes	No	2	2-2	500	4	Yes
Lopez	Yes	1	1	93	0	No
Shaw	Yes	1	1	0	0	No
Orcas	Yes	1	1	146	1	No
Friday Harbor	Yes	1	1	130	0	No
Sidney, B.C.	No	1	2	100	1	No

¹ Toll booths located at the entrance to the vehicle holding area.

Operations

Traffic Management

Traffic management and ferry loading procedures on the San Juan Island routes are unique. Most of the ferry runs serve two or more terminals as destinations and thus have to make one or more stops en route to their destination terminal. This requires that traffic be segregated in the holding area so it can be loaded in the proper sequence. For instance, in the case of a ferry run stopping at all four island terminals, vehicles bound for Lopez (the first stop) must be loaded first, then the vehicles for Shaw (the second stop) followed by Orcas, and finally Friday Harbor. Then, after unloading at each intermediate stop, the ferry on-loads the inter-island traffic. In the case of a super-class ferry, this can be accomplished by having the traffic proceed on the outside vehicle deck (in the opposite direction to the traffic on the ferry) turn at the other end, and proceed forward on the other side of the ferry. Oversize vehicles must back on to face the front for off-loading. To the uninitiated, this is a complex and even bewildering process. However, because of the skill of the crew members and the knowledge of the motorists who are familiar with the process, it does work.

Another, and equally as important, aspect of the traffic management problem is posed by what are called "tall" vehicles—that is, vehicles with an overall height of over seven and one-half feet. Tall vehicles can be loaded only in the center section of the ferry vessels (the unmodified Issaquah class being an exception), and they must be segregated in the vehicle holding area to be loaded at the proper time in the loading sequence. Thirty (30) passenger car equivalent spaces are allocated for tall vehicles on most sailings.

Traffic embarking on the international runs to Sidney, B.C., is still an additional category. However, some of this traffic can be stored in a separate enclosed area provided to hold the off-loaded traffic from Sidney for processing through the customs' booths.

In summary, it is necessary to segregate traffic into as many as eight categories in the Anacortes terminal holding area and into potentially that many on the island terminals if all of the categories were to converge at one time. Since all of the ferry runs do not stop at all terminals, it is very rare to have vehicles in all eight traffic categories at an island terminal holding area at one time. From a practical standpoint, there is a need to segregate

four or five traffic categories in the holding areas at Friday Harbor and Orcas—this includes an additional category of traffic for Sidney, B.C., since each of these terminals is an embarkation stop for one of the daily westbound sailings on the international route.

An important feature of the current operation is one-point fare collection for vehicle and passenger fares on all local trips passing through Anacortes. For island traffic, a round-trip fare is collected for each vehicle and driver and for vehicle passengers at the toll booth entering the Anacortes holding area. On the international route, fares are collected each way. Walk-on passengers are issued tickets that are collected by a purser at the pedestrian ramp onto the vessel.

With this procedure, the fare collection process on the islands is partially simplified. Vehicles and passengers eastbound for Anacortes load free of charge. But inter-island traffic is still required to purchase tickets at the appropriate sales points and present them to the employee directing traffic, who, in this case, also acts as purser.

Existing Reservation Programs

Reservations are available for vehicles traveling on the international route between Anacortes and Sidney, B.C. Reservations may be made by calling a Seattle local number or a toll-free number statewide and may be made up to noon of the day before the sailing. Reservations are identified by the name of the driver and the vehicle license number. Reserved vehicles are verified at the toll booths from a manifest containing the identifying information, which is transmitted from the central computer facility several hours before the sailing. Reservations are confirmed as received, and this allows for reservations to be made westbound for embarkation at Friday Harbor or Orcas, as well as at Anacortes. Since there is no prepayment requirement, there are always a significant number of no-shows (generally 25 to 30 percent).

Reservations for space on the San Juan island routes may be made by commercial vehicles. There are two types of reservations: (1) Pre-notification for a standing reservation; that is, a reservation for space on a specific sailing for one or more days of the week, and (2) short-term request for reservation of space on a specific sailing, usually made by phone call a few days in advance. About 40 percent of commercial vehicle trips are covered by the pre-notification

procedure and about 30 percent by the short-term reservation request. The remaining 30 percent of commercial vehicle traffic is treated as stand-by and is loaded on a space-available basis.

Though it has some difficulties, this program works reasonably well. Those with standing reservations sometimes fail to notify WSF of changes in their travel schedule and this combined with the occasional no-show are the main causes of irritation in the process.

Traffic Volumes and Characteristics

Traffic on the San Juan Island ferry routes includes four distinct groups of users. These are:

- (1) Trips by island residents who rely primarily on the ferry system for travel to and from the mainland and for travel between the islands.
- (2) Trips by nonresidents who either work on the islands or have a second home there and make frequent trips between this second home and their primary place of residence off-islands. (Some of these may consider their island home as primary.)
- (3) Trips by tourists to recreational and vacation destinations on the islands. Most of these trips are one-time events or occur very infrequently.
- (4) Trips by commercial vehicles; virtually all of the commodities used on the islands are transported by truck via the ferries.

Traffic Trends

Traffic on the San Juan Island routes has grown steadily and consistently over the years. The one exception is the period from 1978 to 1980, when national energy conservation policies affected motor vehicle travel. During the past ten years, traffic volumes on the routes (combined domestic and international) has increased by over 70 percent. In 1980, the system carried 406,700 total vehicles, and in 1990, the total is expected to be over 695,000 vehicles.

Overall, this amounts to an average annual rate of growth of 5.5 percent. On the domestic routes, the year-to-year growth has been remarkably consistent, which may indicate the compelling nature of the socioeconomic factors affecting travel to and from the islands.

The data indicates that the most important factor accounting for the traffic growth trend has been the increased popularity of the San Juan Islands as a vacation/recreational destination. Second in importance is the population growth experienced during the last ten years, both on the islands and in the metropolitan centers of the Puget Sound region. The latter generate most of the recreational oriented trips to the islands. Population of the San Juan Islands increased about 24 percent, from 7,800 in 1980, to 9,700 in 1990. Population of the central Puget Sound region (King, Pierce, and Snohomish Counties) increased about 20 percent. Other factors are the prosperous economy, dependable supply of low-priced gasoline during the last several years, and the relatively low fares on the routes. In recent years, traffic growth has probably been constrained to some extent by ferry system capacity, which, for reasons previously discussed, has not increased in response to demand.

Traffic trend data are shown in Table 4. Included are data for the winter and summer quarters for recent years 1986-1990. These data tend to support the contention that traffic growth has been constrained by ferry system capacity limits. During the last four years, while total traffic annually has grown at an average rate of 6.2 percent, summer season traffic has increased at an annual rate of only 3.8 percent a year and winter traffic at the higher rate of 8.6 percent a year.

An explanation of these trends may be found in the data presented in Table 5, which shows ferry capacity and utilization factors by month for service outbound from Anacortes from July 1989 to July 1990. The maximum vessel capacity is provided during the months of July and August which also have the largest traffic volumes, the highest utilization (aggregate load factors), and the highest percentage of overloads (departures with the vessel loaded to the maximum). As might be expected of a recreationally oriented transportation link, traffic is substantially lower in the winter months with the low point being reached in January and February. Vessels are rotated out of service during the off-peak period (mid-September to mid-June) to carry out the necessary maintenance and repair.

Table 4. Vehicle Traffic Trends - Anacortes/San Juan Islands/Sidney

Year	Annual Traffic		Summer Quarter		Winter Quarter	
	Vehicles*	% Change	Vehicles*	% Change	Vehicles*	% Change
1980	406.7	-----	-----	-----	-----	-----
1981	426.4	+4.8%	-----	-----	-----	-----
1982	442.2	+3.7%	-----	-----	-----	-----
1983	467.4	+5.7%	-----	-----	-----	-----
1984	474.9	+1.6%	-----	-----	-----	-----
1985	505.8	+6.5%	-----	-----	-----	-----
1986	551.8	+9.1%	224.1	-----	82.9	-----
1987	579.8	+5.1%	223.0	-0.5%	94.5	+14.0%
1988	625.9	+7.9%	240.2	+7.7%	102.9	+8.9%
1989	652.1	+4.2%	248.2	+3.3%	99.3	-3.5%
1990 est.	695.8	+6.7%	260.5	+5.0%	114.9	+15.7%
Annual Rates of Growth						
1980-1990		+5.5%	-----		-----	
1986-1990		+6.2%		+3.8%		+8.5%
* In 1,000s of vehicles.						

Traffic Characteristics

It is important to have in mind some of the more important characteristics of ferry users on the San Juan Island routes. Information about ferry users on the San Juan Island routes has been obtained from "on-board" surveys of those traveling on the ferries, which are conducted from time to time, the most recent being on Friday, July 6, 1990. Information collected from the on-board survey must be treated as sample data since these surveys are normally conducted for only one day at a time. Based on the survey data and other information, a profile of ferry users traveling by vehicle can be inferred as follows (the estimates are intended to represent average annual conditions):

Table 5. Ferry Capacity and Utilization Factors - Existing Conditions - July 1989-July 1990

Month	Outbound from Anacortes				Total Vehicles	
	Sailings	Over-loads	Nominal Capacity	Units Carried	Percent Utilized	San Juan Routes
1989						
July	448	136	56,200	39,873	70.9	84,600
August	448	180	56,120	44,837	79.9	95,100
September	350	109	46,700	32,356	69.3	68,500
October	312	70	42,960	24,377	56.7	50,000
November	311	56	41,760	20,717	49.6	41,700
December	314	55	42,960	20,645	48.1	42,400
1990						
January	281	16	33,680	16,613	49.3	34,300
February	175	20	28,000	15,549	55.5	32,100
March	204	60	32,840	23,513	71.6	48,500
April	252	71	35,640	25,489	71.5	52,000
May	287	82	37,040	28,562	77.1	58,200
June	357	96	44,225	32,741	74.0	66,800
July	451	183	56,215	43,148	76.4	91,500
1 The aggregate of the vehicle capacity of the ferries departing Anacortes (in standard passenger car equivalents).						

(1) Category of user:

- San Juan County resident: 35 percent
- Nonresident, frequent user: 20 percent
- Tourist - one time or infrequent visitor: 45 percent

(2) Residence of visitors to the islands:

- Seattle Metropolitan Area (King and Snohomish Counties): 50 percent
- Other Western Washington: 22 percent
- Eastern Washington: 5 percent
- Out of State: 23 percent

(3) Use of commuter books - percent of trips used by:

- San Juan County residents: 50 percent
- Nonresidents: 10 percent

(4) Destination of ferry traffic outbound from Anacortes:

- Friday Harbor: 36 percent
- Orcas: 35 percent
- Lopez: 13 percent
- Shaw: 3 percent
- Sidney, B.C.: 13 percent.

There is a clear cut difference between San Juan County residents and nonresidents in the purposes of their ferry trips. The major purposes of ferry trips made by San Juan County residents are: work (26 percent), business (26 percent), shopping (25 percent), and medical (16 percent). This is not much different from the mix of trip purposes found in suburban areas. In contrast, almost half the trips by nonresidents are for vacation and holiday travel and another third are for other social and recreational purposes.

San Juan County residents are further distinguished from nonresidents in the frequency of ferry travel. Almost half of the county residents who make ferry trips make ten or more round trips in a 90-day period (the period for which commuter book tickets are valid). Less than 10 percent of county residents made only one round trip per month on the average. For the nonresidents, about two-thirds of those who did not own or share accommodations on the islands were making their only trip in the last 90 days or more.

In summary, there is a considerable diversity among non-commercial ferry users on the San Juan routes. Island residents depend on the ferry primarily for access to basic needs and for earning a livelihood, and secondarily for discretionary type trips. Most residents use the ferry on a regular basis. By comparison, nonresidents use the ferry primarily (about 80 percent) for discretionary recreational and vacation trips and only secondarily for basic needs. In the latter category are the 13 to 17 percent of trips by nonresidents which involve earning a livelihood. With respect to residence, about a third of all travel is by island residents and about 40 percent by residents of the populous Central Puget Sound Region. Between 20 and 25 percent of all trips are by out-of-state residents.

FERRY RESERVATION SYSTEMS ELSEWHERE

This section provides information on two ferry services elsewhere in North America which have essential similarities to the San Juan routes and have state-of-the-art reservation systems in operation. One of the ferry systems is operated by British Columbia Ferries and provides service between Tsawassen, the main B.C. Ferry terminal, and the Gulf Islands. The other system is operated by the Woods Hole, Martha's Vineyard, and Nantucket Steamship Authority and provides service between Woods Hole, Massachusetts (a mainland terminal) and Martha's Vineyard (an island in Long Island Sound).

Because of the similarities between these two ferry operations and WSF service in the San Juan Islands, their experience with vehicle reservation systems offers valuable information for this feasibility study. Information that is of particular value includes attributes of the respective reservation systems, system software and hardware components, personnel needs and cost of operating the system, and the methods of resolving key issues and impacts of the reservation systems. The characteristics of ferry service and operations which make the Gulf Islands and Martha's Vineyard Ferry reservation systems particularly relevant as sources of information for the San Juan Islands study are as follows:

- Traffic characteristics - More than half of all traffic on the three systems is recreationally related.
- Seasonal variation - The summer peak traffic volume is about three times as great as the winter low point.
- Length of routes - Between 10 and 20 miles in length.
- Characteristics of users - All three systems must balance the travel needs of island residents against the tourist/recreational travel, mainly by residents of nearby metropolitan areas (Vancouver, B.C.; Boston, Mass.; and Seattle, WA).

The biggest differences among the three systems are in the fare structure and the amount of subsidy from tax revenues.

Gulf Islands (B.C.) Ferry Service

Ferry service between the British Columbia Mainland and the Gulf Islands is provided by British Columbia (B.C.) Ferries. The service connects the main B.C. Ferry terminal at Tsawassen with terminals on five of the Gulf Islands; Mayne, Galian, Saturna, Pender, and Salt Spring. The routes cross about 12 miles of open water on the Straits of Georgia. Total route distances between Tsawassen and the island terminals range from 15 to 22 miles.

B.C. Ferries is a crown corporation which operates extensive ferry service between the mainland, Vancouver Island, and the Gulf Island chain (north and south). Operating costs are financed primarily from fares and other operating revenue.

Background

The reservation system on the Tsawassen-Gulf Island dates from the early 1970s. It came about because of demands of the ferry users. Because of the distances involved and the low volumes of (average) traffic, service was limited, and during peak days, vessels would often depart leaving motorists stranded until the next day.

When the reservation system was first established, prepayment of fares was not required. The users, perhaps mainly the island residents, opposed a prepayment requirement. As time went on, however, "no shows" eventually became a problem with the number reaching as high as 30 percent. Some remedial steps—such as cancelling reservations for motorists with a "no show" pattern—were tried but did not solve the problem. Frustrated with the unfairness of this situation, motorists came to accept the fact that a financial commitment was to be a part of the reservation system. The prepayment requirement went into effect five or six years ago.

Another important feature—the technology of processing reservations—was also subject to evolutionary development. Originally, the system was entirely manual. All of the record keeping, accounting functions, and data management were done with manual procedures. This labor-intensive system became unwieldy and archaic with the growth of traffic and the availability of computer technology. The change was made about five or six

years ago with the acquisition of the necessary components of computer hardware and the development of software for the system. The software was custom made—apparently in incremental steps over a period of time—by Heiny Parclan, a computer systems analyst in Vancouver, B.C.

The current emphasis by B.C. Ferries is to describe the reservation system as a traffic management mechanism. This is, in fact, the case because of the nature of the benefits produced by the system. Compared to the traditional "first-come-first-served" policy, the reservation system has the following benefits:

- A substantial saving to users from the reduction of lost "wait" time.
- A reduction in the amount of terminal space required for queuing.
- A substantial reduction in cash handled at terminals.
- A reduction in the anxiety caused by fear of missing the last ferry.

Main Features of the System

The attributes of the reservation system and its interface with users are affected by ferry service policies, geography, and economics in addition to basic decisions regarding operating procedures. The main features affecting the development of the system are as follows:

- The economy of the Gulf Islands is supported as a retirement community, a location of second homes, and as a vacation area. There is very little independent economic activity.
- The one-way fare between Tsawassen and the Gulf Island is \$16 for a standard-sized passenger car and \$4 per person including the driver (denominated in Canadian dollars).
- Tolls are collected in both directions on the Tsawassen-Gulf Island routes.

- Reservations and prepayment apply to only the vehicle—fares for passengers, including driver, are collected at the toll booth.
- All the space on every sailing is subject to reservation; none is withheld. When all the space on a particular sailing is reserved, additional requests go onto a waiting list.
- There is no allocation (among islands) of vessel space for traffic to or from the various islands. Reservations are taken on a "first-come-first-served" basis.
- Some of the service to the Gulf Islands requires timed-transfers and connecting ferries.
- Gulf Island residents have not demanded special service or priority access.

System Software

The elements of software which comprise the system include the following (more detailed information is available in B.C. Ferries Route 9 Manual):

- **Service Schedule.** The service schedule is the prerequisite for defining the space available for reservation.

Currently, two seasons have been defined for the purpose of scheduling service on the Tsawassen-Gulf Island routes: a summer schedule, which (this year) begins June 23 and extends through October 10, and an "Other Seasons" schedule for the remainder of the year. As soon as the service schedule for a forthcoming season is finalized, reservations are accepted for that entire season. This year, the summer schedule will be announced the first week of May.

- **Master File.** This file is structured to contain a file for each sailing. The vehicle capacity of the sailing is an essential data item. Reservations are entered in this file as confirmed. Data for each reservation includes vehicle license number, driver's name, fare deposit, vehicle length, passenger car equivalent (PCE) spaces, telephone number, and destination.

- **Access/Entry/Change Program.** This program accesses the appropriate sailings in the master file and calculates space available. It enters new reservations, cancellations of reservations, and changes.
- **Revenue Reporting and Accounting.** This routine manages the fare collection finances, including the credit card billings.
- **Sailing Manifest.** The sailing manifest is generated from the master file about 6 to 12 hours prior to scheduled departure of the respective sailing and delivered in hard copy to each terminal. When the sailing manifest is printed, reservations are closed.
- **Ticketing.** Tickets are issued for reservations made before the five-day, pre-sailing cutoff. If a ticket is not issued, the reservation and prepayment are verified from the manifest.

System Hardware

The system hardware includes:

- **Four Datapoint 6000 Processors (linked together).** These processors operate the software to access and update the reservation files.
- **Three IBM-AT Processors.** These are used to help with processing data and file maintenance. Back-up files are created on disk and tape at the end of each day.
- **Remote Stations (monitor and keyboard).** There are 17 remote stations in the Reservation Centre. These are used by the telephone operators handling incoming calls. Each of the ferry terminals also has a remote station.
- **Telephone Lines.** The remote stations outside the Reservation Centre are connected to the main processing unit. Telephone connections also provide for contacting the Reservation Centre number as a local call from Vancouver and the Gulf Islands. The agency is in the process of getting a 1-800 number.

Reservation System Operation

Reservations may be made by telephone or in person at the Information Reservation Centre. All requests for reservations, cancellations, or changes, regardless of origin, must be processed through the central office.

The procedure for making a reservation is as follows:

- The motorist contacts the central reservation office by calling (604) 381-1401 or Telex 04-97133.
- The motorist indicates the date and time he wishes to make a ferry trip and the terminal from which he will be departing.
- The reservation clerk calls up the appropriate sailing on the monitor and tells the caller the scheduled sailing time and whether space is available.
- Assuming that space is available and that the caller decides to make the reservation, he must give his/her name, vehicle license number, and the length of the vehicle.
- The reservation clerk then asks for a credit card number and confirms the reservation (payment could also be made by check). If the reservation is within five days of the sailing date, prepayment is not required.
- A ticket is mailed to the caller.
- If space is not available, the caller is put on a waiting list and will be called if and when space becomes available.

Some Additional Items

- Motorists with reservations must check in ahead of scheduled sailing time. The check-in time is 40 minutes in advance of sailing at Tsawassen and 30 minutes on the islands.

- Cancellations made 14 days in advance of sailing date receive a full refund. Within 14 days, refunds may be requested based on extenuating circumstances.
- About 90 percent of payment is by charge card.
- Allocation of space to commercial vehicles has not been a problem.
- Advance bookings by tourist facilities and travel agents has not been a problem.
- Vessel reliability problems (cancellation of sailings) are apparently few and far between.
- The reservation system is not inexpensive. Staffing requirements are 29 in winter and 50 in summer. Cost of the reservation system is treated as a general cost of operations.

Woods Hole-Martha's Vineyard Ferry Service

Ferry Service between Woods Hole, Massachusetts, and Martha's Vineyard, an island south of Cape Cod—and also a part of Massachusetts—is provided by the Woods Hole, Martha's Vineyard, and Nantucket Steamship Authority. The service consists of two routes: one between Woods Hole and Vineyard Haven, the main terminal on the island, and the other between Woods Hole and Oak Bluffs, a secondary terminal. The routes are exclusive, with each ferry run making a single stop. Each route is nine miles in length.

Background

The Steamship Authority is a public agency created by the Commonwealth of Massachusetts but operated as a local entity. The current authority was established by legislation enacted in 1960. The governing body is a three member board appointed by local elected officials of Falmouth (town), Dukes County (Martha's Vineyard Island) and Nantucket County. In addition to a governing board, the enabling legislation also provides for a Finance Advisory Board consisting of three members who are directly elected. The Finance Advisory Board operates as an oversight body on matters pertaining to budgetary decisions and financial conditions.

Besides the Woods Hole-Martha's Vineyard routes, the authority also operates the ferry route between Hyannis, Massachusetts and Nantucket Island. About 82 percent of the traffic is on the Martha's Vineyard routes.

All operating and capital costs of the ferry service are financed from fares and other operating revenues. The Steamship Authority is not a recipient of state or federal funding. Its financing base is the local communities. If faced with an operating loss, the local communities—Falmouth, Martha's Vineyard, and Nantucket—would be required by state law to provide sufficient funding support to cover the deficit. In recent decades, user revenues have been adequate to cover operating costs and debt amortization, and no subsidy has been required since 1962.

In 1989, the authority had an operating budget of \$26.3 million. Over a third of revenues were from passenger fares, a third from auto vehicle fares, and the remainder from freight tariffs, parking fees, and other revenues. During the last 10 years, revenues from auto fares, freight tariffs, and parking fees have grown much more rapidly than have passenger revenues.

The authority operates a fleet of six vessels, three of which provide most of the vehicle and passenger capacity. These vessels have a capacity range from 52 to 60 vehicles and 800 to 1,500 passengers.

Factors Affecting Ferry Operations

The attributes of the reservation system and its interface with users are affected by geography of the area, traffic characteristics, and operating policies of the ferry agency. The more important of these are as follows:

- The tourist industry is the mainstay of the Martha's Vineyard economy. There are about 11,500 permanent residents on the island and about twice that number who own or rent second homes. The peak summer population is estimated at over 50,000.
- In 1989, the Woods Hole-Martha's Vineyard Ferry routes carried 313,000 automobiles, 1,693,000 passengers, and 211,000 tons of freight. The traffic is

highly seasonal; over 55 percent of all passengers and 48 percent of all vehicles were carried in the four months, June through September.

The fare structure is adapted to the seasonal demand conditions. The standard one-way auto fare is \$30 during the period of high demand, May 15 to October 15. During the remainder of the year, it is \$15.25. Passenger fares (one-way) are \$4 for adults and \$2 for children year round. A number of special excursion fares (with discounts as great as 50 percent) are available for round trips beginning on the island. Coupon books are also available for frequent travelers.

- The ferry terminals do not have toll booths and secured holding areas as such. Tickets are issued for all fares and these are collected by a purser at the entrance to the loading ramp. Vehicles having confirmed reservations are required to be in place in the waiting queue 30 minutes prior to sailing time.
- Both at-site and remote parking—with shuttle bus connection—is provided at the Woods Hole Terminal. The parking fee is \$7 per 24-hour period or portion thereof.

System Software

The ferry reservation system was initiated as a manual system in the late 1960s. In the late 1970s, when computer technology had become more sophisticated, an automated reservation system was developed. The software was developed as a custom product by Mr. Carter Brown and was put into operation in 1979. Mr. Brown was subsequently retained as a consultant by the authority to revise and improve the software. An updated version was completed in 1987.

The elements of the software are similar to those used by B.C. Ferries in their reservation system for the Tsawassen-Gulf Islands routes.

- **Service Schedule.** The service schedule is the prerequisite for establishing the space available for reservation.

Currently there are five different schedules through the year. The most important of these, the summer schedule (this year), began on May 23 and extended

through September 13. In addition, there are two schedules in fall and early winter and two more in winter and spring. This year reservations were opened for the spring, summer, and fall schedules on January 26.

- **Master File.** This file is a composite of files—one for each sailing, containing the date and time of the sailing, the departure and destination terminals, the name of the vessel, and the vehicle capacity available for reservation.
- **Access/Entry/Change Program.** This is the program used by the reservation clerks. It calls and displays on a monitor the currently updated data record for a specific sailing. The data record accepts and records pertinent information for new reservations and changes or cancellations of existing reservations. It maintains information on the amount of space reserved and the amount available for reservations on each sailing.
- **Revenue Reporting and Accounting.** This routine extracts information from each completed reservation as entered on the reservation file for each sailing through the Access/Entry/Change Program. The program manages the fare collection finances, including the credit card billings. The program is run at the end of each business day.

An important part of this program has to do with the collection of the fare payment funds. For those reservations where payment is to be made by check, the program generates a billing which is then mailed to the customer. It also adds the name to a suspense file where it remains until the check is received and the bank transaction is cleared. Five business days are allowed for this operation. If it has not occurred within that time, the reservation is automatically cancelled.

If payment has been made by credit card, the amount is entered into a tally for the respective card issuer (American Express, VISA, and MasterCard are accepted) and once a day, at the end of the fare payment processing operation, an electronic transfer is made from the card issuer's account to the Steamship Authority account. The electronic transfer procedure is a fairly recent improvement in the reservation system software. Previously, hardcopy billings had been generated, and these were submitted to the credit card agencies once a week.

- **Tickets.** The Steamship Authority's fare collection procedures require that a ticket be issued for every passage (either a vehicle and passenger or a walk-on passenger). Tickets are generated and printed by computer. Those resulting from telephone reservations are printed off-line at the end of each business day and mailed the next day. For passages bought at the Woods Hole, Village Haven, and Oak Bluffs ticket counters, the tickets are printed on-line at the ticket agent's station.

Virtually all walk-on passenger and stand-by vehicle tickets are purchased at the ticket counters. Coupons may be used to purchase tickets.

System Hardware

The system hardware consists of a main computer center and a network of remote stations.

- **Central Computer Facility.** The central computer station includes the following equipment: a Data General 1500 mini computer, a bank of disk storage units, two printers, and an electric power stabilization unit (to avoid the extreme disruption caused by a power failure).
- **Remote Stations.** The major reservation center for the agency is located in Falmouth and has 10 telephone operator stations. A secondary center with three stations is located on Martha's Vineyard. Each of these stations has a telephone unit, a keyboard, and a monitor. There is an incoming telephone line for each station. There are also two keyboards, monitors, and printers at each terminal ticket counter.
- **Telephone Lines.** There are 13 telephone lines accessible to the Authority's reservations number serving the mainland and 3 lines available to the telephone number on Martha's Vineyard (Island). When these lines are full, the caller gets a busy signal. During the summer, incoming calls saturate the lines available during much of the time.

System Staffing

- **Operations.** The reservation centers are open for incoming calls from 8:00 a.m. to 9:00 p.m. daily, including Sunday. The staffing involves a two-shift operation.
- **Personnel Required.** The operation of the centers requires one manager and four supervisors on a year-round basis. The number of reservation clerks varies through the year as follows: Falmouth Center, 16 year round and 32 at the peak; Martha's Vineyard, 6 year round and 11 at the peak period. The basic pay rate (1990) for reservation clerks is \$6.50 per hour. Fringe benefits include vacation, sick leave, and medical/dental insurance.

Additional personnel are required for operation of the ticket counters.

Operating Procedures (Reservations)

- **Making a Reservation.** Reservations may be made in any one of several ways:
 1. In-person at one of the ferry terminals
 2. Mail-in requests
 3. By telephone.

The majority of reservations are made by telephone. The in-person and mail-in request options are used primarily as a means of giving priority to island residents.

The customer seeking to make a reservation must first identify the dates and times of sailings that are desired. The ticket agent or reservation clerk determines whether there is space available at these times, and if so, proceeds with the transaction. A contact or call may involve a request for a reservation on one sailing or for reservations on several sailings. Most transactions involve reservations for several sailings.

The information required by the reservations clerk—for entry into the computer record—is as follows:

1. Vehicle Type - If the vehicle is over 18 feet in length, the vehicle length must be obtained and converted into vehicle spaces.

2. Other Vehicle Characteristics - Trailers and over-height vehicles are identified.
3. Type of Reservation - A standard reservation is for a one-way or round trip. Multiple reservations are repeat trips with the same vehicle on two or more days of travel. Bulk reservations are for a group of vehicles all on one sailing. (Tourist businesses on the island are free to make such purchases.)
4. From and To Terminals for Each Trip.
5. Sailing Date and Time for Each Trip. At this point, the reservations clerk must determine whether there is space available on each of the sailings. If space is available, the clerk proceeds with the transaction.
6. Fare Category - The categories are standard fare, group fares, and discount fare packages, of which there are several.
7. Passengers - The number of passengers and their respective fare categories are identified.
8. Fare Payment - The fare for the vehicle and passengers is calculated. Payment may be with cash, by coupon (in-person transactions), check, or credit card. If the latter, the clerk obtains the name of the credit card issuer and the card number, which are then verified for authenticity.

With this information, the computer calculates the fare due for each trip and also for all the reservation transactions made on this call/contact.

- **Changing a Reservation.** Reservations may be changed from one sailing to another assuming that space exists on the sailing desired. There is no penalty for a change of reservation.
- **Cancelling a Reservation.** A reservation may be cancelled and the ticket used to pay for stand-by passage within 48 hours of the time and date for which the reservation had been made. There is no penalty for this option.

If the purchaser desires a refund, the ticket must be mailed to the Reservation Center, and there is an automatic \$10 processing fee. If the cancellation is 15 days or more prior to the sailing date, the full fare (less the \$10 charge) is refunded. If the cancellation is within the 15-day period, a 25 or 50 percent penalty may also be applied. If there are extenuating circumstances, written requests for exceptions to this rule are usually accepted by the Authority.

If the tickets have been paid for by credit card, the refund is processed as a credit on the customer's credit card.

Policy Issues

A major policy issue has to do with the recognized need to provide priority access and favorable fare treatment for island residents. This is done in several ways:

- When the reservation season opens (late January), a period of time is set aside when reservations can only be made at the terminals on the islands. At the same time, mail-in requests containing proof of island residency are given priority treatment.
- The Authority sells coupon books with 20 one-way vehicle fares at a 20 percent discount. Frequent users are able to avail themselves of the benefit.
- Several types of fare discount packages are available for round trips beginning and ending on the island. The best discount package is a 24-hour, round-trip package offered at half price during the summer.
- The Authority has assiduously avoided using residency as a qualification for special fares because of the legal ramifications.

FERRY USER DATA

In designing this study, it was recognized from the outset that the validity of the findings and recommendations would depend on having up-to-date and representative information on ferry use and on the attitudes, concerns, and preferences of the ferry users. To obtain this information, two data collection exercises were planned and carried out. The first consisted of public meetings held on Lopez, Orcas, and San Juan Islands, and the second consisted of an on-board survey of vehicle traffic outbound from Anacortes on Friday, July 6, 1990. Prior to the formulation of these two data collection exercises and to obtain information for that purpose, informal meetings were held with elected officials and interested citizens on Orcas and San Juan Islands.

The data collection exercises are reported in detail in Working Papers Nos. 1, 2, and 3.

Attitudes and Concerns of Island Residents

To obtain citizen input on a possible reservation system for the San Juan ferry routes, public meetings were held on Lopez, Orcas, and San Juan Islands on June 11 and 12, 1990.

The meetings were announced through articles in the local newspapers, in an advertisement in the Island *Shopper* which is mailed to residential addresses on the islands, via bulletins posted on the ferries and at places throughout the islands, and through contacts made with community groups. Over 130 island residents participated in the three workshops, including 45 at the meeting on Lopez Island, about 45 on Orcas Island, and about 40 at the meeting in Friday Harbor on San Juan Island.

At each of the meetings, a brief presentation was made by the study team to explain the purpose of the meetings and to ask for the participation of those present. Following the presentation and a brief question and answer period, those present were requested to form small groups to participate in a discussion responding to three questions regarding a potential reservation system: (1) potential benefits, (2) perceived negative aspects, and (3) essential elements of a system considering the best interests of all users. The discussion groups provided an opportunity for each participant to express an opinion and balance it against the

opinions of others in the group. Each of the discussion groups then prepared a written summary of the response of the group. These were reported to the group as a whole.

Following the small group discussions, each of the participants was asked to complete an individual questionnaire.

Group Discussion Results

Considering the question of benefits from a reservation system, there was general agreement that the assurance of obtaining passage on a particular ferry would be a significant benefit to virtually all island residents and thus the main advantage from having such a system. Other potential benefits, such as reduced stress and frustration associated with ferry traffic and the prospect of greater equity among ferry users, were considered to be secondary advantages by the group participants.

On the negative side, there was the perception, emphatically expressed at all the discussion groups, that a reservation system would seriously disadvantage local residents because it would allow the tourist industry to buy up all the available space on the ferries during the most desirable travel times. This fear stemmed from the perception that the operators of tourist facilities could anticipate the need to reserve ferry space for their customers far in advance of the actual travel dates, whereas local residents could not plan ahead that far.

Another important concern was about the cost of establishing and operating a reservation system and how it would be paid for. The concern was that island residents would be required to participate in paying for the system even though the need for a reservation system—as perceived by island residents—was caused by the growth of tourist traffic.

An additional negative concern expressed in the group discussions was the prospect that a reservation system would take away the resident's opportunity to be spontaneous in their daily activities and make travel decisions on short notice. It would require a change in habits toward a more regimented lifestyle.

Among the elements considered to be essential for a reservation system on the San Juan ferry routes, the discussion groups were unanimous in supporting the need for

assuring priority access by island residents. The concern was that some method should be found to guarantee space for island residents. As traffic volumes have increased on the San Juan routes, residents are faced with an ever more serious problem of being able to get on and off the islands to meet their needs. There is a broadly held conviction among island residents that their travel needs involving ferry trips have a higher priority than those of nonresidents and tourists in particular.

Other elements of a system identified in the group discussions included:

- Limit the amount of space that can be reserved, leaving some space for stand-by traffic, so that at no time will sailings be entirely booked ahead.
- Have an equitable means of financing the cost of a reservation system, preferably a means which does not include a fare increase.
- Be aware of the San Juan ferries as an extension of the state highway system.
- Have a 24-hour, toll-free reservation telephone line.
- Make sure space is provided for special needs and emergencies, including new increments of space for commercial vehicles. The perception is that commercial vehicles adversely impact space for the residents.

Questionnaire Results

Following the group discussions, participants at the meetings were asked to complete an individual questionnaire. While the response to this questionnaire cannot be exactly projected to all residents of the islands, it does provide a reasonable indication of their travel characteristics and opinions relating to a reservation system.

Information summarized from the responses to the questionnaire which could be relevant to the design of a reservation system is as follows:

- The frequency of travel by ferry varies from island to island. A little over one-half of all residents make one to three round trips per month. About a third make four to seven round trips per month.
- The average wait for the ferry was reported as 1 hour and 30 minutes. A little over one-third reported waiting two hours or more.
- Most of the residents have some flexibility in their schedule and could have taken an earlier or later sailing if justified. Only 23 percent said that they absolutely had to be on the sailing they took.

On the question of whether one favors or opposes having a reservation system, there was considerable difference in the response between those attending the meeting at Friday Harbor and those attending the meetings on Orcas and Lopez Islands. Those at Friday Harbor strongly favored a reservation system while those at the other meetings were more divided in their opinion. Overall, 43 percent favored having a system, 24 percent opposed the proposition, and 33 percent were not sure.

On the question of who should have priority, there was a high degree of uniformity. Highest priority was indicated for full-time island residents, second priority for trips involving medical needs, and third priority for commercial vehicles. While residents have a keen realization of the need to have essential commodities transported to the islands, they are irritated by the space required to transport trucks, especially the large tractor-trailer rigs.

Finally, on the question of whether fare payment should be required at the time a reservation is made, almost two-thirds agreed that it was necessary. The strength of the answer to this question indicated that many participants had given considerable thought to the subject and had more than a passing idea of what would be necessary to make it work.

Ferry User Travel Characteristics

Information concerning ferry travelers and the characteristics of trips made by ferry is necessary both for the design (preliminary and conceptual at this time) of a reservation system and of its impact on ferry users. Travelers on the San Juan ferry routes fall into

several categories, and it is appropriate to consider the circumstances of each of these categories in determining the elements and attributes that should be included in a reservation system.

It has been customary for WSF to conduct surveys of ferry travelers on a periodic basis. This has been done with what are called on-board surveys. The information collected in these surveys has customarily included: purpose of the trip, origin and destinations of the trip, residence of the tripmaker, method of fare payment, type of vehicle, and mode of travel (that is, auto driver, auto passenger, or walk-on passenger). The most recent survey was conducted in 1986.

For the purpose of this investigation—concerning the feasibility of a reservation system—some additional information was desired. Included are items such as frequency of ferry trips, ferry wait times, flexibility of the traveler, and attitudes toward a reservation system. To obtain this information, a one-day, on-board survey was conducted on Friday, July 6. Information obtained in this survey served two purposes: (1) to corroborate general data about travel characteristics from previous surveys, and (2) to provide some of the specific data needed for the design of a reservation system. Details of the survey methodology and results are presented in Working Paper #3, *Report on Vehicle Driver Survey of San Juan Ferry Routes*. Relevant information from this report is summarized in the following sections.

Survey Methodology

The survey of San Juan Island ferry traffic was conducted on Friday, July 6, 1990. Questionnaires were distributed to drivers of vehicles boarding ferries outbound from Anacortes between 8:30 a.m. and 10:45 p.m.

Over half of the questionnaires distributed were returned. Of those returned, 400 were complete and usable for the survey data tabulation. This represented 34 percent of the 1,174 passenger vehicles (autos, pickups, and RVs) carried by the 13 ferry runs outbound from Anacortes between 8:30 a.m. and 10:45 p.m.

The data summarized from the 400 usable questionnaires was compared with data from previous on-board surveys, and based on this comparison, was deemed to be sufficiently

representative of peak season ferry traffic to be usable for preliminary planning purposes. However, it is important to note the limitations of the survey and the need to augment the data base for use in the actual design of a reservation system. The limitations are:

- The data represents the travel characteristics and attitudes of those who chose to complete and return the questionnaire. The percent of return varied from one ferry run to another and was significantly lower on the runs to Sidney, B.C.
- The data were collected on a single day (Friday) during the summer peak and thus represent travel characteristics for that day. Fridays in summer typically have a higher percentage of tourists and other non-island residents than would be the case for other days of the week and other seasons of the year.

For the purpose at hand, however, it was feasible to make adjustments to the data so as to estimate year-round average characteristics.

Survey Results

The analysis of the survey results was directed toward travel characteristics and other information that would be useful in the design of a reservation system. For this purpose, the responses were grouped into two categories: those of island residents and those of non-island residents. The different characteristics and needs of these two categories had been discussed previously.

The following findings from the survey data are relevant to the design of a reservation system and to the evaluation of the components and overall impacts of a system:

- During the peak summer season, about 30 percent of ferry trips (not counting commercial vehicles) on the San Juan ferries are made by residents of the islands. Considering year-round travel, the percentage is in the range of 35 to 40 percent.
- Over half (55 to 60 percent) of all non-island resident ferry trips are made by residents of King, Pierce, and Snohomish Counties; about one-fourth (20 to 25 percent) are made by persons who reside outside the State of Washington.

- The majority of island residents make between 5 and 10 round trips in a 90-day period. Over two-thirds of non-island residents made just one round trip (the one they were on the day of the survey) during the last 90 days.
- The trip purposes for which island residents use the ferry reflect the day-to-day needs of ordinary living and are very similar to the trip making characteristics of people in similar communities elsewhere. Over half of all trips by island residents were work or business related. By contrast, less than 20 percent of non-island residents use the ferries for work or business-related trips. Over 80 percent are for social recreation purposes—vacation, holidays, and visiting friends. Occasional or one-time travelers from among this group are usually characterized as tourists.
- Trips by non-island residents are planned somewhat further in advance than those by island residents. According to the survey, 55 percent of trips by non-island residents were planned one week or more in advance, whereas only 35 percent of trips by island residents were planned this far ahead. It is significant that about two-thirds of the trips by island residents were planned less than one week in advance.
- The amount of time one has to wait before getting on a ferry depends on two factors: (1) how far in advance of scheduled ferry departure time the traveler arrives at the terminal and (2) whether a traveler has to wait for the next ferry if there are more vehicles in the queue than can be accommodated on the desired sailing. According to the survey, the average wait time of all vehicles was about one hour and ten minutes. There was not a significant difference between island residents and nonresidents in the amount of time.
- Over two-thirds of all travelers indicated they could have made some adaptation in their ferry travel times—that is, changed to an earlier or later sailing without too much inconvenience—if space would have been guaranteed on that sailing.
- About half of island residents and about 10 percent of nonresidents use commuter book coupons to pay their fare. The data indicates that about 15 to 20 percent of the trips by nonresidents are made by frequent travelers who have second homes or jobs on the islands.
- Write-in comments by survey respondents covered a variety of items.

Implications of the Data

The results of the on-board survey of ferry users and the public meetings held on Lopez and Orcas Islands and in Friday Harbor provide valuable information concerning ferry user characteristics, local attitudes, concerns, and priorities regarding ferry service. It is evident that much of this information is essential input for the design of a workable and locally acceptable reservation system for the San Juan ferries.

An analysis of the data indicates a number of key points which address essential elements or attributes of a reservation system.

- There is a strong conviction among island residents (probably a majority) that some type of preferential access to ferry service should be provided for local residents. This is justified (in the minds of its proponents) because local residents are dependent on ferry service for travel essential to their day-to-day livelihood and living patterns. Over half the ferry trips made by island residents are work or business related. Ferry travel is necessary to obtain many goods and services; it is essential for medical treatment since there are no hospitals or medical facilities on the island.
- By comparison, tourists and other nonresidents are generally able to accept the consequences of having a subordinate priority access to ferry service. Over 80 percent of their trips are social/recreational in nature and they are better able to plan their trips well in advance of their intended travel. Since most tourist trips are one of a kind, making a reservation well in advance of a trip would be a normal procedure. For these reasons, local residents fear that many of the more popular sailings would be fully booked far in advance.
- Island residents have given considerable thought to the need for a reservation system and the trade-offs involved. The average wait time for ferries (during much of the year) is between one and one and a half hours. The anxiety of missing the last ferry is ever present. The tradeoff is acceptable. Over two-thirds of all travelers indicated they could have made some adaptation in their ferry travel times (changed to an earlier or later sailing) with little or no inconvenience.

- In spite of the vocalized concerns, when asked to indicate their preference (on the questionnaire distributed at the end of the public workshops), 43 percent of the participants favored a reservation system compared to 24 percent who were flatly opposed and 33 percent who were unsure. The positive benefits of a reservation system, that of having guaranteed space on a given sailing, was seen as the overriding consideration by a plurality of those who attended the public meetings.

CONCEPTUAL DESIGN OF A FERRY RESERVATION SYSTEM

This chapter describes a preliminary design for a prospective reservation system for the San Juan Island Ferry routes. It defines, at a conceptual level, essential elements of the system, including system software, hardware, personnel requirements, and cost. It includes a discussion of design determinants and policy and procedure assumptions. These involve market factors and key operating variables about which estimates or assumptions must be made as a basis for designing a system. It is important to note at this point that the assumptions regarding design criteria, especially those having policy implications, are subject to review and modification as further efforts are undertaken in developing a reservation system.

Design Determinants

As a basis for designing a reservation system, it is necessary to make estimates and/or assumptions regarding market factors and key operating variables that will affect the size and attributes of the system. Estimates of the volume of reservations to be served, the concerns and expectations of ferry users, and those policy and procedural variables that directly affect design and operation of the system, have to be postulated in advance.

If a vehicle reservation system for the San Juan Island ferry routes were to be implemented, it would have to be significantly larger than those now in operation at the British Columbia Ferries Gulf Island routes and the Woods Hole-Martha's Vineyard routes (in Massachusetts). It is appropriate, therefore, to begin with an analysis of traffic volumes and the quantity of reservations that will have to be accommodated by the system.

Traffic Growth

The size of a reservation system, that is, hardware components and personnel requirements, is primarily a function of the number of reservation contacts that will be made through the course of a year. These in turn are determined by a number of variables, the most important of which are traffic volumes (travel demand) and ferry system capacity. For the purpose of this study, traffic and capacity estimates have been made for 1990

based on existing conditions and projected for 2000 based on expected conditions. Considering the steps that would have to be taken to implement a system and the likelihood that these would require several years to accomplish, it is proposed that the projected year 2000 conditions be used for sizing the hardware and costing the one-time investment required for the system, and that an interpolated value for 1995 be used for sizing the software and operating requirements, including personnel needs.

Historical data on traffic growth trends and ferry capacity and utilization on the San Juan routes were discussed in a previous section of the report. During the past ten years, traffic growth on the routes has averaged 5.5 percent a year—a rate substantially in excess of statewide traffic growth during this period. On the domestic routes, the year-to-year growth has been remarkably consistent, which indicates the strength of the underlying socioeconomic factors affecting travel demand to and from the islands. The most important of these factors has been the increased popularity of the San Juan Islands as a vacation/recreational destination. About 65 percent of ferry trips are made by tourists (infrequent users) and persons having a second home on the islands. The growth of these trips has been related to population growth in the metropolitan centers of Western Washington.

Trips by island residents constitute the second major category of ferry users. The growth of these trips is associated with population off the islands. During the past decade, population of San Juan County increased 28 percent from 7,800 in 1980 to 10,000 in 1990. Other factors which contributed to the traffic growth during this period were the relatively prosperous economy and dependable supply of low priced gasoline during the last several years, and perhaps most important of all, the relative low fares on the routes. Summer fares on the San Juan Island routes are about half the fares (in U.S. dollars) of the Gulf Island routes of B.C. Ferries and about one-fourth the fares on the Woods Hole-Martha's Vineyard ferry in Massachusetts.

On the supply side, there are indications that traffic growth in recent years has been constrained by ferry system capacity limits. During the last four years, while total traffic has grown at an average rate of 6.2 percent a year, the rate of growth for traffic during the summer season has been only 3.8 percent a year, the difference being made up by high growth in the non-peak seasons of the year.

In estimating traffic for the year 2000, it was assumed that the demand factor which prevailed in the 1980 to 1990 decade would continue substantially unchanged through the next ten years. That is, the San Juan Islands will continue to be a desirable vacation and recreation destination, there will be continued growth in the demand for recreational opportunities, and the population growth of the islands will approximate that of previous decades. On the supply side, however, there is an expectation that ferry system constraints will become ever more important during the next ten years. Considering that the policies of the State Legislature, the state Transportation Commission, and San Juan County do not—at least at present—include plans for the acquisition of additional ferry capacity (vessels and terminal facilities) for the San Juan Island routes, it is necessary to assume that there will be no increase in peak season ferry capacity and only minor increases in off-peak capacity before the year 2000. Assumptions regarding ferry capacity through the year 2000 are derived from the proposed sailing schedule shown in Table 6.

Table 6. San Juan Ferries' Scheduled Sailings and Capacities - 1991 Through 2000

Vessel Class	Vessel Capacity (spaces)	No. of Runs Daily	Total Capacity Daily (spaces)
June 15 to September 22			
Outbound from Anacortes:			
Superferry	160	6	960
Evergreen State	100	8	800
Nisqually	75	1/7	11
Evergreen State	100	2/7	29
Inter-Island (Westbound)	75	5	375
September 23 to June 14			
Outbound from Anacortes:			
Superferry	160	5	800
Evergreen State	100	3	300
Nisqually	75	4	300
Superferry	160	1/7	23
Inter-Island (Westbound)	---	---	---

Source: Washington State Ferries, Ferry Scheduling Section.

With these considerations in mind, a 3 percent overall annual rate of ferry traffic growth was arrived at as being feasible and reasonable during the 1990 to 2000 period. Because of the capacity constraint factor, growth during the summer is expected to be lower—2.1 percent per year. During the other seasons, a growth rate of somewhat over 3 percent per year would be expected.

It is important to note that the above ferry traffic growth projections were developed for use in this study of a potential reservation system and are not necessarily consistent with forecasts developed by WSF using the systemwide forecasting process adopted several years ago. The projections developed in this study are derived from an analysis of local conditions which will affect traffic trends and the propensity for making a reservation. The WSF process is designed to be consistent with statewide indicators used for budget preparation and revenue forecasting.

Number of Reservations

The sizing and cost of the reservation system will be a function of the number of reservation contacts made by users of the reservation system. Every call to a reservation clerk or face-to-face contact at an office (the reservation center or an outlying station) is a reservation contact. The first step in estimating reservation contacts is to estimate the number of confirmed reservations that would be made. It is expected that users will make reservations when the satisfaction of having a guaranteed space exceeds the trouble of making the reservation. The satisfaction of having a guaranteed space will be high for weekend and midday trips; that is, the sailing times that are most popular. It will be low for early morning runs and generally during the off-peak times of the year. With this in mind, an estimating equation was developed using two variables as indicators of the propensity to make a reservation rather than to take a chance on traveling stand-by. The variables and the relationships are:

- The percent of sailings departing with capacity loads (directly proportional) and
- The percent of unused space available on those sailings departing without full loads (inversely proportional).

The service and utilization conditions by month for 1990 and the estimated number of confirmed reservations that would have been made based on these conditions are shown in Table 7. Similar data for the projected conditions in the year 2000 and the number of reservations expected then are shown in Table 8.

Table 7. Estimate of Vehicle Reservations - 1990 Base Year Conditions

Month	All San Juan Routes				Estimated Reservations
	Total Vehicles	No. of Sailings ¹	Percent Overloads	Percent Space Utilization	
January	34,300	560	6%	49%	8,900
February	32,100	350	11%	56%	12,300
March	48,500	410	29%	72%	30,700
April	52,000	500	28%	72%	32,500
May	58,200	570	29%	77%	37,600
June	66,800	710	27%	74%	41,600
July	91,500	900	41%	76%	67,100
August	99,900	900	44%	84%	77,400
September	72,000	700	35%	74%	49,200
October	52,100	630	24%	59%	29,400
November	44,300	620	19%	52%	21,700
December	44,100	630	19%	50%	21,300
TOTAL	695,800	7,480	28%	74%	429,900

¹ Counted as the number of vessel runs departing from and returning to the Anacortes Terminal.

Source: Ferry traffic and service conditions derived from WSF statistical and operational reports. Vehicle reservations estimated as part of this project.

A considerable variation in the monthly volume of confirmed reservations will occur throughout the year. Considering the 1990 conditions, the number of reserved spaces would be in the order of 75,000 to 80,000 in August, the peak month, and only about 9,000 in January. The reason is apparent. In August, 44 percent of all ferry runs were fully loaded, and some traffic was left standing in the waiting area. Also, only 16 percent of the aggregate space available was unused—virtually all of it at less desirable travel times. By contrast, in January, only 6 percent of vessels departed fully loaded, and over 50 percent of all spaces available were left unfilled.

Table 8. Estimate of Vehicle Reservations - 2000 Projected/Forecasted Conditions

Month	All San Juan Routes				Estimated Reservations
	Total Vehicles	No. of Sailings ¹	Percent Overloads	Percent Space Utilization	
January	53,200	752	19%	58%	26,400
February	47,800	680	18%	58%	23,100
March	70,000	752	28%	77%	45,100
April	75,000	728	31%	84%	51,800
May	80,400	752	33%	87%	57,400
June	86,800	802	39%	85%	64,300
July	112,200	894	67%	94%	99,600
August	115,400	894	75%	97%	106,000
September	93,000	866	41%	86%	70,100
October	72,900	752	29%	80%	48,300
November	64,200	728	26%	73%	39,400
December	64,000	752	26%	70%	38,700
TOTAL	934,900	9,352	37%	80%	670,200

¹ Counted as the number of vessel runs departing from and returning to the Anacortes Terminal.

Source: Data developed as part of this project.

During the next decade—according to the year 2000 scenario projected for this study—vehicle traffic is expected to increase about 34 percent and the number of reservations by over 55 percent. Ferry system capacity will not be increased commensurate with the increase in travel demand; during the summer season there will be virtually no increase. This will bring about higher levels of utilization and, with it, a greater inclination by ferry travelers to secure guaranteed reservations. A consequence of this scenario is likely to be greater pressure on WSF to provide more ferry capacity and/or an increasing acceptance of the need for a reservation system.

As was stated above, the year 2000 projections will be used for sizing the hardware requirements and estimating the fixed costs. A projected 1995 level of activity (average of 1990 and 2000) will be used to determine software and personnel requirements and for estimating annual operating costs.

Ferry User Attitudes and Expectations

The results of the public meetings with island residents and the on-board survey of ferry users were reviewed in a previous section of this report. The information on user travel characteristics and on the attitudes, concerns, and expectations of island residents provides valuable guidance for the design of a reservation system, especially the features that would be necessary to make such a system acceptable to those most affected.

The important conclusions to be drawn from the public input for this purpose are as follows:

- There is support for a reservation system. Based on the survey data, it is reasonable to conclude that those local residents who have formed an opinion on the subject tend to favor a reservation system by a clear majority over those who flat-out oppose the idea. However, there are many who are undecided and may only select a preference after a concrete proposal is presented for review.
- There is a prevalent fear that a reservation system will favor tourists and other nonresidents. Since tourist trips are generally singular events, they can usually be planned and hence, space could be reserved far in advanced. If a reservation system does operate to the advantage of tourists, it would be at the expense of island residents, and this would be clearly unacceptable.
- There is strong support for any system or procedure which will give local residents preferential access to ferry service. Preferential access was seen as necessary and justified because San Juan residents are dependent on ferry service for many of their day-to-day needs. For instance, there are no hospitals or medical treatment facilities on the islands. By comparison, tourists and other visitors, since their trips are discretionary, can accept the consequences of having a subordinate priority access to ferry service.
- Several features of existing service policy are strongly supported and should be included in a reservation systems plan. Two of these features which received the most attention were: the availability of commuter ticket books with their 20 percent fare discount (the effective rate in summer is 33 percent), and priority loading for medical emergencies and certain commercial vehicle cargoes.

The above concerns and expectations stem from a keen sense that all categories of ferry users should be treated equitably. A reservation system for the San Juan ferries must have safeguards which assure that no group of users has an unfair advantage or disadvantage. In developing a reservation system concept, it is necessary to include provisions which will give everyone reasonable access to the available ferry space and are perceived by all user groups as being equitable.

Some options for structuring a reservation system to achieve these objectives were discussed with WSF staff, the participants at the public meetings, and with contacts at the other ferry systems. The ideas that have been identified are as follows:

1. Establish a limit on the percent of space available for booking in the initial (advance) reservation period. This booking limit would be designated for each sailing and included in the sailing record (file). When a predetermined percent of the space on a specific sailing was reserved, reservations would be closed for that sailing.

The percent of space to be made available in the advance booking period—an educated guess initially—would be subject to refinement based on experience. The cutoff percentage would ultimately be set so that the amount of space withheld would balance the amount for which there was a demand in the "late" registration period. This procedure has been used by the Woods Hole-Martha's Vineyard ferries on some of their sailings. Here the cutoff point is a little over 90 percent, leaving a little less than 10 percent of the space available for booking during the late registration period—or for vehicles traveling stand-by.

It should be noted that this reservation technique, which provides the residents of Martha's Vineyard (Island) an opportunity for carrying out last-minute travel decisions, is well received and does not appear to be abused.

2. Open the late reservation period a few days before sailing time. The remaining space would be made available for booking only on the islands and with a cash or coupon transaction. In the case of the Woods Hole-Martha's Vineyard operation, the late reservation period is opened 48 hours before the scheduled sailing.

3. Continue the use of the current frequent user ticket book. Script should be usable directly as fare payment for stand-by passage or as payment for a reserved space ticket. As an alternative, WSF might explore the feasibility and acceptability of a fare card used in conjunction with an advance deposit. The fare card could be used to purchase reserved space tickets or stand-by tickets either in person or by phone. If used as a means of providing discounted fares, the fare card plan would have to require a large advance deposit.

Some comment should also be made about the priority loading concept which has become almost a slogan among island residents. The concept is included in the recommendations of the county's comprehensive plan, and the phrase was used frequently by participants at the public meetings. While the concept has not been detailed in terms of a specific proposal, the general idea seems to be that traffic arriving for a ferry departure would form two separate queues—one consisting of island residents and the other of non-residents. All the island residents would load onto the ferry first and only then would non-residents load. Without considering the legal implications of such a procedure, suffice it to say that this simplistic meaning of the priority loading concept is incompatible with a reservation system and is not being incorporated into this design proposal.

WSF Policies and Procedures

In addition to the market factors discussed in the preceding sections (ferry traffic volumes and user preferences), there are a number of policy and procedural issues which relate to the design and operation of a reservation system. The purpose of this section is to specify and/or define these policy and procedural determinants as they will apply to a conceptual design of a reservation system for the San Juan ferries. In most cases, the preferred option assumed or tentatively recommended is based on the experience and judgment of WSF management. In all cases, where a preferred option has been assumed (or recommended), consideration has been given to the characteristics of existing ferry service and ferry traffic, attitudes and concerns of local residents, and the experience of other ferry systems, namely, British Columbia Ferry service to the Gulf Islands and the Woods Hole and Martha's Vineyard routes, where reservation systems have been in place for some time.

- At this time, the reservation system should be concerned only with the reservation of motor vehicles and bicycles. This would include all commercial vehicles.

The system constraint at this time is vehicle space, although there have been rare occasions when departures have been in an overload condition with respect to walk-on passengers. All traffic, including inter-island traffic, will be subject to reservation.

- Prepayment should be required for all reservations taken on the system. The system should accept major credit cards, checks, frequent user book script, or cash. Payment by check must be received within five business days. Cash or frequent user script would be accepted only at the reservation center or by WSF agents at the Anacortes, Friday Harbor, Orcas, Lopez, Shaw Island, and Sidney, B.C., terminals.
- The system should issue tickets for all reserved space fares. They should be mailed to the customer up to a five or seven day cutoff. Tickets for passage reserved within the cutoff period would be held at the respective toll collection booth.
- Reservations may be cancelled with full refund or full transfer of the deposit to another reservation up to 14 days prior to sailing time. In either case, the original ticket must be returned. Granting partial refunds for cancellations within the 14-day period may not be feasible because the service charge would absorb all or most of the refund. A nominal fee (between \$2 and \$5) should be charged for all transactions involving a change from the original reservation.

"No shows" are absolutely nonrefundable, but consideration should be given to having the ticket valid for stand-by loading for a limited period of time (3 to 5 days, for example).

- Toll collection should be reactivated at the Friday Harbor, Orcas, Lopez, and Shaw terminals, but only for vehicles. This is necessary in order to verify reservations, collect fares and/or tickets, and segregate reserved vehicles from stand-by vehicles. Fare collection for driver and passengers will continue as is with the one-point fare collection at Anacortes. While this change will entail some increase in operating costs, it is not a reversion to the earlier conditions when fares were collected in each direction. The major cost savings resulted from the change to cash register sales and the elimination of the purser at the ferry slip. Currently, ticket sales and fare collection are combined in one operation at the toll booth and it is the intent of WSF management that this will continue.

- For reasons explained in the previous section, the reservation system should have a dual booking period. An advance or early registration period would be in effect for each sailing until a predetermined portion of the space (perhaps 85 to 90 percent) was booked. The late reservation date would then be opened a few days before the sailing date (perhaps 72 hours), and the remaining space would become available for booking. During this late reservation period, bookings could be made only at the counter with agents on the islands. Payment could be made using cash, credit card, or frequent user script.
- Some amount of space on each sailing should be left uncommitted and available for loading medical emergencies and other priority travelers, as provided under the applicable section of WAC. The remaining unused space would be available for stand-by vehicles. The cutoff point for limiting the space available for reservation would probably be slightly over 95 percent of the nominal capacity of the vessel. The problem is that the actual number of vehicles that can be loaded on a vessel depends on the skill of the ferry crew and the actual mix of vehicles that show up for a given sailing. It is generally more than the nominal capacity because a large percentage of vehicles are shorter than the standard 18-foot length used to determine the nominal vehicle capacity. Since the amount of flexibility needed to accommodate conditions as they occur can only be determined from experience, it is assumed that this problem will be resolved during the shakedown period after implementation of a reservation system.
- The cost of operating the reservation system should be defrayed by an overall increase in fares. Otherwise, the basic fare structure should be retained, including frequent-user books with their 20/33 percent fare reduction.

A further innovation which is independent of the reservation system, would be the introduction of a fare card payment procedure. A fare card debit plan could have advantages both to ferry users and the WSF.

There is one additional procedural issue which would need to be addressed as part of the final design of a system. Should the reservation transaction and the fare prepayment cover the vehicle only or should there be the option, should the customer desire it, of including the vehicle occupants (driver and passengers) in the reservation transaction. The question is, should the latter option be available to travelers and if so, what will be its impact on the system operation.

If the reserved space ticket is issued for the vehicle only, then driver and passenger fares have to be collected at the toll booth as at present.

With the one-point fare collection procedure, round-trip fares are collected west-bound from Anacortes for all trips to and from the islands. One-way fares are collected on the islands for trips to Sidney, B.C., and one-way fares are also collected at Sidney for all eastbound trips.

This option is fully compatible with the existing fare collection procedure in which payment of the fare at the toll collection booth admits the vehicle (and its occupants) to a secured area, thus obviating the need to issue a ticket and later have it collected as the vehicle boards the ferry. A motorist with a reserved space ticket would present the ticket at the toll collection booth in payment for the vehicle toll. In addition, the motorist would pay cash for two-way passenger fares for each occupant of the vehicle, including the driver. From here the vehicle would proceed to the holding area for vehicles with reservations. Vehicles approaching the terminal without a reservation would enter the toll booth (a separate toll booth for stand-by fares may be designated at Anacortes) pay the fares as is done at present, and then proceed to the stand-by queuing area.

The other option, that of having the ticket include not only the vehicle but also the driver and passengers as well, is more complicated but with the tradeoff that the money transaction at the toll booth is eliminated. All or most of the advantages of this option can be lost, however, if there is a change in the number and/or fare category of the passengers between the time the reservation is made and the ticket is presented for fare. Also, this option is not well suited for use with the one-point passenger fare collection procedure.

Since the first option—that of selling and issuing a reserved space ticket for the vehicle only—is most compatible with existing WSF operations, it is the one assumed for the conceptual system design.

System Design and Cost Estimates

This section of the report documents the basic hardware and software requirements of a WSF reservation system for the San Juan Ferry routes. It briefly describes the functions the system software must perform and the preliminary hardware configuration upon which the cost estimates are based.

The system design described in this report is tailored to the San Juan Island route structure and the volume of reservations expected on those routes. The hardware requirements have been sized to accommodate the volumes of reservations expected in the year 2000. Personnel requirements and operating costs have been estimated to accommodate 1995 conditions. Expansion of the system to additional WSF routes, and/or to handle larger travel volumes would not be difficult. For most of the items (such as computer terminals, telephone lines, ticket printers, and computer processing capability), the additions could be incremental as needed to meet demand. The largest item would be the additional telephone and counter reservation clerks and the space to support them.

The computer hardware requirements and cost proposed in this report assume that the reservation system will be developed as a stand-alone activity. In practice, the opportunity exists to combine the hardware for the reservation system with hardware needed for several toll collection improvements contemplated by WSF.

Software Requirements

The software requirements for the reservation system are complex but should not be difficult to program. The basic components are described below.

User Environment

The reservation system would have to be a multi-user system designed for remote access. The system would have to be accessible to the toll booths at the Anacortes terminal, a reservation/ticket sales counter in the terminal, and to WSF agents at Sidney, B.C., and each of the island terminals. There would also be a reservation/ticket sales counter at Colman Dock to serve walk-up customers and as a ticket pick-up station. It is assumed

that the reservation center would be located at or near the Colman Dock for WSF management purposes, although this may not prove to be the best location, considering employee access.

File and Record Structure

The detailed design of the file and record structures for maintaining the system should be left to the software developer. A general description of the files and records structure which illustrates the functions and requirements of the system is outlined below.

The reservation system would have to develop and retain the following types of data:

- sailing information (when routes would operate and which vessels would operate those trips),
- space available information (how much space on a particular sailing had been reserved and whether additional reservations could be made),
- reservation information (names, vehicle types, method of payment, space required),
- financial information (credit card numbers, amount billed, status of the payment), and
- cancellation information (reservations that had been removed from the system).

In addition, there needs to be a system management component to maintain the operating system and software programming instructions for the reservation system.

The basic file structure suggested for the preliminary reservation system design would contain three types of files: (1) reservation files, (2) a cancellation file, and (3) a billing file. These files would be supplemented by a fourth file (not discussed in detail below) listing the sailing schedule for future periods of time. This file would be imported to the system from the existing ferry vessel scheduling software and would list each sailing by

date, including departure terminal, time of departure, stops en route, time of each stop, destination terminal, and vessel type (to provide vehicle space capacities on the sailing). On the basis of those data, the reservation system software would create reservations files.

Reservations Files. The system would create one reservations file for each scheduled trip. Eastbound and westbound movements would be separate trips, but more than one stop might occur within a trip. Thus, a vessel traveling from Anacortes to Friday Harbor and back to Anacortes would have taken two trips, but a ferry sailing from Anacortes to Lopez to Shaw to Friday Harbor would have taken only one trip.

Within each reservations file would be two record types. The first record type would contain the sailing information. The second record type would contain reservation information. Only one sailing record would reside in a file. Multiple reservation records might be present in a file.

Sailing Record - The sailing record would be used to track the amount of space that could be reserved for each vessel trip, and thus indicate when a reservation could be made or when a vessel was completely full. One sailing record would be written for each trip. The sailing record could be maintained as the initial record of each reservations file (as described in this report), or all sailing records could be maintained in a separate file, and that file could be linked to the various reservations files. The data items that would be contained in each sailing record are as follows:

1. Sailing Date and Number
2. Sailing Time (initial departure terminal)
3. Trip Segments Covered (route code)
4. Sailing Times (from each intermediate stop)
5. Vessel Type - nominal capacity (PCE spaces)
6. Total Capacity Available for Reservation (PCEs)
7. Tall Capacity Available for Reservation (PCEs)
8. Capacity Used (1st trip segment)
9. Tall Capacity Used (1st trip segment)
10. Capacity Used (2nd trip segment)
11. Tall Capacity Used (2nd trip segment)
12. Capacity Used (3rd trip segment)
13. Tall Capacity Used (3rd trip segment)

14. Percent Capacity that can be reserved (long term)
15. Percent Capacity Available (after closure of long-term reservation)
16. Capacity Used (additional trip segments, if necessary).

To set up the sailing record for each trip entered in the database records, the computer system would read the vessel schedules transferred from the vessel scheduling software, along with dates the user supplied to indicate when those schedules were operational. The computer would then use a look-up table to determine the nominal capacity (in passenger car equivalent spaces) on the vessel assigned to each run in the schedule and would write the appropriate records to disk. The same would also be done for the tall capacity.

Also written to disk would be the intermediate stops for that trip and the scheduled departure time from each stop. Vessel stops would be indicated in the Trip Segments Covered data item (see listing above) with alpha codes that indicated the order of the stops. For example, the code ALSOFC would indicate a trip that started in Anacortes (A) and ended in Sidney, B.C. (C), with stops at all of the islands. The code AOF would indicate a vessel traveling from Anacortes to Friday Harbor with one stop at Orcas. The software would use these codes to determine whether a specific trip stopped at a desired terminal.

The next section of the sailing record would track the amount of space that had been reserved for each segment of the sailing. This section of the sailing record would be used in conjunction with the Trip Segments Covered variable. The Capacity Used (1st trip segment) variable refers to the number of spaces (as defined above) that had been reserved between the initial departure terminal and the first terminal at which that vessel would stop. The system could determine what those terminals were by reading the first two characters of the Trip Segments Covered variable.

A reservation could be made for a specific trip (or trip segment) when Total Capacity Available for Reservation minus the Total Capacity Used was equal to or greater than the capacity needed for the reservation. Thus, assuming a superferry with a Total Capacity Available for Reservation of 153 (95 percent of the nominal capacity of 160 spaces) and Total Capacity Used was 152, then a user could still make a reservation for a car (one PCE) but not for a car and trailer (two PCEs). The case with a tall vehicle is similar except that a proposed reservation must be compared against both the Tall Capacity and the Total Capacity.

The value for Total Capacity Used would be taken from the largest of the Total Capacity Used variables that correspond to the trip segments that would be traveled. The following example illustrates this function. Assume a sailing of a superferry with a Total Capacity Available for Reservation of 153 spaces and a trip segment code AOF (Anacortes to Orcas to Friday Harbor). The Capacity Used on the first segment (Anacortes to Orcas) is 145, but the capacity used from Orcas to Friday Harbor is 153. Assume then that a traveler calls to make a reservation (on that sailing) for a trip from Anacortes to Friday Harbor. Since there are two segments on that trip, the computer proceeds to check the Total Capacity Used against the Total Capacity Usable on both segments. In this case, the reservation clerk is full and the requested reservation cannot be made. However, since the vessel is full only on the segment from Orcas to Friday Harbor, a reservation could still be made for a trip from Anacortes to Orcas.

When a reservation was made, the reservation capacity that corresponded to that reservation would be added to the Capacity Used variable for each segment of the trip that the reserved vehicle would travel. Thus, had space been available in the above example, one space would be added to the Capacity Used variables for both the Anacortes to Orcas and Orcas to Friday Harbor segments of the sailing record.

For vehicles other than passenger cars, the PCE space equivalent would be computed with a formula supplied by the ferry system from the vehicle (and trailer) length the motorist provided.

Tracking of reserved tall space (commercial trucks and recreational vehicles) would be performed in the same manner as tracking of regular vehicle capacity. Note that the tall space that was reserved would also add to the Total Capacity Used variable for each segment traveled, but the reverse would not be true until the tall space remaining equaled or exceeded the Total Capacity Remaining. Some experimentation will have to take place to determine the conditions for holding the tall space for reservation by tall vehicles only.

The final variable stored in the sailing record would control how much of the vessel capacity would be available for reservation in the initial registration period. A figure of 85 to 90 percent was mentioned in the previous discussion of this subject. The software will allow for easy adjustment of this control variable by WSF based upon their evaluation of conditions affecting the demand for space withheld for late reservation use.

Reservations Record - The information that would be contained in a reservation record is shown in Table 9. One reservation record would be written for each reservation made. In this preliminary design, all reservations for a specific sailing would be kept in the same file, and each sailing would have its own file. Information within the reservations record could be divided into four basic categories, vehicle/owner information, payment information, sailing information, and internal ferry system information.

The vehicle/owner information would include data required to determine the fare that should be charged, identification of the vehicle for which the reservation had been made, and an address for mailing the completed ticket. While not all of the items shown in Table 9 would be used for each reservation, they might be required for one time or another to correctly determine the fare for a given vehicle or the mailing address for the ticket.

Payment information would include aspects of the reservation that specifically related to payment. These data would include: the method of payment used (that is, credit card, check, or cash), credit card issuer, card number and expiration date (if a credit card was used), the amount of the fare, and the status of the ticket. The ticket would be delivered by hand for a cash purchase, mailed the next day for a credit card payment, and held pending receipt of a check for that method of payment.

Credit card verification would be made by the reservation clerk and would constitute a prerequisite for completing the transaction. Acceptance of a check by the bank would be a prerequisite for printing and mailing the ticket in the case of payment by check.

The sailing information would identify the trip for which the reservation had been made, including the sailing number (a number that would uniquely identify the sailing time, date, and route) and the terminals that the customer would use. This information would be printed on the reservation ticket.

The internal ferry system information would consist of the ID for the reservation clerk who made the reservation, a confirmation number for that reservation, and the date on which the reservation was made.

Table 9. Reservations Data Record

Field Name	Field Size (characters)
Vehicle/Owner Information	
Last Name	25
First Name	15
Address (line 1)	25
Address (line 2)	25
Address (line 3)	25
Address (line 4)	25
ZIP Code	9
Vehicle Make	6
Vehicle Model	6
License Number	8
State of Vehicle Registration	2
Type of Vehicle	1
Vehicle Length	3
Pulling a Trailer (Y/N)	1
Trailer Length	3
Vehicle/Trailer Height	2
Vehicle/Trailer Width (if > 11 ft)	2
Payment Information	
Method of Payment	1
Credit Card Number	16
Credit Card Expiration Date	4
Dollar Amount Charged to Credit Card	5
Ticket will be mailed/held	1
Sailing Information	
Sailing Number	5
Departure Terminal	2
Arrival Terminal	2
Internal Information	
Reservations Clerk Identifier	2
Reservations Confirmation Number	7
Date Reservation Made	6
Total Field Size	234

Cancellation File. The cancellation file would document the cancellation transaction. The purchaser may choose to use the ticket for stand-by passage, in which case, no refund is necessary. If a refund is requested or if the deposit is to be used on another reservation, the ticket must be returned. Thus, cancellations and changes must be placed in a suspense file. In the meantime, the space becomes available for use by someone else.

This file would provide the system with a means for auditing credits applied to credit card accounts. It would also provide the record of who had made the cancellation and when it had taken place. The data included in the file are as follows:

- a. Reservation Confirmation Number
- b. Last Name
- c. First Name
- d. Sailing Number and Date
- e. Disposition of Ticket/Deposit
- f. Method of Refund (if requested)
- g. Credit Card Number (if applicable)
- h. Card Expiration Date
- i. Amount to be Refunded
- j. Reservations Clerk Number
- k. Date of Cancellation
- l. Refund Check Number.

Billing File. This last file would contain the information that would have to be sent to the bank or credit card company that processed the credit card charges. The necessary information for billing records would be pulled from the reservations records when those records were written to disk. A record format is not provided in this report because that format would likely be dictated by the vendor selected to process the credit card information. The information likely to be included in this file would be as follows:

- Name of the credit card
- Credit card number
- Credit card expiration date
- Billing amount
- Transaction date
- Credit card type billed (VISA, MasterCard, etc.).

Current technology offers a simple and inexpensive method of collecting credit card accounts receivable. This is the electronic fund transfer option.

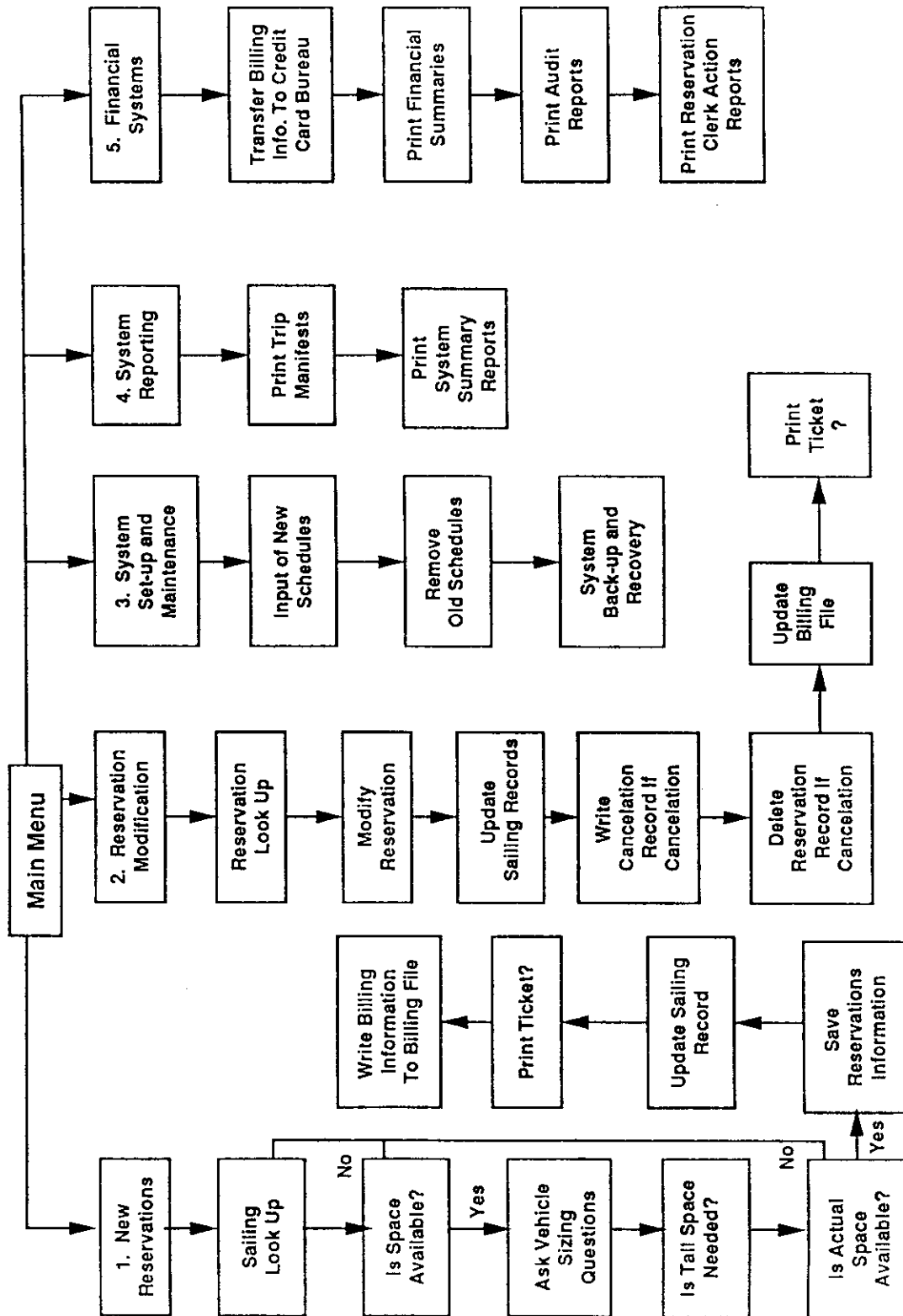
Program Functions

The generic program functions and the flow of processes required by a reservation system are shown in Figure 1. This diagram identifies the main programs and the steps available to complete the transactions, data updates, and reports the system is designed to perform. A more detailed and descriptive system design and information flow outline would be needed for the actual software coding.

The basic programming system is intended to support the sequence of tasks performed by a reservations clerk. These are: to look up specific sailing records, determine the amount and type of space needed by the client, determine whether the space requested was available on the desired sailing, obtain necessary vehicle and payment information from the client, complete the transaction, and enter the reservation into the system. Other tasks which must be performed by the reservation system and programmed into the software, include:

- Print tickets.
- Reserve tickets for later issue.
- Track whether tickets had been printed.
- Maintain and track billing information.
- Transfer billing information to a credit card agency or bank.
- Cancel reservations.
- Apply credit for cancelled reservations to the appropriate account (i.e., either exchange the reservation for a different reservation or refund the appropriate amount of money upon receipt of the original ticket).
- Print a vessel manifest.
- Print summary statistics regarding the operation of the reservation system.

Figure 1
Flow of the Reservation System Software



Software Operation

As shown in Figure 1, there are five reservation system functions in the preliminary design concept. The names of these five functions would be listed on the main menu which would appear on the screen after the operator had gained access to the system. Each authorized operator, including the reservation clerks, would have a personal password admitting the operator to access those parts of the database needed for his/her tasks. These menu selections (preliminary at this time) are:

- New reservations
- Existing reservation modification or printing
- System set-up and maintenance actions
- System reporting
- Financial system updates.

These basic functions of the system are described briefly below.

New Reservations

This function (Item 1 in Figure 1) would be the most used of the reservation system functions. A reservation clerk would enter this program area to determine whether space was available for a new reservation, and if so, would obtain the necessary information from the caller and then create a new reservation.

In using this program, the reservations clerk would proceed through a series of steps, whether the request was via telephone or in person at a walk-up reservation counter. The clerk would identify the specific sailing that fit the customer's request and call up a data display/reservation request menu for that sailing. If that sailing was closed to reservations (temporarily or finally), the clerk would so inform the client, then look up additional sailings if the client wanted to consider alternatives to the original itinerary. If the selected sailing was not already closed to reservations, the clerk would ask the appropriate questions to determine the size and billing rate for the client's vehicle. This information would determine the number of passenger car equivalents (PCEs) the customer's vehicle required and whether it also required "tall" space. It would also determine the cost of the reservation.

With the data on the required vehicle space, the computer would then determine whether the vessel scheduled for that sailing had sufficient space to fit the customer's vehicle. (Note that the initial computer check only determined whether any space was still available for a sailing. Additional checks would be required to determine whether the available space was large enough for the vehicle in question.) If space was available, the clerk would then proceed through the menu to obtain the additional data required to complete the reservation record. These additional data would include the vehicle ID (license number), fare payment information, and ticket mailing instructions. As part of this transaction, the clerk would validate the credit card or provide instructions for mailing in the check—a payment option only available if the sailing date is more than seven days away.

After all the necessary data had been acquired and entered, the clerk would so indicate, and the computer would enter the data into the file, updating the sailing record for that trip. If the sailing was more than five days away, the ticket would then be printed for mailing (unless the operator suppressed the mailing function at the request of the customer). If the sailing was less than five days away or the customer asked that the ticket not be mailed, the system would record that the ticket had not been printed. The customer could then obtain the ticket from a WSF ticket agent at a walk-up counter or toll booth sometime later. When the ticket was printed, the reservations file would be updated to indicate that action.

Existing Reservation Modification

This function would carry out the following transactions:

- Cancel one or more existing reservations.
- Transfer the fare deposit to an alternative trip reservation.
- Process a refund transaction if requested by the customer. This would be governed by WSF regulations as developed for this situation. (Allowing a ticket to be used for stand-by for a limited time would be cost effective.)
- Issue a refund check, subject to receipt of the original ticket.
- Issue a new ticket, if an alternative trip is reserved.

System Set-Up and Maintenance

Under this portion of the software system (Item 3 in Figure 1), routine system maintenance functions would take place. The three major functions would be as follows:

- New schedule input
- Removal of old schedules and reservation data
- System back-up and recovery.

These functions would be necessary to prepare the reservations system for upcoming schedules, clear disk space after a vessel had sailed, and provide for system level back-up and recovery capabilities. This area of the reservation system might be password protected to ensure the integrity of the data included in the system.

Additional system programming functions (other than the reporting needs described in the next subsection) would also fit under this menu option. These additional functions might include the ability to add new reservations clerks to the system or change the passwords of the reservations clerks. Additional system design work is needed to define all of these required capabilities.

A major concern is the need for a back-up capability (or procedure) in case the system crashes. Some kind of paper back-up system would have to be implemented at the ferry terminal toll booths in case the system crashed during their operating hours. (Even a 15-minute delay would be unacceptable at the terminals because vehicles could not be processed through the toll booths.) The toll booth operators have to be able to print tickets for those patrons who made late registrations and have only a confirmation number to verify their purchase of a reserved-space passage. A back-up procedure could involve the printing of vehicle manifests for the next day's sailings at each terminal. This manifest would identify vehicles and drivers on each sailing and whether the ticket had been picked up. Since a ticket could not be printed, the ticket seller would have to provide a coded pass (or some other evidence that the vehicle had a reserved space) as a substitute for a ticket.

In any event, development of workable procedures for dealing with all the consequences of an inoperative system (rare though it might be) will have to be a task for future system design efforts.

System Reporting

The next area of the program (Item 4 in Figure 1) would be the production of system reports. These reports would include at least the following summaries:

- Vessel manifests
- Reservations clerk activity reports
- Reservation summaries by sailing (number and type of reservations)
- Reservation summaries aggregated by week, month, destination or other variables
- Summary revenue statistics.

Additional effort is needed to determine any other reporting capabilities that might be necessary to manage the reservation system, as well as other report summaries that would be useful to WSF for managing the service schedule.

Financial System Updates

The final item in the main menu (Item 5 in Figure 1) would relate to the revenue functions of the reservation system. These functions would have an additional level of password protection, so that only authorized WSF staff would have access to them. Under this programming item the following functions could be found:

- Transfer of the credit card billing and credit information to selected media for transfer to the appropriate bank or financial institution (note that this might also be done as part of the reservations processing, see Credit Card Bureau Charges later in this report).
- Audit capabilities.
- Revenue control functions and tracking.
- Other financial functions determined by WSF and audit personnel.

These functions also need further definition before programming can begin.

Hardware Requirements

The hardware needed to operate the system could be configured a number of ways, especially given the speed with which the computer industry is changing and the new technologies and equipment that are appearing in the market. The most basic hardware design decision would be whether the system should operate as a conventional minicomputer with remote access or as a microcomputer local area network (LAN) in which the LAN would operate with remote workstations. This decision might be determined as much by the status of other WSF computer resources as by the merits of minicomputer and microcomputer LANs. (It might also be desirable to use one of the existing mainframes at WSDOT as the central CPU.)

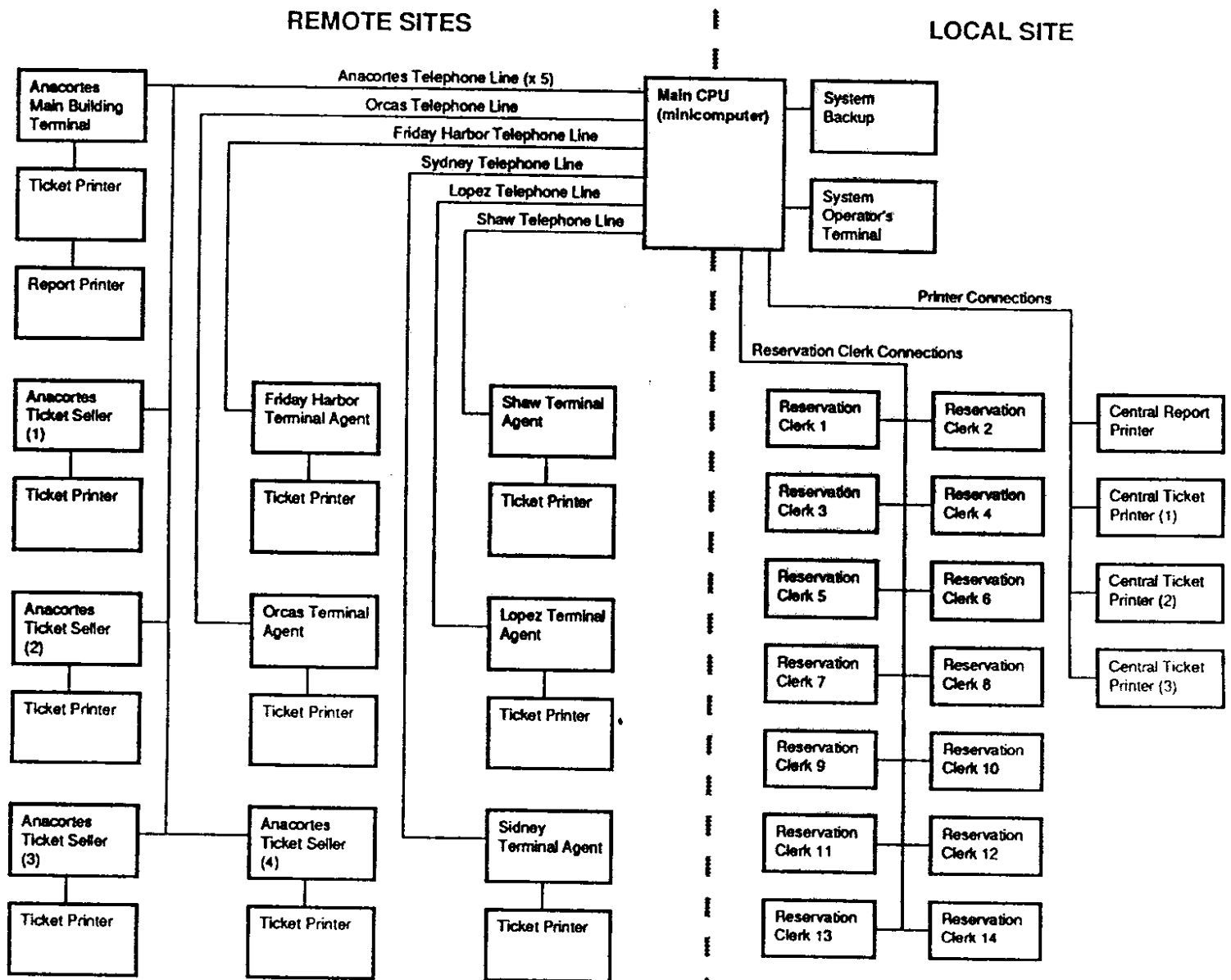
To provide a basic functional description of the required hardware and to develop cost estimates sufficiently accurate to executive decision making (consistent with the conceptual design objective), a minicomputer central processor with smart terminals is described in this report. This is a conservative option since other hardware configurations might be used in the WSF environment with a smaller capital investment than is estimated here. The objective here is to provide sufficient information so that vendors who are more aware of specific machine capabilities, and who have more experience with remote processing and data transmission, can select the best hardware configuration. In view of the conservative hardware assumptions and the potential for continued reductions in computer hardware costs, it is quite likely that the system will be developed at less cost than those estimated here.

Another consideration which enters into the hardware configuration analysis is the potential for cost reductions by combining the reservation system hardware with the hardware needs of other revenue control systems operating within WSF. While these opportunities are important and should be included in subsequent stages of system development, it is not feasible to make specific determinations or recommendations as part of this study.

Hardware Configuration

The hardware configuration described in this report assumes that the reservation system would be a stand-alone operation. This is the most expensive of the alternatives, and thus is conservative as a basis for estimating system cost. The hardware design needed to perform the necessary reservation system tasks is shown in Figure 2. Under this

Figure 2
WSF Reservation System Hardware Design



Note: The number of ticket agents/reservation clerks to be located at each place (the reservations center, the Anacondes Terminal, and the Island terminals) is an item requiring more detailed evaluation.

scenario, the central processing unit (CPU) would maintain all the reservations data. It would be directly connected to all the work stations—14 reservations clerk stations at the central facility and 9 at the ferry terminals on the San Juan routes.

Central Processing Unit - A minicomputer was selected as the CPU for the system because of its suitability in handling the fairly large number of users who would routinely have to access a single database. (At least 25 communications ports would be connected to the central CPU.) Minicomputers are specifically designed to perform these tasks, and sizing such a unit to meet the reservation system's needs would be a simple task for prospective equipment vendors. Although the depiction in Figure 2 shows all the necessary peripheral equipment included as part of the computer, the final configuration may differ from the figure based on final design considerations and vendor proposals.

Work Stations - The hardware configuration assumes that the 14 reservations clerk stations and the nine distant stations would have microcomputers equipped with communications capabilities. It also assumes that there would be a terminal for the system operator's use attached to the CPU and located within the same building. This person, whose duties might be shared with other WSDOT computing needs, would perform routine system maintenance and operations functions (back-up, system recovery, software maintenance, and software upgrades).

Printers - Specialized ticket printers, similar to those used in the airline industry, would be used to print tickets written by the reservations clerks and the ticket agents at the remote locations. Three ticket printers would be located in the main facility and one at each remote location where tickets would be sold. Thus, there would be one ticket printer at each of the four island terminals, one at Sidney, B.C., and one at the reservations/ticket counter in the Anacortes terminal building. In addition, it would be necessary to have ticket printers in at least two of the toll booths at Anacortes. (This would permit their being designated, as necessary, "for reserved vehicles only.")

Also attached to the main CPU at the central location would be a conventional line printer or laser printer. This device would print system reports generated by the reservation software. These reports, outlined in the software section of this document, would be requested both on a scheduled basis by the system operator (or lead reservation clerk) and on an ad-hoc basis by members of WSF planning or operations staffs through either the system operator's or a reservation clerk's terminal.

Office Space - The system will require office space for the hardware described above and the personnel needed to operate it. The main office requirement is that of the Reservation Center. Here, space would be needed for 1 manager, 1 reservations clerk supervisor, 14 reservations clerks, and 1 computer operator. It would be advisable to provide space at the beginning for about 20 reservation clerk work stations so that expansion can occur without the need to move the operation or acquire more space.

There are two potential locations for the reservations center: (1) in the Anacortes area but not at the terminal and (2) downtown Seattle near the WSF offices at the Colman Dock. Since each of these locations has advantages and disadvantages, more detailed evaluation would be required as part of the final design.

It is assumed that work space for reservation clerk/ticket sellers on the island will be provided at existing facilities.

Remote Terminal Capabilities

The remaining devices shown in Figure 2 would be operated from the remote work stations. The system design assumes that access to these stations would be through 9600 baud, dedicated telephone lines in order to provide acceptable communications speed.

The remote terminals would be "smart" terminals. As noted above, this would require microcomputers configured for low-end multiprocessing and PC to minicomputer communications. Each remote terminal would access the main database to obtain the current reservation status of scheduled sailings and to write new reservations to the main database or change reservations. Each of the remote terminals would be able to print tickets on site. This capability would be necessary to enable the system to deliver reserved-space tickets to patrons who made their reservations less than five days before sailing, and also to print tickets for over-the-counter transactions at these remote ticket counters. The preliminary plan is that reservations could be made and tickets purchased at these locations using credit card, cash, or commuter book script as payment.

On-site printing instructions from remote terminals would be sent directly from each terminal to the on-site printer. Remote print requests would not be routed to the main CPU. This configuration is designed to eliminate the need for separate telephone lines from the main CPU to each of the remote printers. Instead, the communications link to the

remote printers would come directly from the nearest remote terminal. In addition to the remote terminal and ticket printer, there would also be a general purpose report printer located in the Anacortes terminal. This printer would provide terminal staff with the ability to print system reports locally and also afford some back-up capability to the main system printer.

To provide a necessary level of security to the reservation system (which would contain financial information), there has to be a means of restricting access to only authorized operators from those designated terminals shown in Figure 2. This can be accomplished by providing the CPU with "call only" modems. That is, if communication to a remote site were lost, the main CPU would have to initiate the reconnection of that site. It should not be possible to connect to the reservation computer by dialing into a modem port from a remote location. That restriction would prevent unauthorized people from calling the main CPU and would create a more secure database. Additional security for the system would also have to be provided in the software design.

Data Storage Requirements

The hard disk required for the main CPU would have to be capable of storing all of the reservation information. The required file storage size is dependent on the size of the reservations file, the record structures (which are described above), and the number of files required (a function of the sailing schedule). The proposed file and record structure would require that one sailing record be set up for each sailing. Each sailing record would require a set of reservation records to maintain the actual reservations information for that trip. Each sailing record would contain 67 bytes of data (stored in ASCII format), and each reservation record, 234 bytes. (The data content and file sizes are described in the previous section.) The computation of total space required for these files is shown on Table 10.

In addition to these basic files, several additional files would be kept temporarily on the CPU hard disk. These would include: (1) a list of reservations that were cancelled, (2) a list of ticket refunds, and (3) information on credit card billings/credits accumulated daily for transmittal to the bank (or other institution) handling credit card transactions. These files would always be present, but their space requirements would remain fairly small because they would be processed routinely with data in the file, then transferred to off-line storage.

Table 10. Total Space Required for Sailing and Reservations Records**Sailing Record Size**

Total days in the database	180
Sailings per day (current summer schedule)	43.5
Records per sailing	1
Record size (bytes per record)	67
Total size (bytes)	524,610

Size For Reservations Records

Total days in the database		180
Sailings per day (current summer schedule)		
by vessel capacity:	10.14 x 75	761
	12.14 x 160	1,942
	<u>16.14 x 100</u>	<u>1,614</u>
	Total	4,317
Record size (bytes per record)		234
Total size (bytes)		181.8 million

The above estimate of space required is a theoretical maximum. Actual space requirements would be less because:

- Vehicle reservations would always be less than the nominal capacity of the ferry vessel because (1) the amount of space available for booking will always be less than the vessel capacity, and (2) some vehicles will occupy more than one space.
- Some sailings will be only partially booked (early morning and late evening).
- Not all of the reservations would be filled at one time (i.e., reservations would be added slowly over time).
- Reservations could be deleted from the file after each sailing took place, so that 180 days of full reservation data would never actually exist on the computer at any one time.

Given the above storage computations and modifying factors, the selection of a 300 megabyte hard disk appears to be a conservative choice. This disk size is common (actually, it is fairly small) for modern minicomputer systems, and it should provide plenty of space for both growth in the size of the database and increases in the types of information that would be stored.

System Costs

Hardware Costs

The estimated costs for the required hardware are itemized in Table 11. The total cost for the items listed is \$197,900 (rounded to \$198,000).

Total one-time costs for the system are equal to the cost for hardware (\$198,000) plus the cost for software development (\$125,000), or \$323,000. This does not include costs for facilities and modifications occasioned by the impact of the reservation system on ferry operations. These are covered in a subsequent section of the report.

Operations Costs

The cost of operating the reservation system will be a function of two variables: the number of reservations made and the number of reservation contacts handled by the system in the process of making these reservations. The number of reservations made will depend on total traffic and demand capacity factors which affect the availability of space on the ferries. The method of estimating the number of reservations that would be made for 1990 and 2000 is discussed in a previous section of the report.

Reservation contacts - Every telephone call directed to and answered by a reservations clerk is a "contact" as is every potential patron served at a reservations/ticket counter. Most reservation contacts result in a reservation transaction; that is, a transaction in which one or more reservations are made and tickets sold. The primary determinant of the number of reservation contacts will be the number of reservations actually made. Other determinants and the assumptions made are:

1. About 75 percent of contacts will obtain reservations for two or more trips.

Table 11. Reservation System Hardware Costs

			Unit Cost	Total Cost
(1) Electronics				
CPU	(minicomputer: 25 ports minimum, 35 ports maximum) Contains hard disk capacity of 300 mb			\$75,000
Data Back-up and Archive Capability				1,000
Uninterruptable Power Supply (for CPU)				2,000
Terminals (includes communications hardware)	5 Anacortes 15 Central 5 Islands	25 @ \$3,000		75,000
Ticket Printers	5 Anacortes 3 Central 5 Islands	13 @ \$500		6,500
Report Printers	1 Central 1 Anacortes	2 @ \$5,000		10,000
(2) Furniture				
Computer desks	25	25 @ \$750		18,750
Ticket Printer Stands	13	13 @ \$50		650
Chairs	15 (Central Office Only)	15 @ \$375		5,650
Anti-static mats	25	25 @ \$50		1,250
(3) Telephone Equipment				
Hand sets	18 (subtract 4 if Islands already have them)	18 @ \$50		900
Phone Line Installation	16 (Central plus one at Anacortes) \$59 each + time and materials	16 @ \$59 + \$250		1,200
(4) Total Equipment Costs				\$197,900

2. About 20 percent will involve a cancellation or change of reservation.

3. One-third of contacts will be made a month or more in advance of sailing.

Estimates of the number of reservations and reservation contacts have been made by month for 1990 and 2000. These are shown in Table 12.

Table 12. Reservation System Contacts - 1990 and 2000

Month	1990		2000	
	Confirmed Reservations	Reservation System Contacts	Confirmed Reservations	Reservation System Contacts
January	8,900	6,900	26,400	20,000
February	12,300	12,300	23,100	21,700
March	30,900	25,100	45,100	38,500
April	32,500	28,200	51,800	47,200
May	37,600	33,200	57,400	55,500
June	41,600	44,000	64,300	71,200
July	67,100	61,800	99,600	92,800
August	77,400	55,300	106,000	78,600
September	49,200	33,300	70,100	47,600
October	29,400	21,700	48,300	36,900
November	21,700	16,300	39,400	29,700
December	21,300	14,800	38,700	27,600
Total	429,900	352,900	670,200	567,300

Source: Estimated by the Project Staff.

Cost Items - Operating costs of the system include the following items:

- Labor costs (including benefits and training)
 - Reservation Center Staffing
 - Reservation clerks/ticket sellers at the ferry terminals
- Computer maintenance
- Telephone line charges
- Mailing charges
- Credit card charges.

Costs reflecting the impact of the reservations system on operations at the Anacortes, Sidney, and San Juan Island ferry terminals are covered in a subsequent chapter of the report.

Personnel Requirements - Labor costs are determined by the staffing required to operate the system. The main portion of the staffing is that required to operate the central reservation office. Staffing includes:

- A manager responsible for the reservation system and the personnel employed to operate it.
- Reservation clerks to handle reservation contacts (telephone requests for reservations and information), process incoming mail (check payments, refund requests, tickets to be exchanged, etc.), and mail tickets.
- Supervisors for the operation of the reservation office.
- A computer system operator to maintain the system.

The reservation system manager would be responsible for the functions of the reservation office as listed above. The manager would also be responsible for coordinating with the software developer and the data processing operation to assure that the needs of the reservation process are met.

The number of reservation clerks that will be needed to staff the operation is a function of the number of reservation contacts that would occur, the average duration of each of these contacts, and the amount of time that would be consumed by other activities or that would be idle time. Other activities include training of new employees, handling information requests which do not produce a reservation and resolving unusual situations. Idle time occurs during those periods of time when the number of incoming calls on the line would be less than the number of reservation clerks on duty. The assumptions used to estimate reservation clerk staffing requirements (annual person-hours) are as follows:

- The estimate of reservation contacts for 1990 and 2000 as shown in Table 12 are the basis for the calculation. Reservation contacts require an average of 2.5 minutes each (based on B.C. Ferries experience). This is net time.

- About 85 percent of reservation contacts would be handled by the clerks at the reservation center and the remainder by ticket sellers at the ferry terminals. (This assumes that about 45 percent of reservations made by island residents would be made at the ferry terminals.)
- About 30 percent of staff time will be consumed by training and evaluation activities, breaks while on duty, processing of incoming mail, and mailing tickets.
- About 25 percent of the clerical staff time at the reservation center will be spent on "information only" calls. It is assumed that the existing information service operated by WSF will be merged with the reservation operation.

The person-hours of time required to handle reservation contacts based on the above assumptions are shown by month in Table 13. As can be seen from this table, the staffing requirements for the reservation center—and also for the reservation clerk ticket sellers at the terminals—will be highly seasonal. The person-hours of reservation clerk time is six times as great in the peak months of July and August as it is in the low months of January and February. (These numbers assume that bookings for the summer season sailings would not be opened until sometime after March 1.)

Table 13. Reservation Clerk Personnel Needs

Month	1990			2000		
	Reservation Contacts	Contact Hours	Staffing Person-Hours	Reservation Contacts	Contact Hours	Staffing Person-Hours
January	6,900	288	450	20,000	833	1,300
February	12,300	513	800	21,700	904	1,400
March	25,100	1,046	1,600	38,500	1,604	2,500
April	28,200	1,175	1,800	47,200	1,967	3,000
May	33,200	1,383	2,100	55,500	2,312	3,500
June	44,000	1,833	2,800	71,200	2,967	4,600
July	61,800	2,575	4,000	92,800	3,867	5,900
August	55,300	2,304	3,500	78,600	3,275	5,000
September	33,300	1,387	2,100	47,600	1,983	3,000
October	21,700	904	1,400	36,900	1,538	2,400
November	16,300	679	1,000	29,700	1,238	1,900
December	14,800	617	950	27,600	1,150	1,800
Total	352,900	14,704	22,500	567,300	23,638	36,300

Under these circumstances, efficient staffing of the reservation center would have to include a staff of full-time employees augmented by a substantial component of part-time employees. The full-time staff could handle the workload through the winter months but would have to be augmented by part-time personnel from March through October. Part-time staff would be scheduled as necessary to meet the reservation system demand, with the peak coming in July and August. This is the staffing procedure used by B.C. Ferries and the (Mass.) Steamship Authority.

Given these considerations and assumptions, the reservation center staffing requirements would be as shown in Table 14.

Table 14. Reservation Center Staffing Requirements

Personnel		1990	1995	2000
Manager	FTE	1	1	1
Supervisors	FTEs	3	3	4
Reservation Clerks				
Regular	FTEs	6	8	10
Part-Time	hrs/personnel	10,300/17	13,600/23	16,800/28

The above estimates of reservation clerk staffing and personnel hours are subject to several assumptions regarding the operation of the reservation system:

- The reservation center will be open about 14 hours per day on weekdays during the peak season (for example, 7:00 a.m. to 9:00 p.m.). While there are advantages to having a single schedule year-round, the need to minimize cost will probably require that hours of operation will be reduced during the off-peak seasons and on Sundays.
- The operating plan will minimize idle time and limit the capacity and peak staffing of the reservation center. The sizing of the reservation center—in terms of reservation clerk stations and incoming telephone lines—involves a trade-off between customer service and convenience and reservation system labor efficiency and cost. It is assumed that the center would be equipped and staffed to handle the average daily volume of incoming calls during peak days but not necessarily the peak demand within the day. During these times, calls will have to be put on hold and answered in sequence.

Based on the service criteria implied above, and the fact that the hardware plan calls for 14 reservation clerk stations, there would be a need for 14 incoming telephone lines in 1990 and 20 in the year 2000.

As was noted above, the reservation clerks will handle the processing of incoming mail and the mailing of tickets in addition to their primary duty of handling reservation contacts. The time required to accomplish these additional tasks was included in the overall personnel estimates.

There would also be a need for a computer system operator to maintain the computer hardware. The time required to perform this task would be roughly 25 percent of a full-time equivalent position (FTE). Scheduling the workload of this position would require some unusual arrangements involving other assignments. While the routine duties of system operation could be scheduled so as to allow the reservation system to share the cost of a system operator with some other WSDOT function, the quick response maintenance duties would be unpredictable and irregular in their occurrence. It would be most cost effective, therefore, to limit the scope of the system operator's job to the basic system maintenance functions and to contract the unscheduled maintenance requirements to an outside vendor.

With the implementation of a reservation system, it would be necessary to change some of the terminal operating procedures. To achieve positive traffic control, all vehicles would have to possess a ticket—for a reserved space or for a stand-by space—and this ticket would be collected by loading attendants as vehicles drive onto the loading slip to the ferry boat. This procedure would require additional staffing of reservation clerk/ticket sellers at Anacortes and on the islands. The additional staffing would amount to 7,060 hours of personnel time in 1990 and 8,300 hours in 2000.

Labor Costs - Labor costs were computed using the estimates and assumptions regarding personnel time described above. The annual wage and salary rates used include fringe benefit costs for full-time employees and are based on the prevailing WSF (contract) rates or on the civil service pay plan for state personnel. Wage rates were estimated and labor costs calculated taking into account the prevailing conditions at each respective location. The labor costs for the main reservations operation are shown in Table 15.

Table 15. Annual Labor Cost Estimates

Cost Component	1990	2000*	2000**
Reservation Center			
Reservation Center Manager 1/1 FTE @ \$37,065	\$ 37,100	\$ 37,100	\$ 49,900
Supervisors 3/4 FTE @ \$25,000	75,000	100,000	134,400
Clerks (Full-Time) 6/10 FTE @ \$22,500	135,000	225,000	302,400
Clerks (Part-Time) 10,300/16,800 hrs. @ \$10.80	111,200	181,400	243,800
Computer System Operator 0.25/0.25 FTE @ \$30,825	7,700	7,700	10,300
Total Reservation Center	\$366,000	\$551,200	\$740,800
Ferry Terminals			
Reservation Clerk/Ticket Sellers 7,060/8,300 hrs. @ \$12.00	\$ 84,700	\$ 99,600	\$133,900
* 1990 dollars. ** 2000 dollars. Notes: 1 The year 2000 costs shown in year 2000 dollars were calculated using a 3 percent per year compounded rate of price inflation. 2 The cost of a computer maintenance contract to cover special maintenance needs is not included.			

Telephone Line Charges

The reservation system would experience substantial telephone line charges. These charges would be of two types: (1) line rentals for the computer connections to Anacortes, Sidney, B.C., and the four island ferry terminals, and (2) long-distance charges for phone calls made to the reservations center from outside the Seattle area.

As a basis for estimating telephone rates (installation and operation), it was assumed that the central reservation system would be located in downtown Seattle near, but not in, the Colman Dock. It was also assumed that AT&T rates would be comparable to long-distance rates now being charged WSF and that U.S. West rates would be the same as those in the existing state contract.

Telephone line costs for connecting the remote terminals to the main reservation center computer are estimated to be \$2,418 per month. This assumes six lines to Anacortes and one each to the other ferry terminals. Line charges for the operation of a 14-line rotating system at the main reservations center would be \$675 per month.

It was estimated that about 40 percent of the calls made to the reservation center would be long-distance and would use the 1-800 service provided by U.S. West. At 2.5 minutes per call and 22 cents per minute, long-distance charges would equal approximately \$77,600 in 1990 and \$124,800 in 2000.

Computer Maintenance

Special computer troubleshooting and maintenance needs (a "quick response" capability) were discussed in a previous section. The estimate of computer maintenance charges were based on the current annual cost of computer maintenance and support for the DEC VAX computer used on the I-90 project.

The estimated annual costs of computer maintenance for the reservation system computer installation located in Seattle are as follows:

• System management support	\$6,000
• Maintenance service (2 hour response, 365 days/yr)	\$17,000
• Software licenses and documentation	\$12,000
• Software support and upgrades	<u>\$1,500</u>
Total	\$36,500

In addition to the above costs, WSF might want to contract with the hardware vendor for the use of an alternate CPU at the vendor's location on those infrequent occasions when the main reservation computer crashed. A cost for such a service could not be obtained for this report.

Mailing Charges

It was assumed that about 85 percent of the tickets purchased as part of the reservation transaction would be mailed to the customers. About 15 percent of the reserved space tickets would be taken or picked up directly as indicated above. As a basis for the cost estimate, it was assumed that each envelope would contain an average of two tickets and would cost 30 cents per mailing.

Using the estimates of reservations made as shown in Tables 7 and 8, the cost of mailings would be approximately \$54,800 in 1990 and \$85,450 in 2000.

Credit Card Bureau Charges

Standard credit card charges consist of a basic access charge and a percentage of the transaction billed. The access charge depends on the type of connection made to the charge card processing center, and the percentage charged depends primarily on the dollar volume of the transactions.

Conversations with one commercial bank (Seafirst) indicated that WSF would qualify for a rate between 2.3 and 2.6 percent of the billed amounts. If a telephone line connected the central bank's computer to the reservation center's minicomputer, the bank would also charge \$1,500 per month. The bank also indicated that there was an alternative method of connecting to WSF operation at less cost. Based on the experience of the Woods-Hole Ferry in Massachusetts (which has obtained a credit card rate of under 2 percent), it is likely that more favorable rates would be offered when an actual proposal is put forth.

Credit card billing charges were estimated with the assumption that 80 percent of reservations would be paid by credit card. The average charge per reservation transaction would be about \$24.00 and the billing rate would be 2.3 percent. Calculation of the average fare took into account the distribution of traffic among the islands, the summer surcharge, the extra fare on the international runs, and the incidence of oversize vehicles. The estimate of credit card billing charges is \$67,200 in 1990 and \$104,800 in 2000.

Cost Summary

A summary of the cost items discussed above is shown in Table 16. The cost items include all one-time purchase costs and the operating costs directly attributable to the reservation system functions. Indirect costs resulting from the impact of the reservation system on ferry terminal operations are not included.

For the year 2000, two-cost calculations are shown: the first column represents cost estimates using 1990 unit cost levels, and the second column is an illustrative estimate based on an assumed 3 percent per year compounded rate of inflation. The cost of the credit card billing charges has been included.

Table 16. System Cost Summary (Direct Costs Only)

Item		One Time Costs		
Computer Hardware		\$195,800		
Telephone Installation		2,100		
Software		125,000		
Total One-time Costs		\$322,900		
Operating Costs		1990	2000*	2000**
Labor				
Reservation Center		\$366,000	\$551,200	\$740,800
Terminals (Ticket Sellers)		84,700	99,600	133,900
Mail		54,800	85,500	114,900
Telephone (computer lines)		26,400	26,400	35,500
Telephone (long distance & local phone lines)		77,600	124,800	167,700
Computer Maintenance		36,500	36,500	49,100
Credit Card Access Charge		18,000	18,000	24,200
Credit Card Billing Charge		67,200	104,800	140,800
Total Operating Costs		\$731,200	\$1,046,800	\$1,406,900
Average 1995 Cost		\$889,000		

* Increased costs based only on increased usage, no inflation assumed.

** Cost increase of 3 percent per year compounded assumed on top of the increased rate of system usage.

Note: The above does not include the costs resulting from increased staffing requirements at the terminals.

RESERVATION SYSTEM IMPACTS

The implementation of a reservation system for the San Juan Ferries will have impacts both on WSF operations and on ferry users. The purpose of this section of the report is to identify and quantify these impacts to the extent possible. The level of analysis undertaken here is commensurate with the conceptual design described above and is not intended to meet the requirements of an Environmental Impact Assessment as specified in Washington State Legislation.

The section also includes overview comments regarding the potential impact of a reservation system on the economy of the San Juan Islands.

Impact on Ferry Operations

The impact of the reservation system on ferry operations will involve changes in fare collection procedures and in traffic management and control in the terminal holding areas. An immediate effect will be the replacement of the one-point fare collection procedure with fare collection each way for vehicles. Fare collection for passengers would remain as is with round-trip fares collected at Anacortes (inter-island travel is free). While this procedure is not new or untried—it is the same procedure used on the main cross-sound routes of the WSF system—it will require reactivation of the toll collection booths at the higher volume island terminals and some additional personnel for ticket taking.

Overall, the reservation system will make a large contribution toward improved traffic management and traffic safety, both with respect to the stream of vehicles entering the terminals and the requirements of vehicle classification and storage within the terminals.

Traffic Management

The most significant effect of the reservation system on ferry system operations would be to improve traffic management by reducing the demand for vehicle holding space at the terminals and the adverse effects of queuing on the access roads to the terminals. Since demand generally exceeds capacity on the more popular ferry runs, especially in summer, travelers arrive well in advance of sailing time hoping to secure space on their

desired sailing. As a result, during peak periods, the number of vehicles waiting to board the ferry often exceeds the capacity of the terminal holding areas and causes queuing on the access roads. As ferry traffic continues to grow in relation to a relatively fixed-system capacity, this situation would create increasingly longer periods of time when the terminal holding space is filled and the arriving vehicles must queue on the access road to the terminal. Current WSF experience would indicate that as this becomes a more prevalent occurrence, there would be an increasing need for extending traffic control involving uniformed officers and pressure to expand terminals because of the adverse effects.

Currently, the average vehicle wait time—that is, the time between arrival at the end of the queue and eventual boarding of the ferry—is over one hour during the summer peak season. At Anacortes, it is approximately one and one-half hours for the midday and evening sailings. Furthermore, with the expected growth of traffic, average wait times in excess of two hours would not be uncommon on summer days in the future. (It already occurs, in fact, on Sundays during much of the year at some of the island terminals.)

By comparison, at ferry systems with reservation systems (described in a previous chapter) vehicles with reservation have an average wait of 45 minutes. In both cases, surveyed vehicles with reservations are required to be in the holding area 30 minutes prior to scheduled sailing time. The experience is that vehicles begin arriving about one hour prior to sailing time and are distributed through the next 30 to 35 minutes. (About five to ten minutes grace is usually allowed in the advance arrival requirement unless there is a large queue of vehicles waiting for stand-by space.)

Based on these data, the peak holding space requirement could theoretically be reduced by half. However, there are some offsetting factors; the space requirement for segregating vehicles (by destination terminal and by size) will increase because there will be twice as many categories since for every existing category there could be an accumulation of both reserved and stand-by vehicles. Another factor is that there will still be some travelers willing to tolerate long waits to travel by stand-by. Considering all of these factors, a 35 to 40 percent reduction of in the number of peak period vehicles on hold, with some variance among terminals, would be a reasonable expectation with the implementation of a reservation system. As a result, there would be a definite reduction in the adverse impacts of off-terminal vehicle queuing and in the pressure to expand the terminal holding area.

It can be argued that there will be appreciable long-term cost savings associated with the benefits described above. Since they cannot be readily quantified, however, they have not been included as offsetting cost savings in this stage of the analysis. In any event, these would be major considerations favoring a reservation system from a management standpoint.

Terminal Operations

The implementation of a reservation system would increase the staffing requirements at all San Juan Ferry Terminals because of the need to reactivate one-way fare collection for vehicles and the collection of tickets at the loading ramp. As envisioned by WSF management, the procedure would include the following assignment of activities:

- Reservation transactions, call-in and walk-in, will occur at the ferry terminal offices. Reservation clerk/ticket sellers will be on duty about 12 hours per day, seven days a week during the peak season. There would have to be short-term (15 minutes) parking near the terminal offices for those wishing to pick up tickets.
- Verification of reserved space tickets, vehicle passenger ticket sales, and stand-by vehicle ticket sales will occur at the toll booths. Also, walk-on passenger tickets would be sold when the main ticket offices are closed. Toll booths would have to be staffed 16 to 18 hours per day year-round.
- Collection of tickets, both reserved space and stand-by, would be done by a loading attendant at the ferry ramp. This function would have to be staffed for every sailing.
- Actual operations would involve combining some of the functions depending on circumstances at each terminal. Generally, all the functions would be operated May 1 through October 15.

The cost of the additional reservation clerks/ticket sellers at the terminals was identified as a direct expense and included with the cost estimates for the reservation center.

Anacortes

The Anacortes terminal would operate essentially as is with some revision of the holding area to accommodate stand-by vehicles segregated from vehicles with reserved fares. An expansion of the holding area to the east is a possibility. A stand-by-only toll booth would need to be identified so that stand-by fares could be segregated within the holding area.

Operation of the Anacortes terminal would require an additional eight FTE loading attendant/ticket-taker staff.

Lopez

A toll booth would be rebuilt at the south end of the Lopez terminal holding area and parking would have to be reconfigured. Access to the terminal office and short-term parking would be provided for walk-in reservations and pick up of tickets.

Additional staffing requirements would include 0.5 FTE management and 3.8 FTE attendants.

Shaw

Some additional holding area would be needed at the Shaw terminal to provide space for segregating reserved from stand-by vehicles. Staffing requirements would be an additional 4.5 FTE employees at the terminal.

Orcas

The existing toll booth and holding area at the Orcas Island terminal would be adequate with minor modifications (probably on the access road) to provide the space needed for storage of stand-by traffic. There are 27 daily departures from Orcas during the peak season, and this would require continuous staffing of the toll booth from 6:00 a.m. to 10:05 p.m. During the off-peak seasons, there are approximately half as many sailings, and the toll booth would operate fewer hours.

An additional 3.6 FTE employees would be required at the Orcas terminal with the implementation of a reservation system.

Friday Harbor

Operation of a reservation system would require additional secured holding space and a suitably positioned toll booth at the Friday Harbor terminal. Several alternatives for accomplishing this expansion have been proposed in previous studies. However, the extension has been put on hold pending the resolution of the ferry terminal location issue.

For the purpose of this report, it has been assumed that appropriate ticket sales offices would be constructed but there would not be a secured holding area. All vehicles would have to possess a ticket which would be collected at the ferry ramp upon boarding. The ferry schedule includes 14 departures daily during the summer season and 8 during the other seasons. Assuming continuous staffing of the toll booth from 5:30 a.m. to 8:30 p.m. during the summer and partial staffing during the other seasons, there would be a need for an additional 3.5 FTE positions at Friday Harbor.

Capital Costs

As evident from the above discussion, there are some capital and other one-time costs for major improvements that will have to be met. The costs for these items were not estimated as part of this study, and they are not included in the cost analysis.

Ferry System Cost Impact

The additional staffing requirements of WSF and the contract agents on the islands (based on 1990 conditions) are summarized in Table 17, along with cost estimates. Estimates of year 2000 needs were projected based on variables that would change the staffing needs.

Table 17. Additional Staffing Requirements and Cost Estimates

Terminal	Category	1990	2000*	2000**
Anacortes	Attendants	\$202,000	\$234,000	\$314,500
Lopez	Management	12,300	12,300	16,500
	Attendants	67,200	80,100	107,600
Shaw	Management	21,800	21,800	29,300
	Attendants	56,400	56,400	75,800
Orcas	Management	15,100	15,100	20,300
	Attendants	25,200	36,500	49,100
Friday Harbor	Management	15,100	15,100	20,300
	Attendants	40,000	48,300	64,900
Sidney	Management	10,600	10,600	14,200
	Attendants	9,100	14,800	19,900
Total Cost		\$474,800	\$545,000	\$732,400

* 1990 dollars.
** 2000 dollars.

Impact on Ferry Users

The perception that a reservation system would produce clear-cut, tangible benefits for users has, from the beginning, been the primary impetus behind interest in and investigation of such a system. The perceived benefits (and these are certainly borne out as real in other ferry operations with reservation systems) are two-fold. The first is, of course, the removal of anxiety and uncertainty that now exists over being able to get on the ferry that one is planning to catch. The anxiety is especially acute when the desired ferry is the last one of the day. Instances of travelers being left on the dock after the last ferry run of the day occur now and are bound to become more prevalent. The benefit comes from the satisfaction of having a guaranteed space on the ferry that one is planning to take.

The second benefit to ferry users of a reservation system also results from the assurance of having a guaranteed space. It is the ability to arrive at the terminal a reasonable time in advance of the scheduled sailing, rather than having to arrive far in advance of the ferry departure just to be able to get on it. A significant reduction in ferry wait-times is a tangible and quantifiable benefit of a reservation system for most travelers.

Based on observations of existing ferry wait-times at the Anacortes and island ferry terminals, and comparing these to data from ferry systems with reservation systems (described previously in this report), estimates have been made of the savings in wait-time that would occur with a reservation system. Currently, the average vehicle wait-time at Anacortes during the summer season (excluding the early morning sailings) is on the order of one and one-quarter to one and one-half hours. By comparison, the average wait-time of vehicles having reserved space is 45 to 50 minutes. The arrival pattern is affected by the fact that vehicles must be in the queue 30 minutes in advance of scheduled departure. The estimate of time saved annually is shown in Table 18.

Table 18. Estimated Annual Time Savings

	1990	2000
Vehicles With Reservations		
Summer Season	198,100	284,400
Remainder of Year	231,800	385,800
Average Time Savings		
Summer Season	35 min.	50 min.
Remainder of Year	25 min.	40 min.
Estimated Time Savings		
Total Vehicle Trips	212,000 hrs.	494,000 hrs.
Work-Related Trips	53,000 hrs.	124,000 hrs.
Nonwork-Related Trips	159,000 hrs.	370,000 hrs.

The next step is to place a value on the time savings, and this is more difficult. The difficulty arises from the fact that the value of time for travelers is not uniform. Rather, it varies depending on the circumstances of each individual. It varies from zero to the level of professional billing rates, which can exceed \$100 per hour. Because of this characteristic of the value of time for travelers, estimating the value of time is problematical at best and is done only to illustrate benefits in relation to cost.

Without entering into an overly technical discussion of the value of time, there are a few considerations worth mentioning:

- There is a more tangible economic basis for estimating the value of time for work and business-related trips than for other trips.

- Unlike the ferry ride itself, the experience of waiting in a holding area before boarding a ferry has very little intrinsic value.
- Even with social-recreational (vacation, holiday, etc.) trips, for which there is no alternative economic endeavor, the ferry wait is a loss, since it takes away from the experience anticipated at the destination end of the trip.
- The repeated requests made to WSF by island residents to have a priority loading feature for island residents is an indication of the disutility (negative value) of waiting to board the ferry.

Based on these and other considerations, the average value of time arrived at for this analysis is: \$6 per hour for work and business-related trips (vehicle occupancy 1.2) and \$4 per hour for nonwork-related trips (vehicle occupancy 2.2).

Using these values, the monetary estimate of annual time savings of San Juan ferry users that could be associated with a reservation system is:

<u>Trip Categories</u>	<u>1990</u>	<u>2000</u>
Work-related trips	\$318,000	\$744,000
Nonwork-related trips	<u>\$636,000</u>	<u>\$1,480,000</u>
Total	\$954,000	\$2,224,000

Inflated at a compounded rate of 3 percent a year, as was done with the system cost data, the year 2000 time savings is valued at \$2,989,000.

Impact on the Local Economy

The economic impact of transportation changes are best understood as a function of two factors:

- The value of the trip; that is, the activities (rewards and benefits) which are expected to occur at the destination of the trip.
- The disutility of travel, as measured by the cost of the trip, the total travel time, and travel comfort. The priority order of these items depends on the individual.

Transportation access is a major factor in the economy of the San Juan Islands because travel to and from the islands is more expensive and less convenient than if the islands had direct highway access. Given that the islands will never have a land bridge connection, the main factors are the fare, the frequency of sailings, and the assurance (dependability) of boarding.

The impact of a reservation system would be (1) to increase the fare (about \$1 per vehicle trip) and (2) to increase the assurance of being able to make the trip according to the user's time plan. The first is a negative impact, and the second is positive. To illustrate the relative effect of the former item, Table 19 shows a fare and schedule frequency comparison among the WSF, B.C. Ferries, and Woods Hole systems (the fares are one-way auto without driver).

Table 19. Fare and Schedule Frequency Comparison

Ferry Service	Summer			Off-Season		
	Daily Runs	Regular Fare	Discount Fare	Daily Runs	Regular Fare	Discount Fare
WSF						
Anacortes-Friday Harbor	8	\$6.71	\$4.48	7	\$5.62	\$4.48
Anacortes-Orcas	9	5.98	3.68	8	4.65	3.68
B.C. Ferries						
Tsawassen-Gulf Island	3	13.60	10.90	3	13.60	10.90
Steamship Authority						
Woods Hole-Martha's Vineyard	13	30.00	15.00	12	15.25	12.50

Note: The B.C. Ferries fares have been stated in U.S. dollars.

From the above, it can be seen that the fare increase required to cover the cost of the reservation system is fairly inconsequential compared to these other ferry operations. It is all very much relative. If San Juan ferry fares had been at a level comparable with the other systems cited (an increase of from 100 to 400 percent), there would be a different scale of development. In other words, there would have been a substantial economic impact; that is, a lesser rate of population growth and less commercial activity.

FINDINGS AND CONCLUSIONS

Cost-Benefit Summary

The cost-effectiveness of a reservation system as described and detailed in this report is summarized in Table 20.

Table 20. Cost-Benefit Summary

		1990	2000
Costs	Direct Costs	\$731,200	\$1,046,800
	Indirect Costs	474,000	545,000
	Total Costs	\$1,206,000	\$1,591,800
Benefits	Time-Savings Benefits	\$954,000	\$2,224,000
Benefit/Cost Ratio		0.79	1.40

While the above numbers should be taken as generalized estimates at this time, they are indicative of the equivalence of benefits and costs of a reservation system and of the probability that benefits would increase more rapidly than costs in the future. In any event, the comparison is conservative because the cost estimates were generally on the high side, and the benefits do not include some items that are subjective and were, therefore, not included in this quantified comparison.

The net additional cost occasioned by the reservation system amounts to approximately \$1.70 per vehicle trip. How this cost is to be borne would be decided as part of the fare and subsidy policy determined by the State Transportation Commission.

Overall Findings and Conclusions

- The decision to conduct the study at this time was correct even though to many island residents, conditions do not yet warrant the cost and inconvenience associated with a reservation system. It is prudent for both WSF management and the public to have information well in advance of when conditions will warrant implementation of a major program such as a reservation system.
- The study demonstrates that a reservation system is feasible for the San Juan Island Ferry routes; and that one could be established without any serious obstacles. If established, the system would operate comparably to such systems on ferry operations elsewhere.
- The cost of a reservation system, while not insignificant, would be commensurate with quantifiable benefits to users. Benefits to the WSF—although not quantified in this study—would be substantial. They are:
 - Traffic management and safety benefits from the orderly arrival of vehicles in advance of scheduled ferry sailings.
 - A reduction, if not elimination, of vehicle queuing on the access roads to the terminals.
 - Less need for traffic control involving uniformed police officers; fewer traffic infractions and citations.
 - Less pressure to expand holding areas at terminals to reduce the adverse impacts of vehicle queuing.
- The effects of a reservation system are perceived as threatening to some ferry users, particularly island residents. This is because the ferry service is essential to the day-to-day activities of most island residents, and because it is at the center of controversial issues, such as state subsidies and local growth management.
- The study report provides sufficient technical detail so that it can provide a resource for future discussions of ferry service conditions and the potential role of a reservation system.