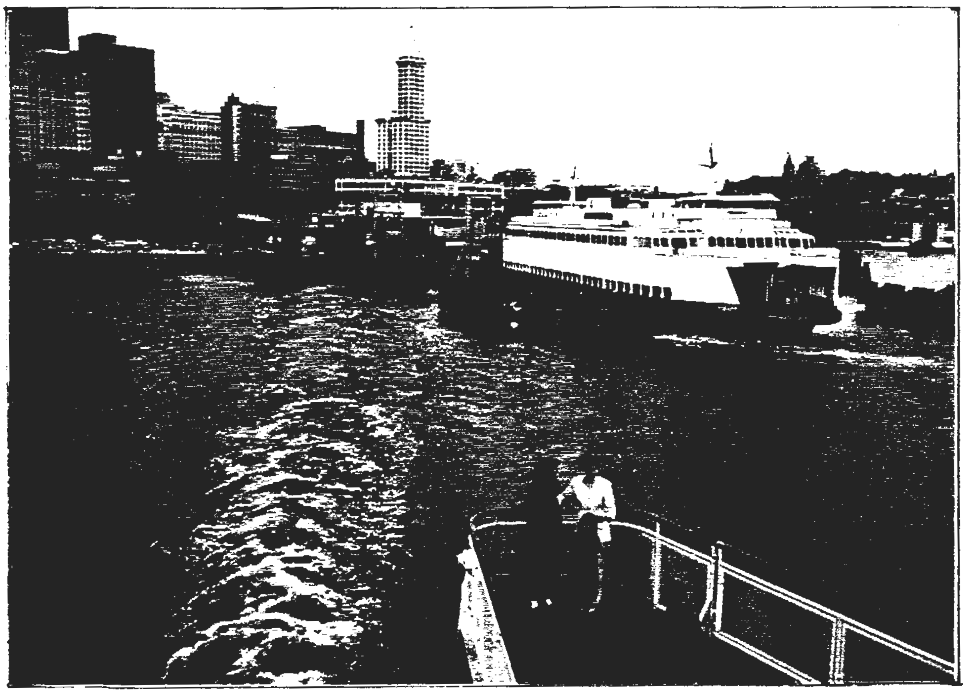
U.S. Department of Transportation
Federal Transit Administration

ASSESSMENT OF FERRIES AS ALTERNATIVES TO LAND-BASED TRANSPORTATION:

Phase 1: System Types and Surveys

Volume II of III



Prepared By: Charles R. Norris
446 Huron Avenue
Cambridge MA 02138

In Association With: Urban Harbors Institute
UMASS-Boston
100 Morrissey Boulevard
Boston MA 02125-3393

Prepared For: The Office of Technical Assistance and Safety
Federal Transit Administration
U.S. Department of Transportation

nal Report FTA-MA-06-0197-01-03
ay 1994

NOTICE

U.S. Department of Transportation
Federal Transit Administration

ASSESSMENT OF FERRIES AS ALTERNATIVES TO LAND-BASED TRANSPORTATION:

Phase 1: System Types and Surveys

Volume II of III

Prepared By: Charles R. Norris
446 Huron Avenue
Cambridge MA 02138

Under Contract To: Urban Harbors Institute
UMASS-Boston
100 Morrissey Boulevard
Boston MA 02125-3393

Prepared For: The Office of Technical Assistance and Safety
Federal Transit Administration
U.S. Department of Transportation
400 Seventh Street SW
Washington DC 20590

Final Report
May 1994

FTA-MA-06-0197-01-03

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FTA-MA-06-0197-01-03		UMTRIS

4. Title and Subtitle

ASSESSMENT OF FERRIES AS ALTERNATIVES TO LAND_BASED TRANSPORTATION
Phase 1: Survey of System Types nad Networks
Phase 2: Case Studies of Five Representative Systems

5. Report Date
May, 1994

6. Performing Organization Code

7. Author's

Charles R. Norris

8. Performing Organization Report No.
Urban Harbors Institute
UMASS-Boston
Boston MA 02125-3343

9. Performing Organization Name and Address

Charles R. Norris
Urban Design and Transportation Planning Consultant
446 Huron Avenue, Cambridge MA 02138

10. Grant or Project No.
MA 06-0197-01

11. Contract or Grant No.

12. Sponsoring Agency Name and Address
U.S. Department of Transportation
Federal Transit Administration (FTA)
400 7th Street, SW
Washington, DC 20590

13. Type of Report and Period Covered
Maritime Research

14. Sponsoring Agency Code

15. Supplementary Notes
Assessment of Ferries as Alternatives to Land-based Transportation
Report in Three Volumes: 1) Phase 1 Report, 2) Phase 2 Report, 3) Executive Summary

16. Abstract

1. Purpose: To assess the current and future uses ferries as altenatives to land-based transportation modes. Phase 1 consisted of a survey of 25 routes and systems in the U.S. to identify locations where ferry services have been used to provide an alternative to bridges, tunnels, highways or rail routes or construction. From the list of 25 sytems, five representative networks were selected for Phase 2 case study analysis. Phase 2 consisted of a detailed case study analysis to determine in more the various choice factors for providing water-based alternatives as well as user preferences for selecting ferries over land-based options. The analyses consisted of document research and site visits to assess the history, context, operations, landside options and other unique factors contributing to mode development and choice.

Method: Phase 1 was conducted by document search, phone interviews and personal experience of the author. Phase 2 included detailed document search and review, site visits and interviews, data compilationand draft and final reports. Since there is little comparative or descriptive literature available on the various routes studied, the site visits and interviews proved invaluable.

(continued on following page)

17. Key Words
Intermodal ferry links
Marine highways, Highspeed ferries, low wake/low wash, Essential/complementary/optional ferry routes.

18. Document Availability - Available to the public through the National Technical Information Service (NTIS).
5285 Port Royal Road
Springfield, Virginia 22161
- telephone 703/487/4650

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
unclassified	unclassified		

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Technical Report Documentation Page (Continued)

16. Abstract (continued)

3. Results/Findings: Phase 1 findings included identification of typologies of ferry service, general decision factors, and documentation and categorization of system by type and characteristic. All services tended to be multi-functional to varying degrees with the majority focussing on passenger and vehicle transport, and most serving tourism and recreation needs as well. Public transportation services ranged from lifelines serving islands, to through traffic marine highway links, to commuter vehicle transfer, to passenger commuter transit functions. Phase 1 concluded by identifying 5 representative networks as case studies for Phase 2, including ferries serving Seattle WA, Portland ME, San Francisco CA, new Orleans and the Mississippi River, and New York City.

Phase 2 case studies were evaluated in much greater detail, with a focus on characteristics such as system historical decision points, assessment of effectiveness of water routes compared to land-based alternatives, and future plans for expansion. Each system was found to have distinguishing features relating to operations, vessel technology, planning methods, environmental factors, and institutional settings. The case study locations were selected to represent a range of waterbody types, geography, climate, navigational conditions and other factors influencing route definition. Three basic ferry transportation functions were identified: 1) essential services to islands or other locations without land-based alternatives, 2) complementary services where ferries provide more efficient routes than land-based alternatives, and 3) optional services where ferries compete with land-based alternatives but provide qualitative advantages to attract riders.

All services were found to provide significant contributions to their regional transportation networks. Seattle and the Washington State Ferry System provide the largest volume passenger and vehicle system in the U.S., acts as a major tourist magnet to the Northwest, and provides a variety of complementary and essential services. The Portland-Casco Bay system is a classic example of an island lifeline type service, and is used year round by commuters, also serves seasonal vacationers, and provides essential services for which there are no landside alternatives. San Francisco's
Golden Gate Ferries set the precedent for contemporary fast ferries serving as alternatives to expanding landside highway and bridge infrastructure in the 1970's, introduced the first highspeed catamarans in the 1980's and plans expansion of routes with the next generation of faster vessels for even longer routes, while providing complementary services. The Mississippi River and New Orleans vehicle/passenger ferries continue to serve as "ferry-bridges" connecting residents with employment across the river, reducing auto trips with complementary services to the infrequent bridge and highway network. New York commuter ferries provide attractive options to the congested and unpredictable routes into Manhattan, with an innovative use of private passenger ferry links serving key commuter corridors, and helping to relieve pressure on the road, tunnel and rail systems.

4. Conclusions and Recommendations:

1. Ferries are providing cost-efficient and environmentally compatible alternatives to land-based transportation in many regions of the country.
2. Ferries are filling increasing new roles as links in intermodal transit and vehicle links across water, and are serving as integral components of regional transportation networks.
3. The number of ferry services have increased significantly in urban areas in the past decade with commensurate increases in volume of users.
4. Ferry use for recreation and tourism has also increased during the same time frame often on the same

16. Abstract (Continued)

routes and systems.
5. Lower volume, essential services continue to provide important lifeline transportation functions for island communities.
6. Complementary and optional services in urban areas appear most likely to grow by relieving pressures on landside infrastructures filled to capacity.
7. Emerging new highspeed vessel technologies will provide new more competitive longer distance route options in many areas.
8. A National Ferry Policy is recommended to recognize the expanding role of ferries as key links in intermodal regional transportation systems, and to provide expanded federal assistance through emerging ISTEA programs.

METRIC / ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in) = 2.5 centimeters (cm)
1 foot (ft) = 30 centimeters (cm)
1 yard (yd) = 0.9 meter (m)
1 mile (mi) = 1.6 kilometers (km)

AREA (APPROXIMATE)

1 square inch (sq in, in^2) = 6.5 square centimeters (cm^2)
1 square foot (sq ft, ft^2) = 0.09 square meter (m^2)
1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)
1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)
1 acre = 0.4 hectares (he) = 4,000 square meters (m^2)

MASS - WEIGHT (APPROXIMATE)

1 ounce (oz) = 28 grams (gr)
1 pound (lb) = .45 kilogram (kg)
1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

VOLUME (APPROXIMATE)

1 teaspoon (tsp) = 5 milliliters (ml)
1 tablespoon (tbsp) = 15 milliliters (ml)
1 fluid ounce (fl oz) = 30 milliliters (ml)
1 cup (c) = 0.24 liter (l)
1 pint (pt) = 0.47 liter (l)
1 quart (qt) = 0.96 liter (l)
1 gallon (gal) = 3.8 liters (l)
1 cubic foot (cu ft, ft^3) = 0.03 cubic meter (m^3)
1 cubic yard (cu yd, yd^3) = 0.76 cubic meter (m^3)

TEMPERATURE (EXACT)

$[(x - 32)(5/9)]$ °F = y °C

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm) = 0.04 inch (in)
1 centimeter (cm) = 0.4 inch (in)
1 meter (m) = 3.3 feet (ft)
1 meter (m) = 1.1 yards (yd)
1 kilometer (km) = 0.6 mile (mi)

AREA (APPROXIMATE)

1 square centimeter (cm^2) = 0.16 square inch (sq in, in^2)
1 square meter (m^2) = 1.2 square yards (sq yd, yd^2)
1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
1 hectare (he) = 10,000 square meters (m^2) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gr) = 0.036 ounce (oz)
1 kilogram (kg) = 2.2 pounds (lb)
1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

VOLUME (APPROXIMATE)

1 milliliter (ml) = 0.03 fluid ounce (fl oz)
1 liter (l) = 2.1 pints (pt)
1 liter (l) = 1.06 quarts (qt)
1 liter (l) = 0.26 gallon (gal)
1 cubic meter (m^3) = 36 cubic feet (cu ft, ft^3)
1 cubic meter (m^3) = 1.3 cubic yards (cu yd, yd^3)

TEMPERATURE (EXACT)

$[(9/5)y + 32]$ °C = x °F

QUICK INCH-CENTIMETER LENGTH CONVERSION

INCHES	0	1	2	3	4	5	6	7	8	9	10

CENTIMETERS 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 | 25.40

QUICK FAHRENHEIT-CELCIUS TEMPERATURE CONVERSION

°F	-40°	-22°	-4°	14°	32°	50°	68°	86°	104°	122°	140°	158°	176°	194°	212°
°C	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°

For more exact and/or other conversion factors, see NBS Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50. SD Catalog No. C13 10 286.

ASSESSMENT OF FERRIES AS ALTERNATIVES TO LAND-BASED TRANSPORTATION

PHASE 1: System Types and Surveys

Table of Contents

4.0 Evaluative Criteria for Selection of Case Study Systems

A. Appendix

A.1 Ferry System Data Logs

List of Figures:

List of Tables:

ASSESSMENT OF FERRIES AS ALTERNATIVES TO LAND-BASED TRANSPORTATION

Phase 1 - System Types and Surveys

1.0 Introduction: Project Objectives and Historical Context

1.1 Project Objectives and Description

Waterborne ferry services have served as primary transportation links carrying passengers, freight, and vehicles between shore locations since the earliest waterfront settlements in North America. While the reliance on ferry systems has greatly diminished in the United States in this century with the construction of highways, bridges, and tunnels, there remain a significant number of locations where water transportation is the most effective method of travel. The purpose of this report is to identify representative ferry transit systems, analyze the decisions which led to the choice of water-based versus land-based transportation, by assessing a representative cross section of ferry systems serving differing transportation needs in a variety of marine and geographical settings in the United States.

The primary focus of the study was to identify and assess those factors of the past, present, and future which have influenced decisions on choice of water-based versus land-based transportation for passenger travel over or around water bodies of various types. While many ferry systems serve multiple transportation functions, the concentration of the research was on those principally serving commuter needs and/or providing essential connections between roadways or other points separated by water. The project research was conducted in two phases. The first phase, described in this report, consisted of the following sequence of tasks;

o Identify and define different categories and typologies of commuter-oriented and marine highway link ferry systems based on general knowledge of U.S. examples.

o Catalogue and describe primary operational characteristics which differentiate those system and route types.

o Define and categorize typical decision-making factors which contribute to choices between water or land-based transportation modes.

o Identify a representative cross section of 25 past and present systems to establish a data base for providing examples of typologies and decision factors.

o Select a short list of 9 systems for more detailed evaluation and identification of decision-making factors. Analyze each system and determine the significance of each to national trends in transportation planning.

o Assemble a data base for the 9 systems to serve as a reference for the phase 2 and analyses of ferry systems.

o Identify and prioritize evaluative criteria for determining candidate systems for phase 2. and recommend 5 systems for in-depth case study analysis.

The second phase is intended to take the 5 case study systems through a more detailed evaluation to determine more specific conclusions about the factors which have influenced decisions on choice of one mode of transportation versus another, and describe those which are most likely to influence future planning choices. The case studies will include detailed historical analysis of the implementation of the systems and a documentation of the performance characteristics of the ferry routes related to the larger regional transportation network. The systems will then be evaluated in terms of current national transportation policy objectives including those set forth in the Intermodal Surface Transportation Act (ISTEA).

1.2 A Brief History of Ferry Systems in the 20th Century

Ferry systems have been experiencing a renaissance in many regions of the United States ranging from the establishment of new routes in the New York and Boston harbors on the east coast to the start-up of systems in San Francisco Bay and across Puget Sound in Seattle on the west coast. There has also been a revival of many lake and river services in otherwise landlocked areas of the country. After many decades of ferry routes being abandoned and replaced by new bridges, tunnels and highways, there has been a decided trend during the past 30 years in restoring or creating new passenger water transit routes which serve an increasingly wide range of transportation needs. Many of the newer systems which are both publicly and privately operated have discovered and responded to specific new niches in regional and metropolitan transportation demand. At the same time, various continuously operating ferry systems, such as those serving islands or crossing long distances over larger water bodies, have adapted to changing demands, such as greatly increased seasonal recreational use.

During the long and varied history of transportation in the United States, ferry services have played a critical role in both urban and rural areas to carry passenger and vehicles over otherwise impassable water areas. During the 18th and 19th centuries, water transportation was an essential and often the only means of conveyance of passengers and commercial goods from short trips across the many rivers and harbors around which most of the trade was concentrated, to longer trips connecting major river or coastal cities. In many regions water routes were far more efficient travel routes in terms of cost, time, and comfort than were overland or shore based roadways. As technology and commerce combined to build bridges and tunnels connecting heavily travelled routes across rivers and harbors, the ferry systems were put out of business. Of equal importance in the shift away from ferry travel was the growth of interurban rail and trolley systems which provided inexpensive and efficient landside transit options to long haul river or coastal trips, or short haul work commutes.

In the first half of the 20th century, the massive commitment to construction of regional and national highway networks included the filling in of many other water links with bridges, tunnels and causeway combinations to allow for all types of new vehicular and rail connections. The decisions to replace ferry routes and bridge the gaps across water areas were driven by varying combinations of determinates. Reasons for faster and/or higher capacity connections included such factors as: regional economic development pressures to keep industrial or commercial areas moving and competitive, land development initiatives to open up new areas for urban growth, or in already densely developed urban areas such as New York City to allow access for the ever expanding numbers of commuters by increasing traffic capacity to work centers from residential areas. As the new roadway and rail connections were completed the passenger oriented ferry systems often became redundant, and since they were usually privately operated, would go out of business.

By 1960, most major port waterfront cities on both coasts, along the great lakes and along major rivers had completed significant highway programs including water crossings and the vast majority of ferry systems were gone. Mid-century factors which contributed were the increasing reliance on auto travel by commuters, ever expanding suburban residential development, and a national commitment to a defense highway network with a federal funding program which assisted states in building the system. Another factor in port cities was the massive renewal efforts which often included portions of their derelict maritime waterfronts for the ambitious transportation links. The train systems were also in decline, forcing more commuters into automobiles as rail transit became less frequent and unpopular. Even the numbers of commuters to the downtowns were diminishing, and the newly completed highway networks appeared capable of handling the demand. There were, however, several notable exceptions to the trend of building enough new roads and bridges to handle all traffic needs in cities and regions where such solutions were either extremely difficult and costly, such as in Seattle and San Francisco, or virtually unbuildable as in the case of island connections such as in Portland's Casco Bay,or along a coastal shore such as that of the southwest Alaska. In these cases ferry systems continued to be necessary and were converted effectively into publicly mandated and operated systems, whereas they had been privately operated before.

From the 1950's on, conditions affecting ferry viability began to shift in new directions as the urban development and commuter travel patterns began to change. The residential and work patterns began to change dramatically in different urban areas; In some of the older port cities such as New York, Boston,Chicago, San Francisco, and Seattle, work destinations remained central while residential sprawl created an extended commuter pattern served predominantly by auto. In some older and newer waterfront cities such as Norfolk, Baltimore, Los Angeles and Houston the growth patterns of both work and residential locations became decentralized.

As early as 1950, Seattle and the state of Washington realized that in order to sustain growth in the major economic center, ferry travel across Puget Sound must be sustained and improved, and the Washington State Ferry system was begun. In the mid 1960's in San Francisco, while the Bay Area Rapid Transit rail system was being planned, the communities on the north shore of the bay decided to invest in a ferry system rather than rail or an expanded Golden Gante Bridge and the Golden Gate Ferry system was begun. Alaskans voted in 1960 to formalize a state operated "marine highway" ferry system to insure year round connections between coastal cities as well as to Seattle, instead of attempting to find and fund an impractical overland route around its virtually impassable coast.

By the late 1970's, congestion had begun to build up in cities like Boston which were enjoying some repopulation and economic growth. A commuter ferry service was reinstituted from coastal south shore communities across the harbor to the downtown business district, beginning the return of a public/private fleet which has grown steadily into the 1990's. Manhattan has enjoyed continuous service from the venerable Staten Island Ferry carrying commuters to the Battery area since 1900. New York City had for many decades possessed the most extensive transit and commuter rail system in the U.S.. It wasn't until 1986 that congestion on the combined transit and highway connections led to such long commuter trips from New Jersey residential areas that two new private services were started and proved successful enough to generate a steady stream of new routes which presently combine to carry over 16,000 passengers a day to Manhattan, excluding the high volume Staten Island Ferry.

Many factors have contributed to the start-up and success of these and other representative systems. Of equal importance in evaluating recent ferry development is to identify both historic and emerging new factors which may play increasing roles in future choices of land-based or water-based transportation.

2.0 Comparing Ferry Systems with Land-based Transportation

2.1 Ferry System Determinates; Variable Factors in Planning, Design, and Operations

When considering the planning history of an individual ferry system, it often seems that there are as many different combinations of variables which have contributed to their development as there are systems. In analyzing the wide range of systems, however, it does seem useful to consider the categories of factors which have historically been considered in decisions of land-based versus water-based transportation. System choice factors observed in a wide range of cases may be included in the following categories;

1) Transportation: The transportation factors in determining water or land based modes remain the dominant determinates. Planning decision points may include one or more of the following, but always involves consideration of transportation demand levels.

- Traffic Congestion/Mass Transit Demand/Ro-Ro Demand
- Intermodalism
- Interstate/State Transportation Systems
- Legislative Policy

2) Environmental Issues: Factors such as how bridges or ferries impact the natural or man made environment have become increasingly important in considering transportation mode alternatives since an increasingly broad range of national and regional concerns have been incorporated into the planning, permitting and regulatory processes. The trade-offs and constraints have become much more complex during the 25 years since the National Environmental Protection Act was passed and put into practice. While there are many factors which are necessary to consider, those most commonly affecting water areas include the following;

- Coastal Zone Issues
- Energy Efficiency
- Air Quality
- Water Quality
- Wildlife Habitats
- Community Impacts/Concerns

3) Cost Effectiveness: In selecting a water or land based transportation mode, cost factors are always a determinate, particularly when public funding is involved. Cost/Benefit analyses are often needed to assess the preferred mode or route. Factors to be considered include;

- Technological Advances
- Capital and Operating Costs
- Public vs. Private Operation

4) Geographical Conditions: Geographical conditions as distinct from environmental concerns have historically been major factors in water related environments. The spectrum of conditions to consider varies dramatically by region and by water body type. The more dramatic the landscape, watersheet conditions, weather ranges, and shore conditions, the more they are likely

to affect decisions on modes and systems. Basic categories include:

- Weather Patterns
- Waterbody Type and conditions
- Tide/Flood Conditions
- Year-round vs. Seasonal Operation Requirements

5) Economic Development: In parallel with the other planning and decision factors is the important consideration of economic development, ranging in scale and impact from regional to metropolitan to local to site specific. In many instances, the historic decisions to replace ferry systems with bridges, tunnels, or rail were based on changing economic objectives which in turn determined new transportation system needs. Included in such mode choices are the following:

- Urban Business Development and Employment
- Residential and Commercial Land Development
- Water and/or Land Based Recreation and Tourism
- Delivery of Goods and Services
- Water Dependent Activities or Businesses

2.2 Ferry System Typologies by Transportation Function and Context

In order to consider the broadest range of ferry systems and functions, a list of primary system types or typologies was prepared and matched with representative examples of U.S. ferry operations. Similarly a set of secondary system characteristics was identified and matched with representative and sometimes overlapping examples. In keeping with the project objectives of focusing on ferries as components of the public transportation network, only systems primarily involved with waterborne passenger mass transit and/or roll-on roll-off (ro-ro) vehicular transport were included. Excursion ferry service is included only as an ancillary aspect of point to point routes, and not as a separate category. Other types of ferry systems are excluded altogether, such as water taxi, tour routes, whale watches, or other recreation oriented services. The accompanying set of system characteristics are often factors in decision-making for land-based or water-based travel, and were also factors in selecting the system examples to try to cover a wide range of contextual and functional conditions. The ferry system typologies and characteristics considered in this study are listed and described as follows:

Ferry System Typologies (Described as water based versus land based transportation choices):

1. Ferry vs. Bridge or Tunnel
2. Ferry vs. Parallel Highway or Rail
3. Ferry to Island(s)
4. Ferry in Addition to Parallel Bridge or Tunnel
5. Ferry in Addition to Highway or Rail
6. Roll-on Roll-off(Ro-Ro) Vehicle Ferry as Highway Link

Ferry System Characteristics:

A. Commuter vs. Recreation/Tourism Ferry

B. High Volume vs. Low Volume Passenger or Highway Link
C. International vs. Interstate vs. Intrastate vs. Intercity Systems
D. Public vs. Public/Private vs. Private System Operation
E. Existing vs. Expanding vs. New System

Description of Primary System Types: The typologies are described in terms of water based versus land based transportation choices.

1. Ferry in lieu of Bridge or Tunnel: While vast numbers of ferry systems have been replaced by combinations of bridges or tunnels, there are still remaining many ferry systems which have not been replaced for various reasons depending on the location and function. There are other systems more recently which have been initiated in order to avoid building new bridge or tunnel crossings such as Seattle. Historically many ferry systems were replaced by bridges or tunnels when traffic demands increased beyond the capacities of the ferry systems as in the case of the Coronado-San Diego bridge, or for purposes of completing a segment of highway deemed to be an important travel link requiring higher capacity for vehicular travel.

- o Seattle/Bainbridge (formerly)-Winslow/Bremerton/Vashon Is.
- o Coronado-San Diego (Historical)
- o Norfolk VA-Eastern Shore MD (Historical)

2. Ferry in lieu of Parallel Highway or Rail: In some cases, a choice has been made to maintain a water transportation link parallel to the shore instead of building a road or rail system. Geographical and environmental conditions of the shoreline may preclude road or rail construction as in the case of segments of the Alaska Marine Highway where the terrain is too rugged, the traffic demands too small, and the distances too great to make the parallel shore route economically viable. In urban areas where the road and transit networks are operating at or near capacity, choices have been made to establish new ferry links or replace previous ones instead of expanding the landside transportation system, as was the case with San Francisco's Golden Gate system or the Bayshore NJ to Manhattan service.

- o Alaska Marine Highway
- o Bayshore NJ-Manhattan (Hist.)
- o San Francisco-Golden Gate/Vallejo

3. Ferry to Island(s): One of the more fundamental tasks that ferry systems serve is to provide basic transportation connections from island to mainland in coastal or lake situations. Many of the best known systems in the U.S serve islands on a year round as well as seasonal basis. The major shift in island services has been a gradual conversion to public operation from private particularly where there is a year round resident population to be served. Among the many examples of island ferry systems are the following:

- o Martha's Vineyard/Nantucket
- o Portland-Casco Bay
- o Staten Island to Manhattan
- o San Juan Islands-Anacortes
- o Maine State Ferry System
- o Port Clinton to Put-in-Bay
- o Long Island to Fire Island

4. Ferry in Addition to Parallel Bridge or Tunnel. There are both older and newer systems which exist parallel to an existing bridge or tunnel, but serve either complimentary or different transportation functions. The newer systems which are parallel to land based systems are often added because of traffic congestion and overcrowding on the bridge or rail. The ferry provides an alternative route and can help to relieve congestion. Examples include:

- o Norfolk-Portsmouth
- o Boston-Logan Airport to Rowes Wharf
- o New Orleans to Algiers
- o Philadelphia to Camden

5. Ferry in Addition to Parallel Highway or Rail. Similarly there are ferry routes which operate in parallel with road networks or rail transit, but serve complimentary or sometimes different needs. The newer systems, as above, may have been added as a traffic congestion relief measure and/or to encourage transit as opposed to auto commuting. Such systems have also been introduced as mitigation measures during land side construction to relieve temporary congestion. Examples of parallel systems include the following:

- o Boston-Hingham
- o New York City/Cross Hudson
- o Bayshore-Manhattan
- o San Juan-Old San Juan

6. Ro-Ro Ferry as Highway Link: Roll-on roll-off ferry systems for autos and trucks provide the necessary connecting links between roads and highways on opposite sides of water bodies without bridges or tunnels. Such ferries are still in use where the volume of traffic is either too small to warrant a bridge, where the environmental conditions may preclude such a crossing, or where an alternative higher volume highway route exists in parallel. While most ferry to island routes may be considered links in the highway system, those found on the mainland include the following:

- o New London-Long Island
- o Cape May-Lewes
- o North Carolina-Hatteras

List of System Characteristics and Examples: (by function,service, or context)

A. Commuter and Recreational/Tourism Ferry: Many ferries have historically served a combination of transit and recreational functions, particularly those operated privately where the operator wanted to optimize use of the vessels. Even today, most of the publicly operated systems have a dual function with off-peak and weekend routes being used for recreation in addition to the primary peak period uses for commuter transportation. In addition, many systems operate with different seasonal mixes, and use the tourism income to offset the less profitable off-season operations.

- o Cape Cod to the Islands
- o Burlington-Ft. Kent/Lake Champlain
- o Mackinaw City-Mackinac Island

- o Staten Island Ferry

B. High Volume vs. Low Volume Highway or Transit Link: While the better known urban ferry systems tend to be high volume for transit and/or ro-ro links, the majority of routes nationally are ones with relatively small volumes, serving as substitutes for bridges or tunnels as well as connecting islands to mainland. Depending on demands and context the design and operations are likely to differ greatly between high and low volume systems.

- o Seattle to Winslow
- o Mississippi River/Golden Eagle(IL)-St.Charles (MO)/
- o Angola State Prison (LA)/New Orleans-Algiers (LA)
- o Mississippi River Bridge Authority

C. International vs. Interstate vs. Intrastate vs. Intercity Systems: The majority of systems in the U.S. are within a given state jurisdiction. When state borders are crossed, the nature of the system is likely to differ, particularly on optional routes which tend to be privately operated. Notable exceptions exist as in the case of Alaska Marine Highway, where no feasible alternatives to the international and interstate routes exist.

- o Seattle-Prince Rupert-Ketchikan
- o New London CT- Long Island NY
- o Cape May NJ-Lewes DE
- o Maine State Ferry System

D. Public vs. Public/Private vs. Private Operated System: Three types of operations can be identified all of which serve transit functions. The public systems are most common where the ferry is filling a gap in the transportation system, particularly as a link in the highway network. However there are private operations which serve the same functions without subsidy in locations where the demand is such that the system can be operated at a profit. An emerging newer type of ferry operation is one in which a private operator is contracted to perform a public transportation service, or has some portion of their operation subsidized. Another form of the Public/Private operation is one where some of the terminal facilities or landside functions are subsidized.

- o Seattle/WA State (public)
- o Portland/Casco Bay Authority (quasi-public)
- o Martha's Vineyard-Nantucket Steamship Authority (quasi-public)
- o Block Island/Interstate Navigation Co. (private)

E. Existing vs. Expanding vs. New Ferry Systems: Systems can be categorized as being static existing operations, expanding of routes and/or new vessel technology, or proposed new routes and operations.

- o San Francisco-Vallejo (expanding)
- o New York Commuter System (new routes and operations)
- o Monmouth County NJ/Bayshore-Manhattan (expanding and new routes)
- o Corpus Christi Bay (proposed new system)
- o Boston Harbor Commuter/Shuttle (expanding and new routes)

2.3 System Evaluative Criteria

Based on the analysis of generic ferry typologies and examples of systems around the country, several key criteria emerged in addressing the primary study goals. The selections for further study focused on those systems with the following characteristics:

1. Urban Passenger Commuter Transit; as complimentary or supplementary to other urban transit services and promoting diminished auto use in high density areas.

2. Highway Links; provision of critical highway linkages where no alternatives exist (such as connections to offshore islands), where alternative land-based routes are circuitous, or where topography or environmental factors preclude a parallel shore route.

3. Contributions to Economic Development; sytems providing broad public benefits such as expansion of tourism, waterfront redevelopment, and/or other opportunities for job creation.

4. Short or Long Term Mitigation for Environmental Purposes; including air quality improvements, relief of major shoreline construction project impacts, wetlands protection, or growth management in sensitive areas requiring limits on visitation or density.

5. New Ferry Technologies; new opportunities for routes and services through advancements such as high speed, high volume, or ocean going vessel types.

6. Public-Private Partnerships; new methods and techniques for sharing start-up costs, capital expenses for terminals and/or vessels, and operating costs through innovative transportation programs at federal, state, and local levels.

7. Intermodalism; identify and encourage new ways to combine use of ferries for multiple water-based transport modes, with connections to other land or water-based transport modes at the water's edge.

3.0 Ferry System Analysis and Screening

3.1 National Survey of Ferry Systems by Type; Past, Present, and Future.

The list of choice factors, typologies, and system characteristics was derived through consideration of a cross section of ferry routes and systems from all regions of the country and all types of operating conditions. From nearly 300 existing systems operating in the U.S., as well as historic systems and proposed new systems, a representative group of 25 were surveyed and catalogued to test the various evaluative criteria, and to determine which systems or groups of systems might be most suitable for case studies for the more detailed analysis. The purpose was to include the broadest array of examples, with the general condition that each must serve a basic transportation need connecting passengers across a water body.

The systems were compared in a cross referenced matrix format similar to that shown in Table 3.3, by system type and characteristic as well as by other factors. The primary differentiation between systems was based on typology. Other comparative factors were also included such as public vs. private, passenger and/or ro-ro, volume of ridership, age of system, vessel technology, and other relevant general characteristics. Also included are capsule descriptions of each system summarizing historical decisions relating to land versus water-based choices. The locations of the 25 systems are shown in the U.S. map in Figure 3.1.

Summary Descriptions of National Survey Ferry Systems

1. Seattle to Winslow/Bremerton/Vashon Island; (Puget Sound, Washington State; Figure 3.2). Washington State operates the largest and most extensive ferry system in the U.S.. Of the many routes, those connecting Seattle and surrounding communities are noteworthy as high volume passenger and ro-ro commuter links across Puget Sound. The systems evolved from the mosquito fleets of the early 20th century which transported passengers, vehicles, and goods across the virtually un-bridgeable tidal waters of Puget Sound. A variety of routes serve the islands and western shore of Puget sound which are populated by year round commuters to Seattle work destinations. The largest of the operations is the Winslow/Bainbridge Island route which carries nearly 5 million passengers per year.

The system fits several of the typologies in addition to "ferry in lieu of bridge or tunnel", as the Vashon and Winslow routes serve islands, and the Bremerton route constitutes an east-west ro-ro/highway link. Characteristically, the system serves commuter and recreational needs, operates at high and medium volumes, connects the city with surrounding residential communities, is publicly operated by the state of Washington, and expands service within given routes as the demand warrants. The Seattle commuter ferry system has evolved into one of the most efficient combination passenger and ro-ro services in the U.S. and presents many lessons in optimizing public intercity highway links where the existing landbased alternative, a 70 mile drive through Tacoma, is clearly not feasible, and where bridges or tunnels would be prohibitively expensive and technologically difficult.

2. Norfolk to Portsmouth; (Elizabeth River, Virginia, Figure 3.3). Norfolk-by-Boat Inc. operates two reproduction paddle-wheel ferries between Norfolk's downtown festival marketplace (Waterside), across the Elizabeth River to Portsmouth. The service, used primarily as a recreational service with a secondary use by commuters, restored passenger ferry service in 1983 which had been discontinued in 1955 with the opening of the Portsmouth-Norfolk Bridge/Tunnel. It serves to connect historic sites in Portsmouth to the year round attractions at Waterside and the revitalized Norfolk downtown waterfront. The weekday commuter use has gained in popularity during recent years because of increased bridge and tunnel traffic and downtown congestion.

The system is an example of a passenger ferry system operating in addition to a parallel bridge and tunnel. Characteristically, the system is used for both recreational and commuter use, has medium volume, covers an intercity route, is privately operated, and uses low technology "character" vessels to cross the narrow river. The system is a good example of a privately operated excursion service which reduces traffic by visitors on a congested bridge/tunnel link between two riverfront attractions. Because of the circuitous tunnel-bridge route (Alt.460) connecting downtown Norfolk to Portsmouth, residents have found the ferry route a time-efficient commuter mode, further reducing traffic.

3. San Diego to Coronado Bridge; (San Diego Bay, California, Figure 3.4). The construction of the bridge connecting Coronado to San Diego in 1960 replaced the ro-ro and passenger service which had been operating since the turn of the century. The land based connection to the Coronado peninsula had always been a long (30 miles) and circuitous trip, particularly as Coronado changed from being a bedroom community for San Diego, a resort community and an employment center with the growth of the Naval Air Station, both of which generated increasing amounts of commuter demand. The toll bridge crosses San Diego Bay at a narrow point and connects with Interstate 5. As the bridge faces extensive upcoming repairs, plans are underway to use a temporary ferry service to mitigate traffic delays during the repair period.

The Coronado bridge represents a typical historical example of ferry system replacement by bridge or tunnel as land-uses changed and traffic demands increased beyond the capacity of the ferry link. These transportation decisions involved a short-distance, intracity, high volume roadway link. The recently proposed use of a temporary ferry route during bridge repairs represents an example of waterbased transportation as a mitigation measure. The original ferry was a typical example of a low tech, slow speed system, which may be replaced during its proposed new mitigation application with a more efficient contemporary vessel type expediting trip time.

4. Norfolk Chesapeake Bay Bridge Tunnel to the Eastern Shore; (Chesapeake Bay, Virginia. Figure 3.5) When completed in 1964, the 20 mile long bridge and tunnel connected Norfolk with the Eastern Shore of Virginia and replaced the ro-ro ferry service which had long served as the main connection to the agrarian, sparsely populated peninsula from the port of Norfolk. The bridge/tunnel was intended to open up a new north-south coastal travel route from Florida to New York as an alternative to the inland route through Washington and Baltimore. The former ferry route was a lengthy trip across open ocean, and it was intended that the new toll road would encourage additional tourism and a better truck route for the port. To date, the inland connection to the interstate system through Norfolk to North Carolina have not been completed and the full benefits of the coastal route have yet to be realized.

The Chesapeake Bay Bridge represents another typical historical example of a bridge and tunnel replacement for a ferry system link in a highway network. The long connection was made possible by the general shoal waters around the mouth of the Chesapeake Bay which allowed for a combination of causeway, bridge, and tunnel (notably under a major shipping channel).

Figure 3.1 - Ferry System Locations

Key:

Ferry vs. Bridge or Tunnel

1. Seattle to Winslow/Bremerton/Vashon Island
3. San Diego to Coronado Bridge
4. Norfolk to Cape Charles/Bay Bridge

Ferry vs. Parallel Highway or Rail

5. Alaska Marine Highway
6. Boston to Hingham
7. San Francisco - Golden Gate Ferry
8. San Juan to Old San Juan
9. Bayshore NJ to Manhattan

Ferry to Islands

11.Cape Cod to Martha's Vineyard/Nantucket
12.Portland to Casco Bay Islands
14.San Juan Islands to Anacortes WA
19.Long Island to Shelter Island
20.Port Clinton to Put-In-Bay OH
21.Staten Island to Manhattan
23.Block Island to Pt.Judith/Newport

Ferry Plus Bridge or Tunnel

2. Norfolk to Portsmouth
10.Cross Hudson to Manhattan
13.Logan Airport to Rowes Wharf, Boston

Ferry Plus Highway or Rail

24.San Francisco to Vallejo
25.Cross Corpus Christi Bay (proposed)

Roll-on Roll-off Ferry Highway Link

15.New London to Long Island
16.Cape May to Lewes
17.North Carolina to Cape Hatteras
18.Burlington to Ft.Kent
22.Mississippi River Bridge Authority

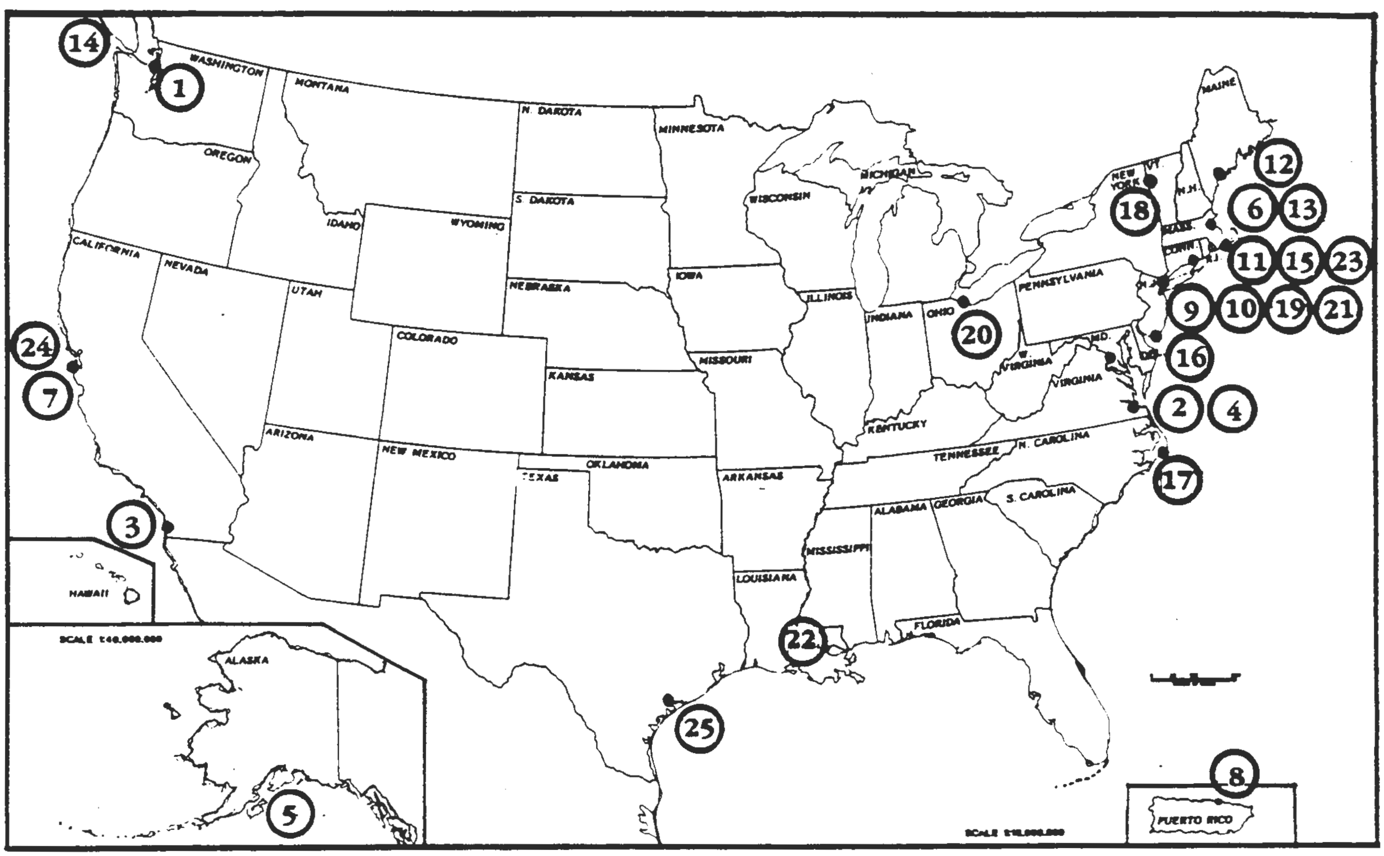


TABLE 3.1 - Survey of 25 Ferry Systems

Key:

Type:
1.Ferry/Bridge or Tunnel
2.Ferry/Parallel High.or Rail
3.Ferry to Island(s)
4.Ferry + Bridge or Tunnel
5.Ferry + High. or Rail
6.Ro-Ro Highway Link

Characteristic:
A.Commuter/Recreation or Tour
B.High or Low Volume
C.Int'natonal/Int'state/Int'city
D.Public vs. Private
E.New or Expanding System

Ferry System	Type	Charact eristics	Public /Priv.	Pass. RoRo	Vol.of Riders	Syst. Age	Tech	General
1.Seattle/ Winslow,etc	1,3,5,6 ,		Pub.	P/R	3.49m	1951	Low	
2.Norfolk/ Portsmouth	1,4		Priv.	P	.82m	1983	L	
3.San Diego/ Coronado	(1), (6)		Pub.	(R)	-	(1960) Ended	L	
4.Norfolk/ CapeCharles	(1), (6)		Pub.	(R)	-	(1964)	L	
5.Alaska Marine Highway	1,2,3,6		Pub.	P/R	.41m	1963	L	
6.Boston/ Hingham	1,2,4,5		Pub/ Priv.	P	.61m	1984	L	
7.San Fran./ Golden Gate	1,2,4,5		Pub.	P	1.52m	1970	High	
8.San Juan/ Old San Juan	2,5		Pub.	P	2.1m	1989	H	
9.Bayshore/ Manhattan	5		Priv.	P	.24m	1986	H	
10.New York/ Cross Hudson	3,4,5,6		Priv.	P	2.65m	1987	Med.	
11.CapeCod Vineyard Nantucket	3,6		Pub.	P/R			L	

Ferry System	Type	Characteristics	Public Priv.	Pass. RoRo	Vol.of Riders	Syst. Age	Tech	General
12.Portland/ Casco Bay	3,6		Pub.	P/R	600k	1871	Low	
13.Boston/ Logan	4,5		Pub/ priv	P	180k	1985	L	
14.San Juan Islands	3,6		Pub.	P	NA	1951	L	
15.N.London/LI	3,6		Priv.	P/r	NA	1937	L	
16.Cape May/ Lewes	4,5,6		Pub.	P/R	1.05m	1964	L	
17.N.Carolina/ Hatteras	3,6		Pub.	R		1961	L	
18.Burlington/ Ft.Kent	5,6		Priv.	P/R	NA	1913	L	
19.Long Island/ Fire Island	3		Priv.	P	1.4m	1972	L	
20.Port Clinton/ Put-in-Bay	3,6		Priv.	P/R	NA		High, L	
21.Staten Island/ Manhattan	3,6		Pub.	P/R	21m	1905	L	
22.Miss.River Bridge Auth.	1,6		Pub.	P/R	NA	1900	L	
23.Newport and Pt.Judith/ Block Island	3,6		Priv.	P/R	NA	1945	L	
24.San Fran./ Vallejo	4,5		Pub/ Priv.	P	250k	1986	H	
25.Corpus Christi Bay	5		Pub.	P	0	1995	H	

Figure 3.2 - Seattle to Winslow/Bremerton/Vashon Island WA

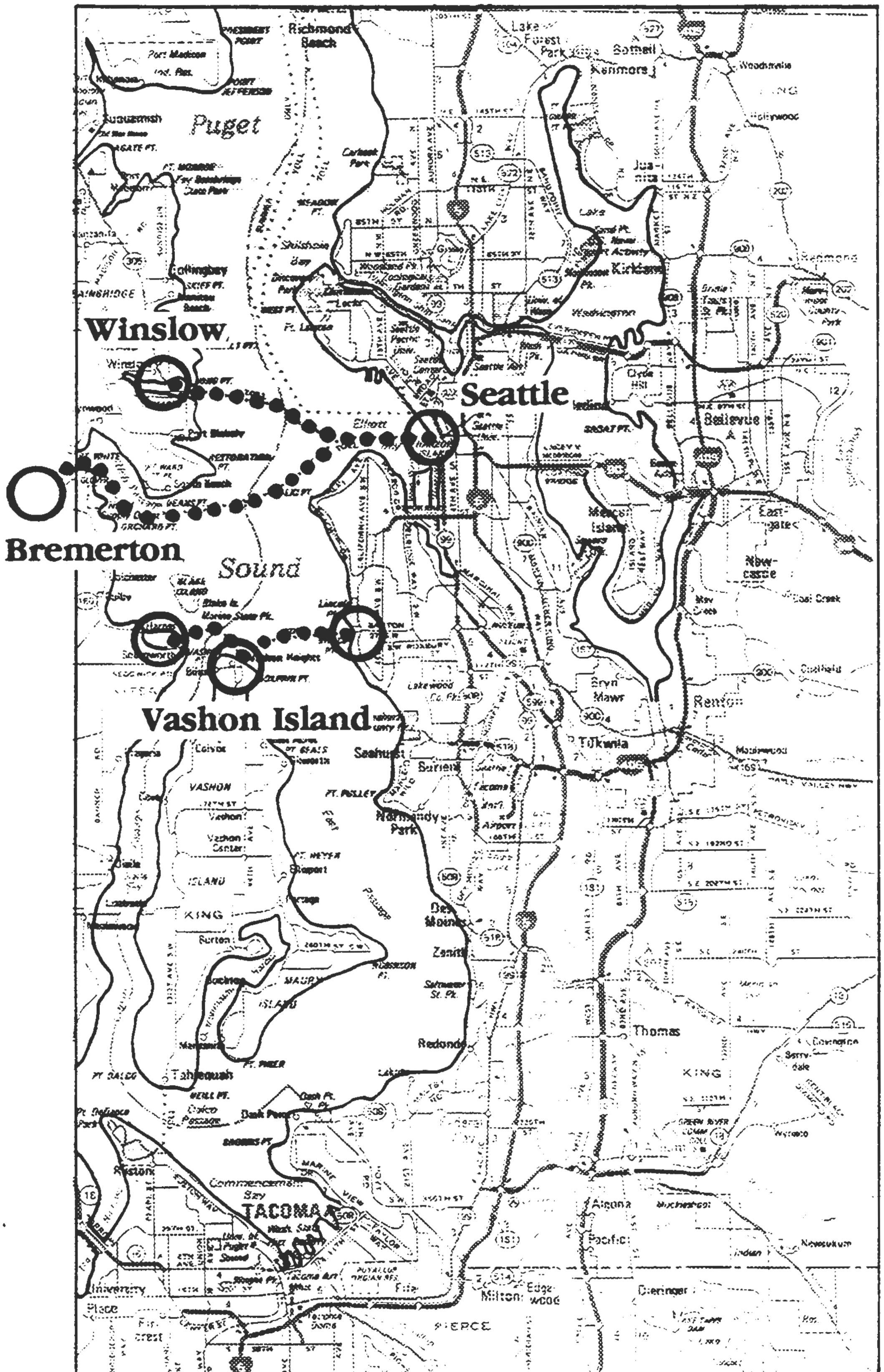
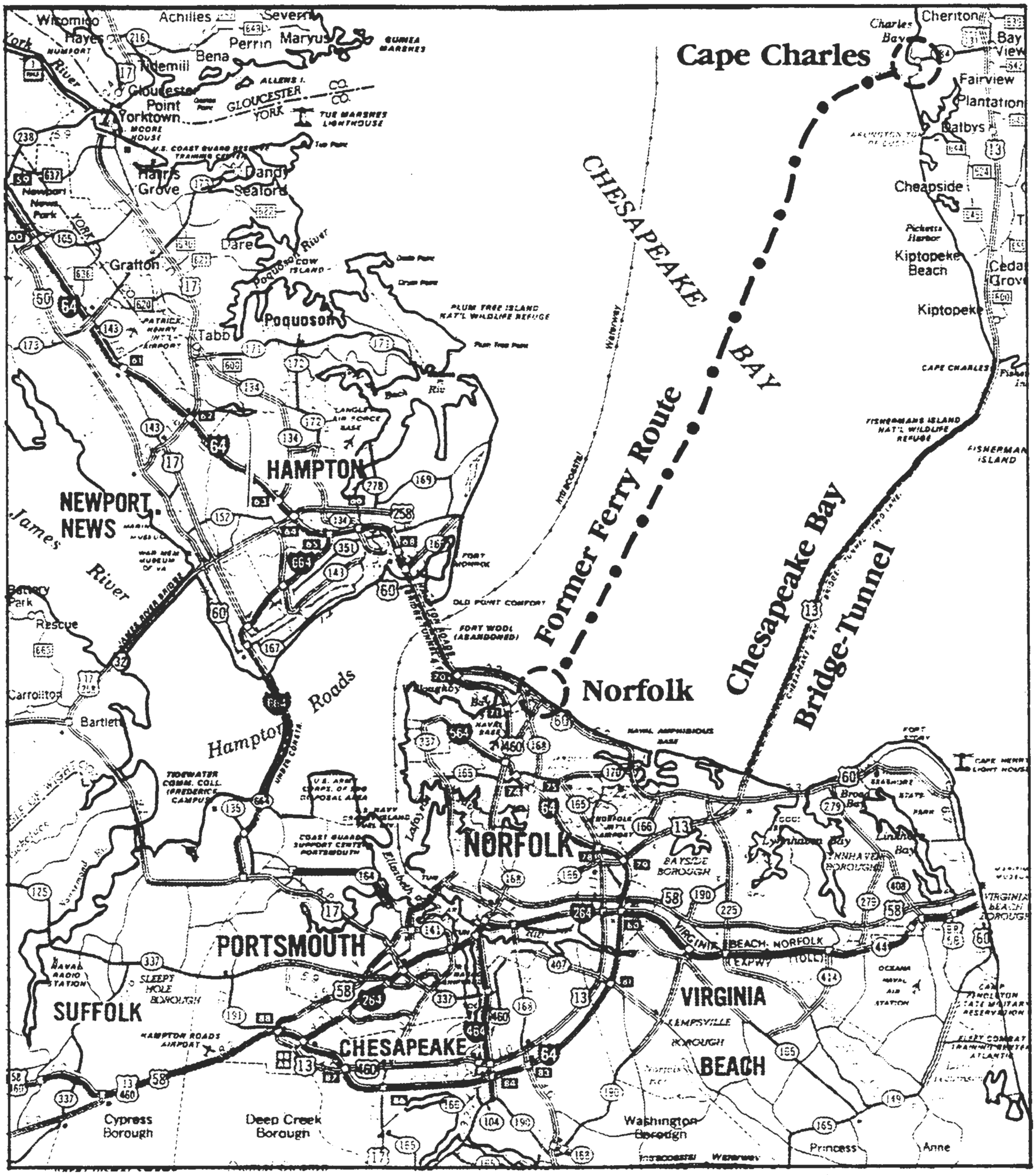


Figure 3.3 - Norfolk to Portsmouth VA

Figure 3.4 - San Diego to Coronado CA (Bridge and Former Ferry Route)

Figure 3.5 - Norfolk to Eastern Shore VA (Bridge/Tunnel/Causeway and Former Ferry Route)



Such a solution would not, for example, be possible across Puget Sound because of excessive depths and tides. The transportation decision was a regional, long term, economic, and political determination. Under today's environmental standards, such an extensive alteration of tidal areas would undoubtedly require much greater scrutiny and might result in a different configuration. One interesting consequence of the Bay Bridge was its contribution to a decision to implement a new ferry system between Lewes, Delaware, and Cape May, New Jersey, since the southern highway link greatly enhanced the possibility of continuing the coastal route along the New Jersey shore. (see the Cape May/Lewes system description which follows)

5. Alaska Marine Highway; (Pacific Ocean and Gulf of Alaska from Seattle to the Aleutian Islands, Figure 3.6) Established in 1960 by a vote of the state residents to support the bonding, the system represents the longest public ferry route in the U.S.. The fleet of 9 ocean going passenger and ro-ro ferries carries over of 410,000 passengers and 110,000 vehicles per year along 3400 miles of coast. The system is similar to the Norwegian coastal ferries and provides year round connections between many coastal cities which have no highway links. The topography and distances along the Alaskan shore make roadway construction alternately infeasible to impossible. Divided into the Southeast and Southwest networks, the system has continued to expand since its inception by adding vessels and routes. The ferry serves as the primary life line for many port communities once served only by commercial shipping. While used in part by tourists, the marine highway provides the primary transportation system for the majority of Alaskans, who are concentrated in coastal communities.

The Marine Highway provides an example of a ferry system as a necessary substitute for a landbased transportation network, serving a coastal area equivalent in length to the entire East Coast (approximately 1600 miles long). While there are some highway segments and rail links, the rugged coastal and inland terrain combined with the fierce winters preclude any statewide highway system. The public funds that might have been spent on road and rail can therefore be invested in much greater proportion for waterbased transportation. The system is also the only publicly operated international ferry. The Southeast route stops in Prince Rupert British Columbia, since it connects with the Canadian highway system providing the most practical northern jumping off point. The long distance system, which for example requires a 3 1/2 day trip from Seattle to Skagway, with its relatively low volume per route, functions because of the small population and relatively light demand.

6. Boston to Hingham; (Boston Harbor, Massachusetts, Figure 3.7) The commuter service between Hingham on Boston's South Shore and the downtown financial district, was begun in 1978 as a private service and expanded in 1984 as a mitigation measure to relieve traffic pressure during the widening and repair of the Southeast Expressway. The intent was to offer a fast and reliable waterbased alternative for residents of the coastal communities and reduce the number of auto commutes during that construction period. The system was operated as a publicly funded, privately operated year round service under the management of the Massachusetts Bay Transportation Authority (MBTA). It attracted enough ridership during the highway construction to warrant continuing the service after the project was complete. The ridership continued to expand during the 1980's and has leveled out at approximately 2400 trips per day. The vessels used are medium speed, low tech passenger ferries with capacities of 149 to 300.

The Hingham-Boston system is a good example of a commuter route in addition to a parallel highway and commuter rail system. The public management/private concession operation of the Hingham system is also an interesting aspect of the route. Characteristically, the system has a dedicated commuter ridership which connects several coastal residential communities with the downtown financial district, and operates at medium volumes. The Hingham ferry route comprises one component of a harbor wide system of commuter and cross harbor shuttle routes. The Boston ferry system is currently being considered for expansion to meet emerging new cross harbor needs, and more particularly to contribute to transit mitigation for the major central artery/third harbor tunnel construction which will accelerate during the 1990's.

7. San Francisco Golden Gate Ferry System; (San Francisco Bay, California, Figure 3.8) The Golden Gate system which connects the downtown (Embarcadero) with Sausalito and Larkspur was established by vote in Marin County as the chosen alternative for addressing increasing commuter travel demands. The publicly operated ferry system was designated instead of county participation in the BART commuter rail program or expansion of the Golden Gate Bridge and commuter bus system. Service commenced in 1970 with a state-of-the-art monohull ferry and fleet which has grown to 4 vessels with capacities varying between 375 and 575. The system has enjoyed immense popularity and also serves an off-peak recreational function in the pleasant year round climate of the Bay Area. The system carries 1.5 million passengers annually with 2 out of 3 as commuters. The Larkspur terminal provides park and ride facilities as well as a feeder bus system. The terminal has helped catalyze a mix of new surrounding development uses.

The Golden Gate system represents an early example of community and regional transportation decision making by selecting waterbased transit over expansion of parallel landbased highways or addition of new commuter rail. The regional public transportation authority management system model is also noteworthy. The system may be characterized as high volume, medium tech by today's standards, intercity, and in the process of considering expansion. The original decisions to select water routes over landbased auto and bus travel 25 years ago appear consistent with current environmental requirements. The expansion of the system will be discussed at greater length with regard to the Vallejo-San Francisco route.

8. San Juan to Old San Juan; (San Juan Harbor, Puerto Rico, Figure 3.9) The San Juan system was completed in 1990 and provides a triangular high-speed catamaran service from the old center of the city across the harbor to Catano, a residential area, and on to the newer commercial district, relieving traffic congestion on the narrow older streets which connect the two areas. The new San Juan Agua Guagua terminal provides parking and bus connections for commuters and visitors headed for old San Juan. The system was publicly funded with UMTA grants and is operated as part of the regional transit system. The vessels are single deck, high speed catamarans accommodating 149 passengers. The low clearance vessel was designed to allow for passage under low clearance bridges which are part of the city street system.

The San Juan system is another recent example of a new ferry route intended to relieve traffic congestion on parallel urban streets. It also offers a new park and ride and bus feeder link for commuters across a harbor, similar to San Francisco and Boston. The system is characteristically high volume, high tech, public transit, and is a relatively new route.

9. Bayshore to Manhattan; (New York Harbor and East River, New Jersey and New York, Figure 3.10) The privately operated Bayshore commuter service provides a 50 minute catamaran route from residential communities in northern Monmouth County to the Wall Street area in lower Manhattan. The service parallels landside highway/bridge/tunnel routes by auto and bus, as well as commuter rail and subway connections. The service carries an average of 900 passengers per

Figure 3.6 - Alaska Marine Highway

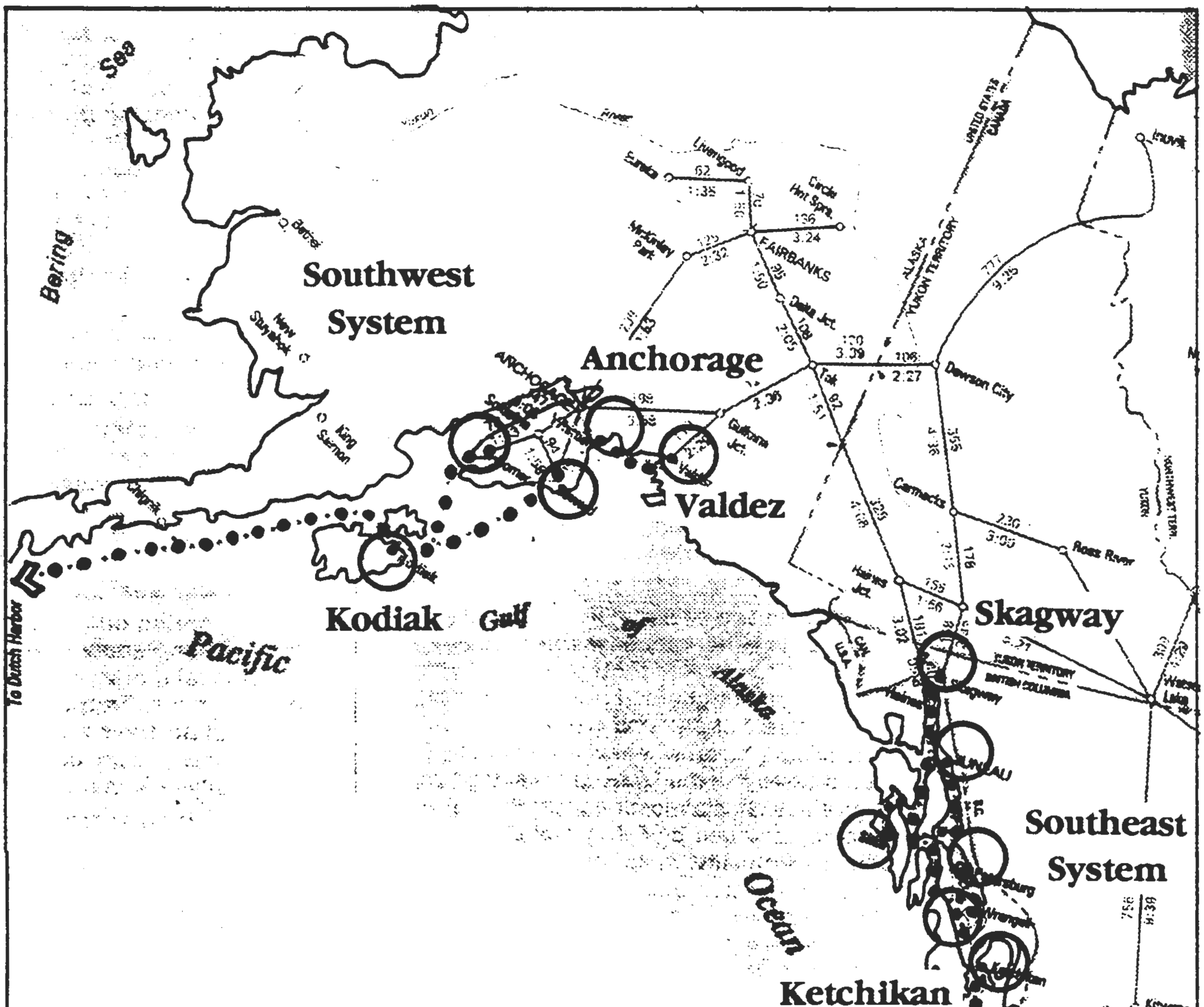


Figure 3.7 - Boston to Hingham MA

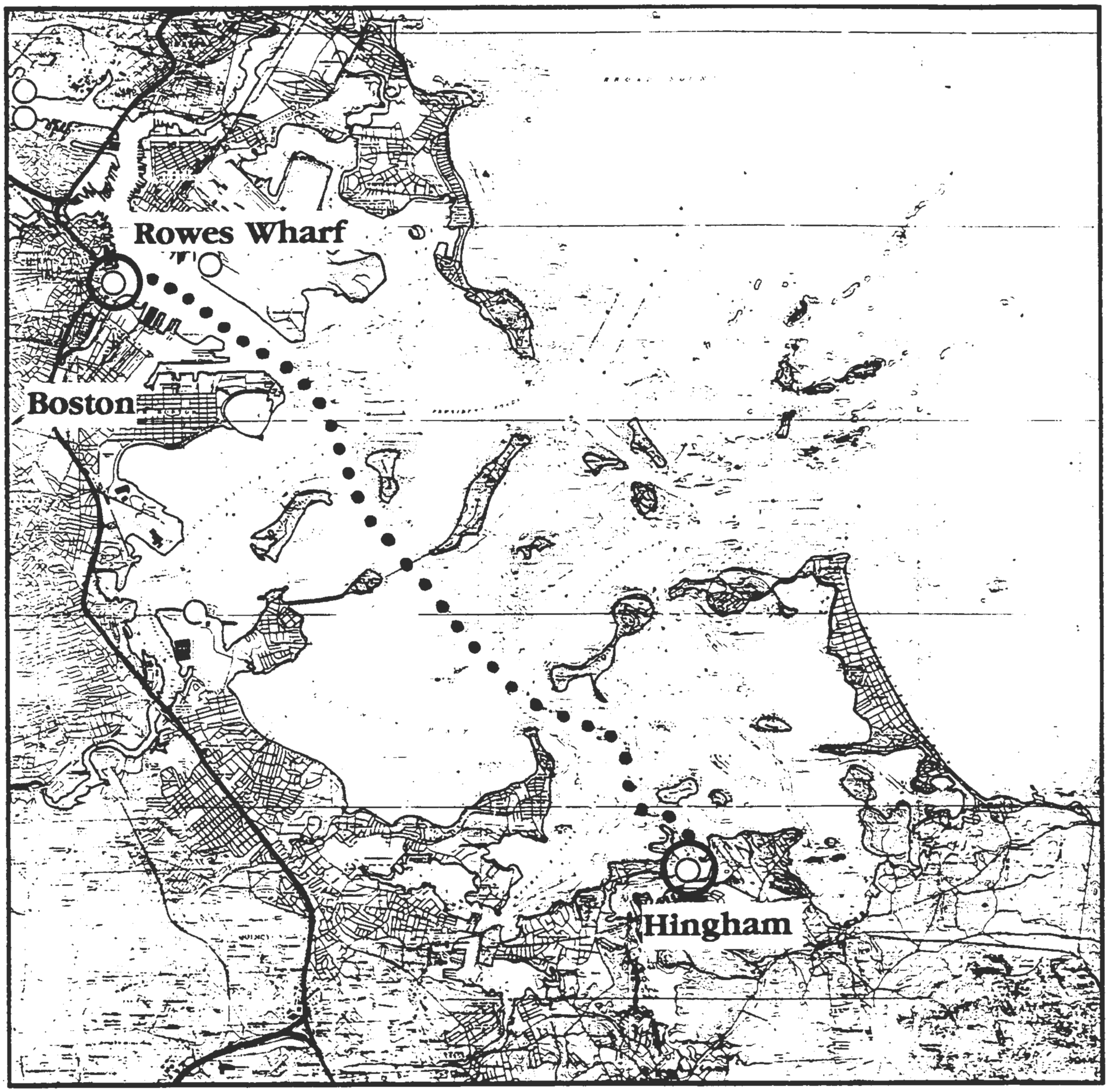


Figure 3.8 - San Francisco, Golden Gate Ferry System CA

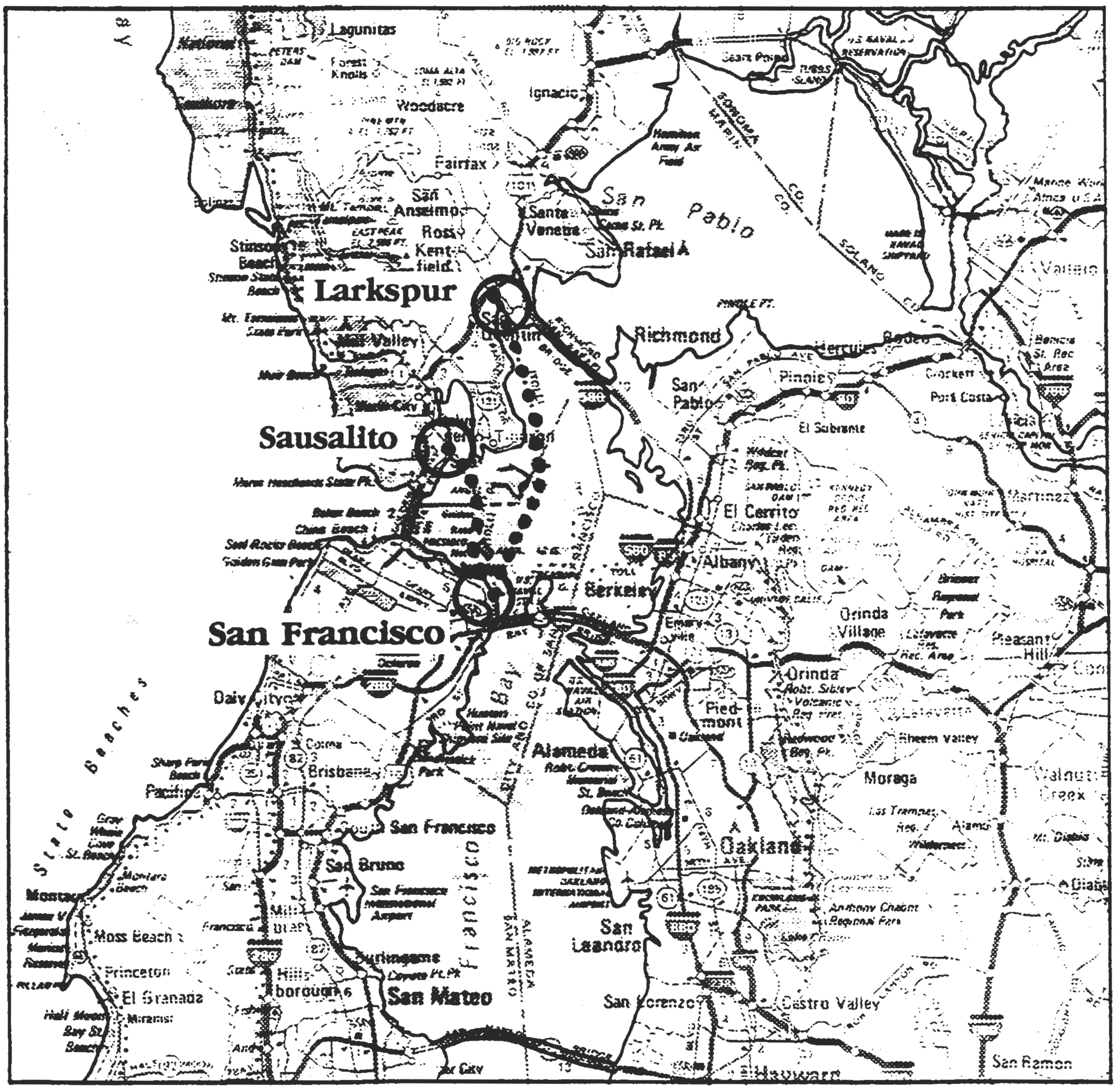
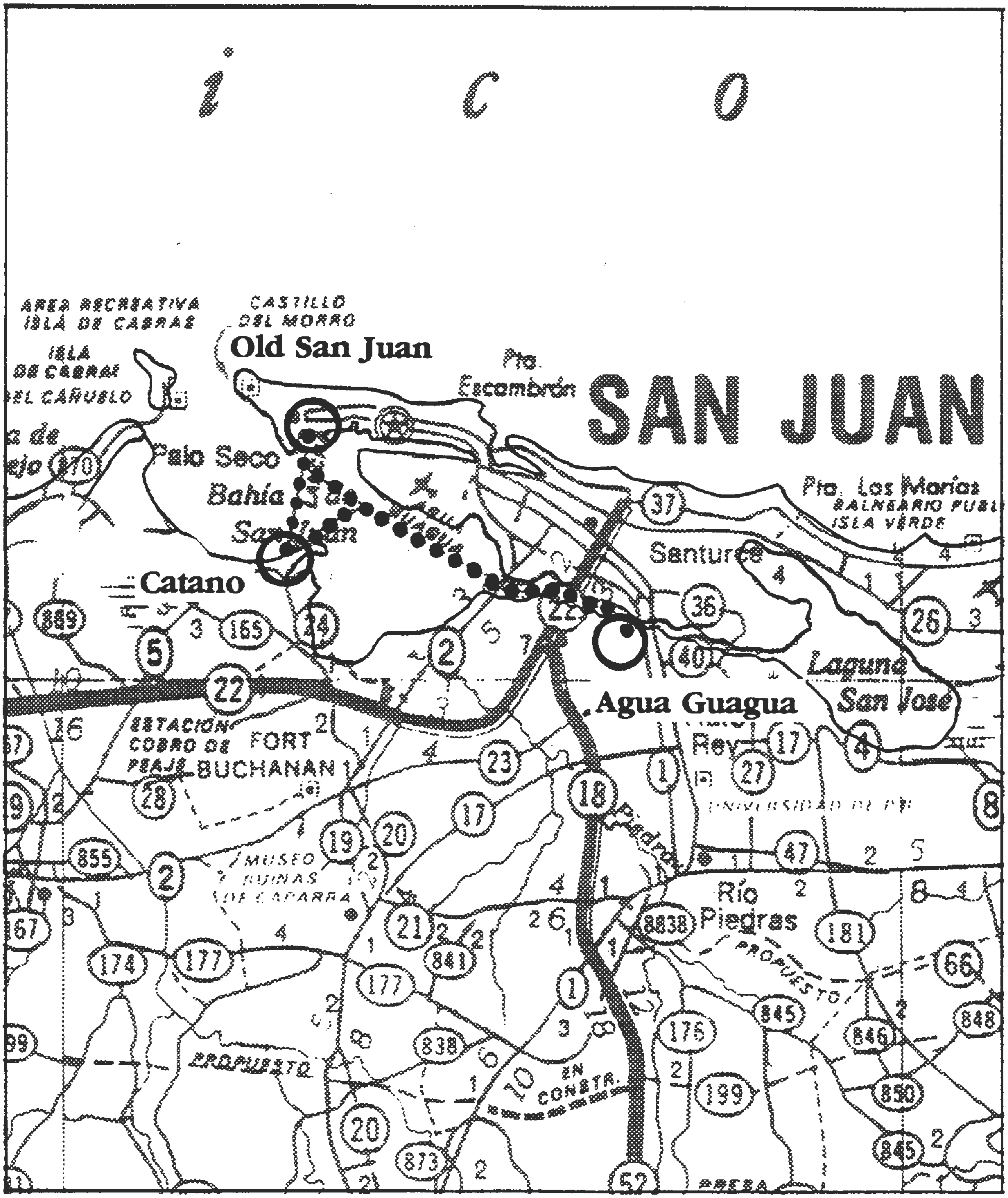


Figure 3.9 - San Juan to Old San Juan PR



day. The private operator uses the vessels for excursion services around New York City during the off-peak hours and on weekends. The service started in 1986 with converted crew boats and evolved into the larger and faster 250 passenger catamarans in use today.

The Bayshore service is currently the only long distance commuter route into New York City and is a good example of how application of new vessel technology can open up new waterbased transportation alternatives to landside options in increasingly congested urban centers. The system operates at medium volume, is privately operated, uses high tech vessels, and is considering expansion in the Bayshore area as well as in other metropolitan New York long distance commuting markets. The system is an interstate operation by a private operator. The Bayshore system should be considered as part of the total expanding New York commuter ferry system.

10. New York Cross Hudson; (Hudson River, New Jersey and New York, Figure 3.11) Cross Hudson ferry service from New Jersey residential communities to Manhattan was reinstated with the Weehawken to midtown (pier 78, 38th Street) in 1986 after a lapse of nearly 20 years. The 3 minute crossing time, with ample parking (1800 spaces) on the Jersey shore allowed commuters to avoid the increasingly congested bridges or tunnels and the high cost of parking in Manhattan. Since the successes of the Weehawken route, several other services have been added providing commuters with alternatives to auto and bus congestion as well as overcrowded PATH transit. The most notable of the other new services has been the Hoboken to Battery Park City in the lower Manhattan Financial District, which utilizes 400 passenger vessels to make the 8 minute crossing, and provides direct connections in Hoboken to PATH and commuter rail. The success of the systems is in part because of the significant increase in Manhattan workers seeking housing in the cities and towns along the Jersey side of the Hudson.

The cross Hudson systems are significant examples of privately operated ferry services being restored in response to user demand for more cost and time effective commutes from home to work. The systems are supported by public investment and maintenance of some of the docking facilities. Both systems described use medium tech vessels equipped with front end loading and unloading to expedite travel time. They are high volume services collectively carrying in excess of 10,000 passengers per day. The routes collectively serve regional transportation objectives by filling niche travel needs and in aggregate relieve overly congested routes. The Port Authority initiated/privately operated Hoboken service coupled with the previously described Bayshore service have served as a model for the New York Transportation Department's recent (1992) request for proposals to greatly expand commuter ferry operations throughout the metropolitan region.

11. Cape Cod to Martha's Vineyard and Nantucket; (Vineyard and Nantucket Sounds, Massachusetts, Figure 3.12) The year round passenger and ro-ro service to the two islands is operated by the Woods Hole, Martha's Vineyard, and Nantucket Steamship Authority, a state established authority with a strictly defined charter to provide a marine highway to the offshore communities. The popularity of the two islands as seasonal recreational destinations allows the Authority to operate profitably with the summer revenues more than offsetting the offseason services which provide the year round residents with their lifeline to the mainland. The service operates from two Cape locations at Woods Hole and Hyannis to Vineyard Haven and Oak Bluffs on the Vineyard and to Nantucket Harbor. While there is no possibility of bridge or tunnel connections to the islands, there is also no desire for such connections by the residents, and even the Authority's actions are often influenced to limit or control access to the islands.

The Cape to Islands service is an example of a limited mandate public authority operation of ferry to island as a highway link. The system uses low tech, high capacity, ocean-going ro-ro vessels to insure year round service in most weather conditions. The system is eligible for and has used federal highway funding for capital improvements. The system has upgraded facilities and gradually added to its passenger and freight fleet but has no immediate plans for expansion. There has, however, been pressure from several mainland communities to establish additional boarding locations off the Cape and add routes to relieve congestion in Falmouth and Hyannis, raising questions regarding regional transportation planning.

12. Portland to Casco Bay Islands; (Casco Bay, Maine, Figure 3.13) The year round passenger and separate ro-ro system connects 6 islands in Casco Bay to a new intermodal terminal in downtown Portland. The system functions as the basic transportation link for island residents seven days a week year round with a fleet of passenger vessels and on demand ro-ro service for vehicles. During the summer months the services expand to accommodate the island visitors and vacation home owners. As is the case with other services to islands with a mixture of year round and seasonal residents, the high season ferry operations balance off the low season ridership. The trip distances vary from 2 1/2 miles to Peaks Island to 10 miles to Cliff Island, and the corresponding trip times including loading are from 20 to 50 minutes. Of the 600,000 annual riders, approximately 360,000 are between June and September during the short Maine tourist season. The 4 passenger vessels and 2 roll-on roll-off vehicle ferries are designed to operate in the wide range of weather, tide, and sea conditions experienced in Casco Bay. Of the islands, only the nearest one, Peaks, could be considered remotely feasible for a bridge or tunnel connection. However, with its relatively small size, and devoted island population, no recent considerations have been given to linking across the main deep water shipping channel into the Port of Portland.

The Casco Bay ferry system is an interesting example of a city to island service which serves as a commuter and basic transportation connection year round with an expanded tourism function a seasonal basis. The summer revenues from the added ridership as well as from excursion operations during off-peak periods help offset the losses incurred during the less intensive months from September to May. The system is the oldest continuously operated daily system in the U.S. dating back to 1871. The efficient Intermodal Terminal completed in 1988 includes a bus loading and holding area, a parking garage, a mail facility, and separate passenger and vehicle loading areas. The management system, Casco Bay Lines, under the original charter from the State Legislature is separate from the Maine Ferry System, and represents an example of an unusual public/private hybrid.

13. Boston to Logan Airport; (Boston Harbor, Massachusetts, Figure 3.14) Ferry service from Logan Airport to the downtown financial district in Boston is provided year round by the Airport water Shuttle. The 10 minute ride across the Boston Inner Harbor provides a pleasant alternative to the Callahan Tunnel and to the Blue Line of the transit system. The service was started by the Massachusetts Port Authority (MassPort) as an experimental effort to reduce auto trips to the airport through the adjacent residential area of East Boston. The ferry now carries over 200,000 passengers a year, with vessels leaving every 15 minutes. It is connected to the airport terminals by shuttle bus and is within a short walk of most downtown destinations on the Boston side. The Boston terminal at Rowes Wharf connects passengers with the commuter ferry to Hingham on the south shore. The shuttle is managed by the Rowes Wharf Company with financial assistance from MassPort.

Figure 3.10 - Bayshore NJ to Manhattan NY

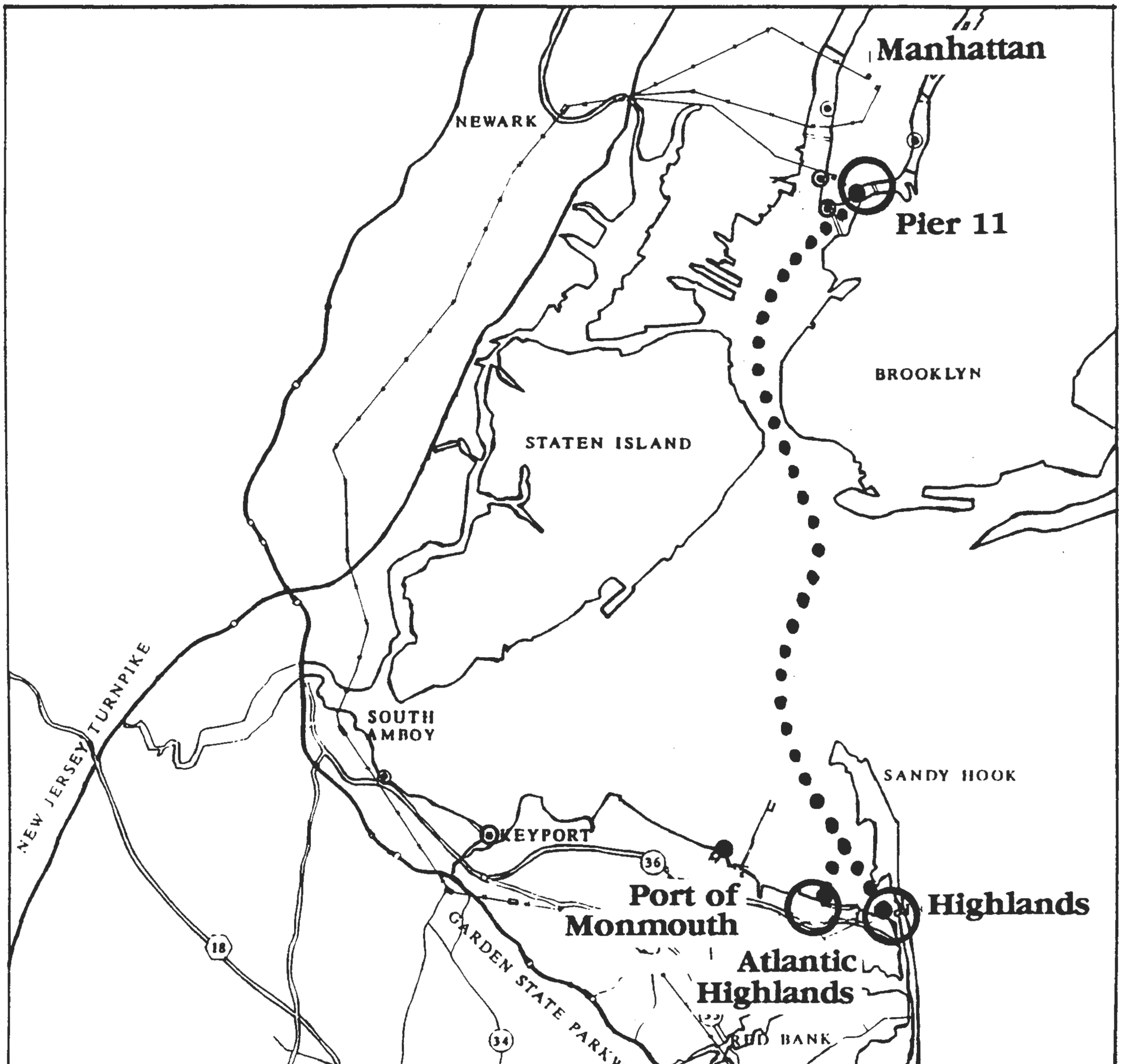


Figure 3.11 - New Jersey Cross-Hudson to Manhattan NY

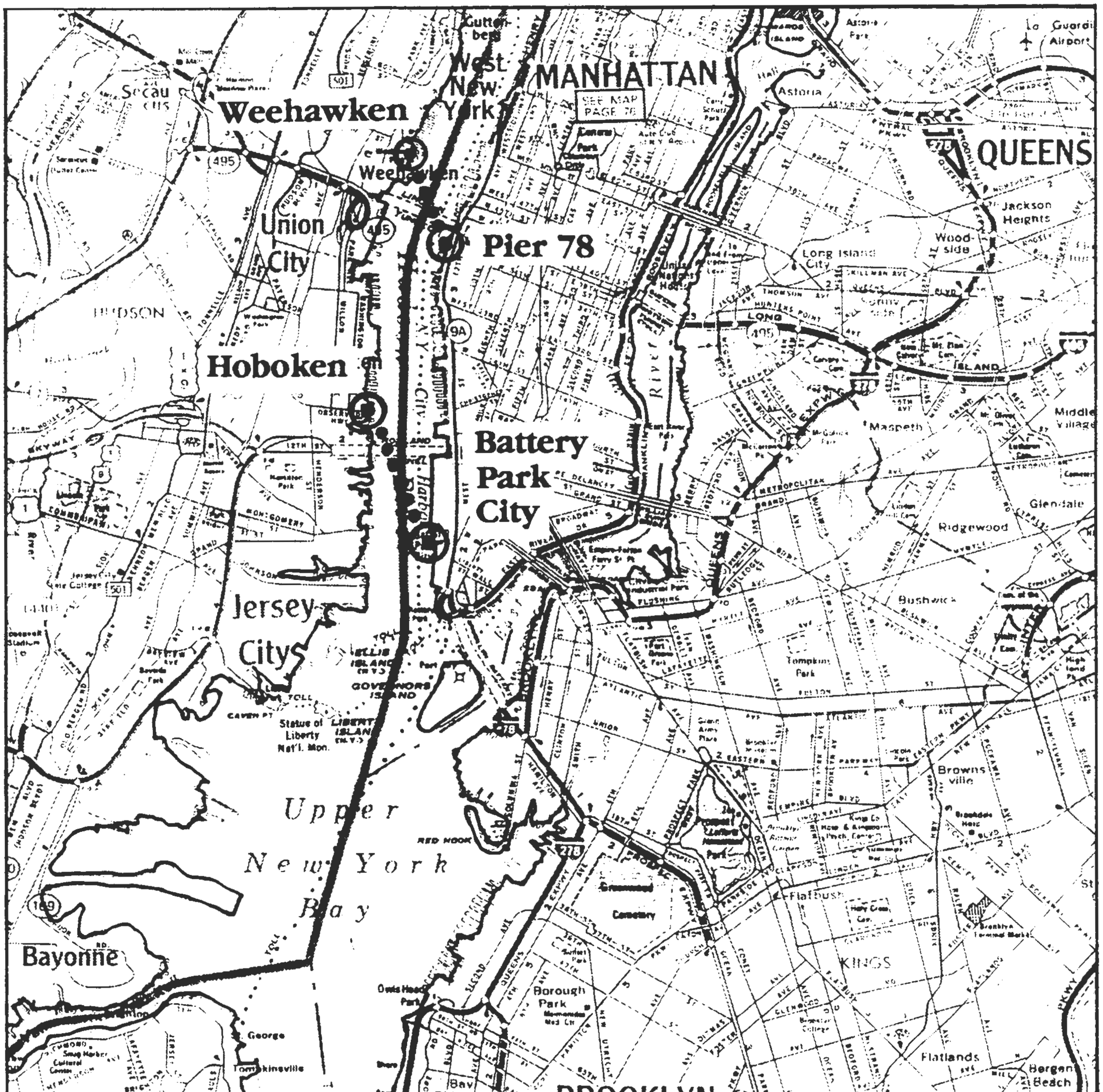


Figure 3.12 - Cape Cod to Martha's Vineyard and Nantucket MA

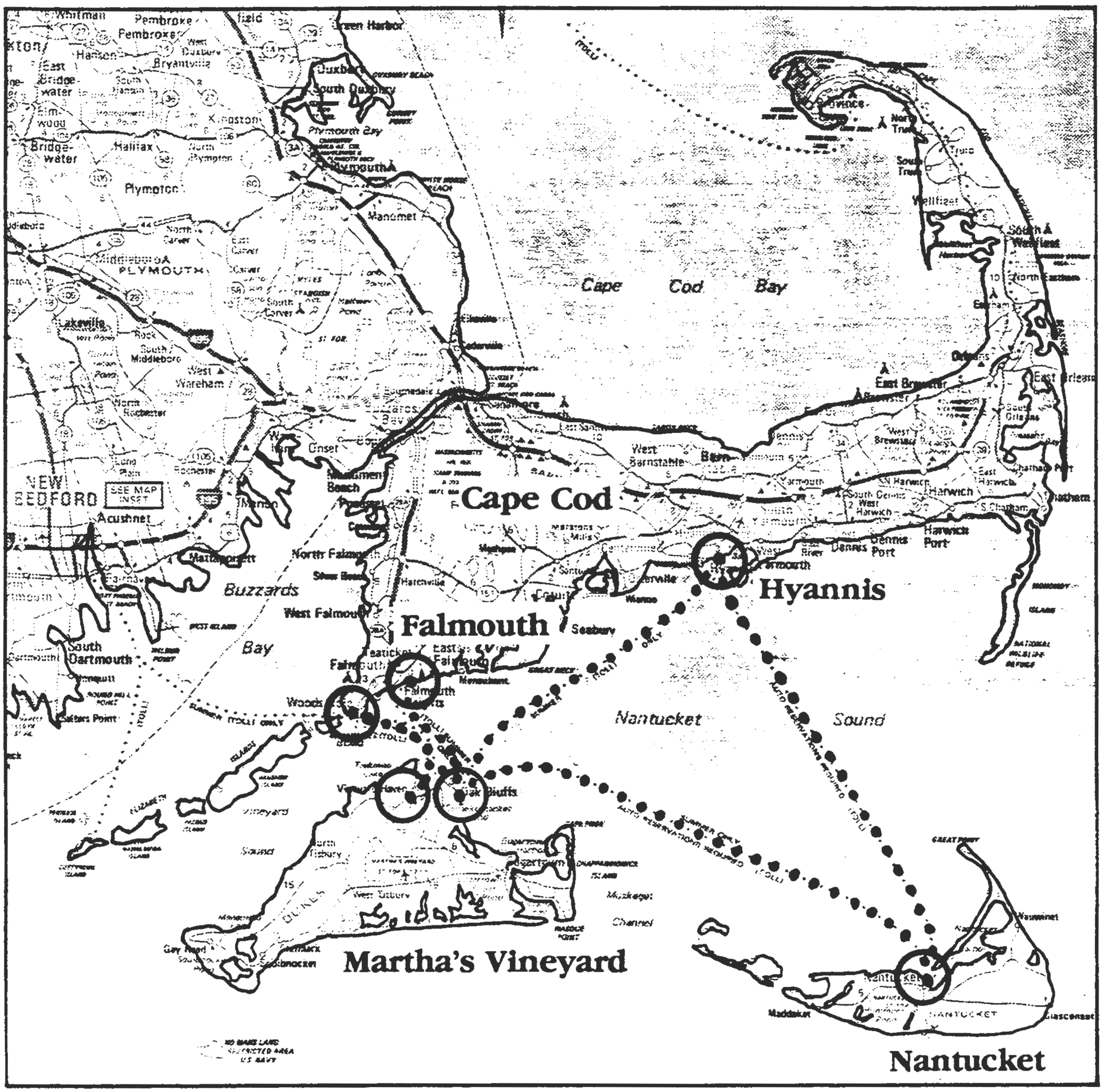


Figure 3.13 - Portland to Casco Bay Islands ME

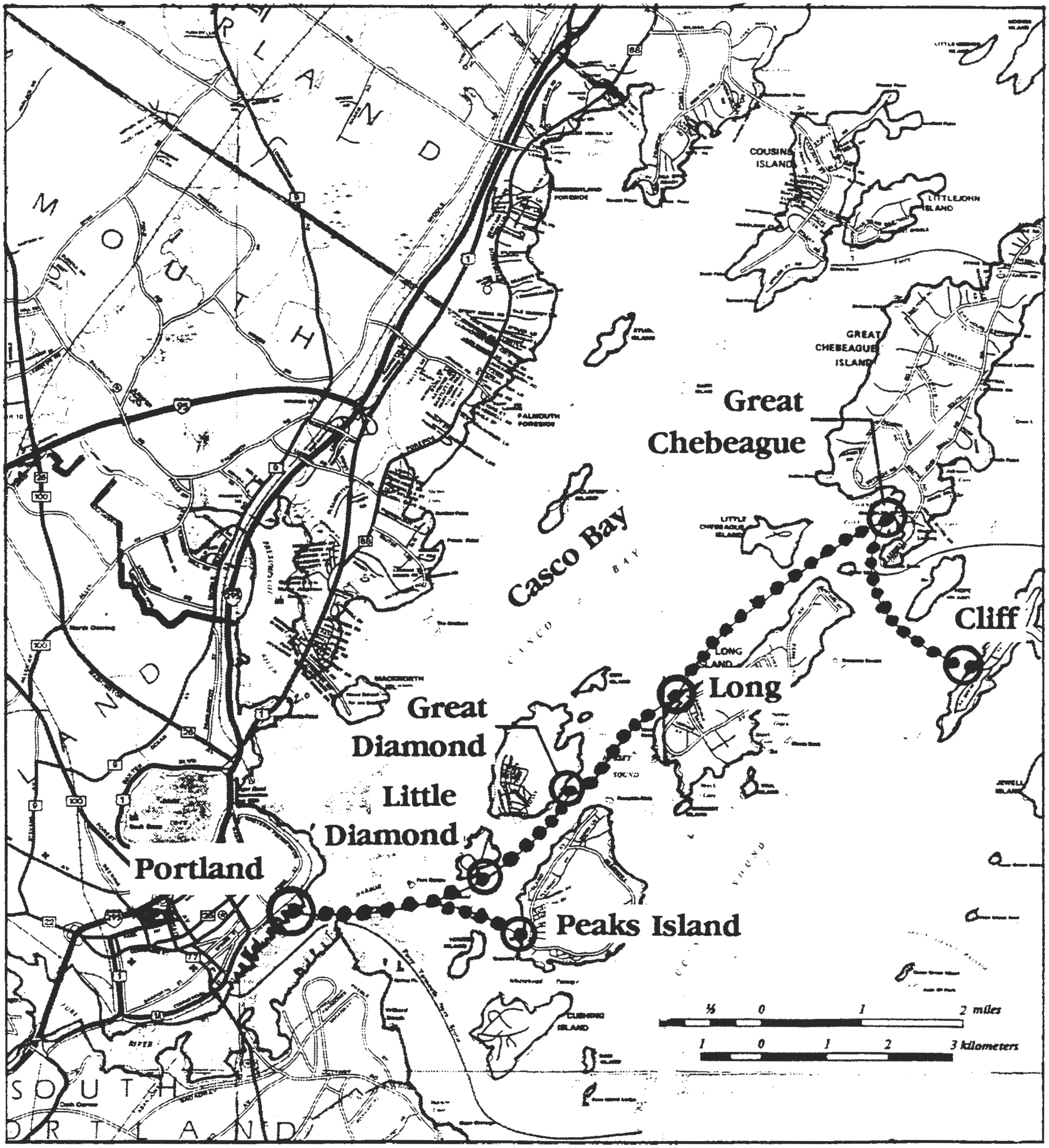
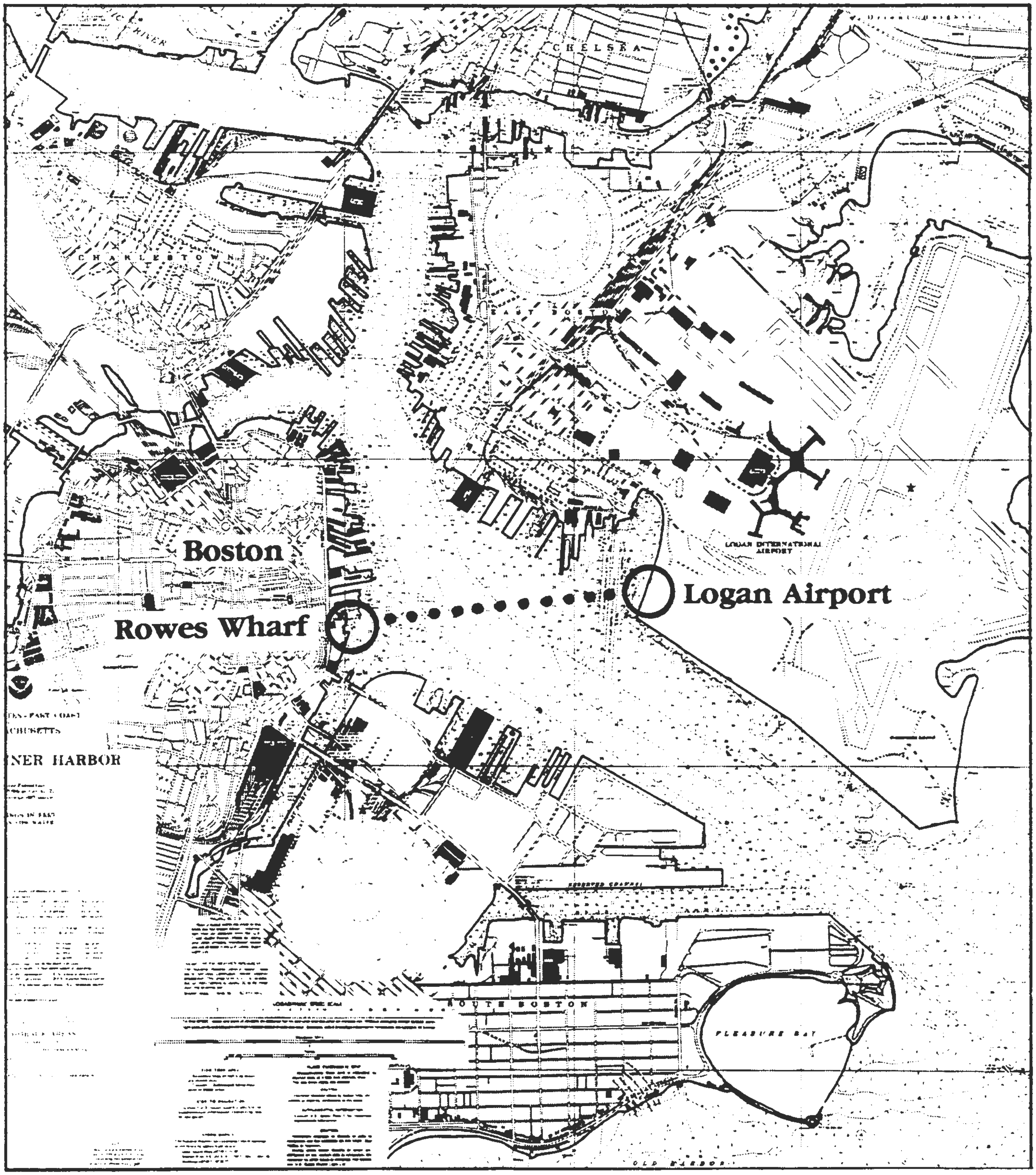


Figure 3.14 - Logan Airport to Rowes Wharf, Boston MA



The Logan Airport Water Shuttle has demonstrated that there are water transit services which can fill a niche despite parallel auto and transit links. The shuttle appeals primarily to business travellers and visitors as an efficient and enjoyable route for arriving and departing from downtown Boston. It has fulfilled its original intention as one component of a larger strategy by MassPort to discourage auto trips to the airport and achieve the parking limits set. The shuttle will have an expanded role in the short term as a new hotel opens at the airport terminal, and in the longer term as new routes are added to other downtown destinations. The vessels used are low tech, attractively converted crew boats, and carry 40 passengers each.

14. San Juan Islands; (Strait of Georgia, Washington, Figure 3.15) The San Juan Islands are located in the straits between Anacortes, Washington, and Vancouver Island, British Columbia. Service to the islands was started by the Washington State Ferries in 1951. Originating in Anacortes, the passenger and vehicle ferries serve the four San Juan Islands,Lopez, Shaw, Orcas, and San Juan (Friday Harbor). The variety of routes serve the year round residents as their primary transportation link to the mainland, and also serve the influx of tourists and visitors during the summer months. One of the routes connects Anacortes to Victoria BC through the San Juan Islands with a stop in Friday Harbor. The combined services from anacortes to the Islands carry nearly 800,000 passengers per year. No serious attempts have been made to bridge or tunnel the deep straits separating the islands from the mainland, nor is there any inclination to do so by islanders.

The San Juan Islands ferry services are an example of an efficiently operated state system providing ferry links in lieu of highway connections. The island economy has evolved from a sustaining agricultural and aquacultural base to tourism in the past 30 years. Owing in large part to the remarkable geography of the setting, the ferry system takes on a festive role as it hops from island to island through the picturesque thoroughfares, adding to the experience of island life for tourist and islander alike. The vessel technology is that of the characteristicly the low speed, high capacity and seagoing nature associated with such year round ro-ro operations.

15. New London to Long Island; (Long Island Sound, Connecticut and New York, Figure 3.16) The privately operated, year round service runs across Long Island Sound from New London CT to Orient Point LI,NY, carrying passengers, vehicles and freight in varying quantities depending on the season. Orient Point is at the northeastern tip of Long Island and connects by highway to western Long Island and New York City, or by two ferry routes via Shelter Island to the Hamptons and southeastern Long Island. As such the 1 1/2 hour trip across the Sound provides a link in the coastal highway system for travelers and freight carriers with destinations on Long Island. During the summer and fall months the service is used predominantly by auto tourists and daytrippers, and during the winter and spring by island residents and truckers serving the farmlands and towns along the north side of Long Island. The routes are served by 4 ro-ro vessels the largest of which carries 1000 passengers and 100 vehicles.

The New London to Long Island service is noteworthy for several reasons. It provides an important ro-ro highway link which is a long running (50 Years), privately operated service (Cross Sound Ferry Services). The service is an interstate operation without subsidy from the states or federal government. The mixture of functions the ferry serves is similar to many island services. The heavy volume of service during the summer and fall months cross subsidizes the off-season, when scheduled operations are cut back, and serve predominantly freight and business vehicles. The variety of low tech ro-ro vessels are built to operate in exposed seas and all weather conditions.

16. Cape May to Lewes; (Mouth of the Delaware River, New Jersey and Delaware, Figure 3.17) The passenger and ro-ro service operating between the small resort towns of Lewes DE and Cape May NJ was started in 1964 after many years of planning by interests on both sides of Delaware Bay. The crossing takes 1 hour and 10 minutes across the exposed mouth of the bay. The year round operations are served by 5 double ended, shallow draft ferries. The publicly run ferry system is operated by the Delaware River and Bay Authority, which also runs the Delaware Memorial Bridge. From its inception the ferry system has been planned, financed and operated in conjunction with the Memorial Bridge. The system was intended from the beginning to provide a link in the New England to Florida coastal route by connecting the Garden State Parkway to the Delmarva Peninsula and with the Chesapeake Bay Bridge-Tunnel to Norfolk VA and points south. In fact the Bridge-Tunnel opening in 1964 coincided with the start-up of the ferry service which was able to purchase and operate the former Norfolk to Cape Charles vessels.

The Cape May - Lewes Ferry is a prime example of a ro-ro highway link which was the result of deliberate long range regional planning. The creation of a new coastal route from Norfolk to the New Jersey, was conceived to provide a basic transportation link as well as to serve as a catalyst for tourism and development in a 4 state area. The benefits of this unusually large scale and long range plan are being realized incrementally some 30 years after the system opened. The system is well-managed, family oriented and has become a tourist attraction itself. In 1990 the ferries carried over 1.1 million passengers and 375,000 vehicles.

17. North Carolina to Cape Hatteras National Seashore; (Pamlico Sound, North Carolina, Figure 3.18) The ferry service connects the mainland of North Carolina across Pamlico Sound to the Outer Banks. The system consists of series of inter-connecting links which allow travel from the north end of the Cape Hatteras National Seashore along the barrier islands and back to two mainland towns. Ferry services connect Okracoke Island to the mainland from Cedar Island (NC 40) and Swan Quarter (US 264). A free ferry link connects Okracoke Island to Hatteras across Hatteras Inlet, completing the highway link which proceeds northward on Route 12 to Route 258 at Nags Head and back to the mainland across Currituck Sound. The complete linking system has been intact since 1960. The earliest ferry to the outer banks was started in 1932 from Wanchese on Roanoke Island to Rodanthe on Hatteras Island and ran until 1963 when it was made obsolete by the H.C.Bonner Bridge. The system is operated by the Ferry Division of the state highway department.

The Outer Banks ferry system is another example of a ro-ro highway link, created to provide continuous access from the north end of Cape Hatteras along the banks and back to the mainland. However, the system is also noteworthy because the ferry links across Pamlico Sound actually serve to control the flow of visitors to the outermost and most environmentally sensitive of the fragile barrier islands. The alternative of building a chain of bridges from south to north would have provided more capacity for visitation to Cape Hatteras and would have attracted far greater numbers of through travellers. Therefore the ferry link can be regarded as a traffic and development moderating device for the National Seashore visitors, and through state operation of the system offers an effective control mechanism. The ferries serve predominantly a tourism function with a smaller volume but more essential service component as general transportation for the year round island fishing village residents.

18. Burlington to Fort Kent; (Lake Champlain, Vermont and New York, Figure 3.19) The 12 mile ro-ro ferry route connects Burlington VT to Fort Kent NY across Lake Champlain. The crossing saves the passengers an 85 mile drive around either end of the 108 mile long lake. The

Figure 3.15 - Anacortes WA to San Juan Islands to Victoria BC

Figure 3.16 - New London CT to Long Island NY

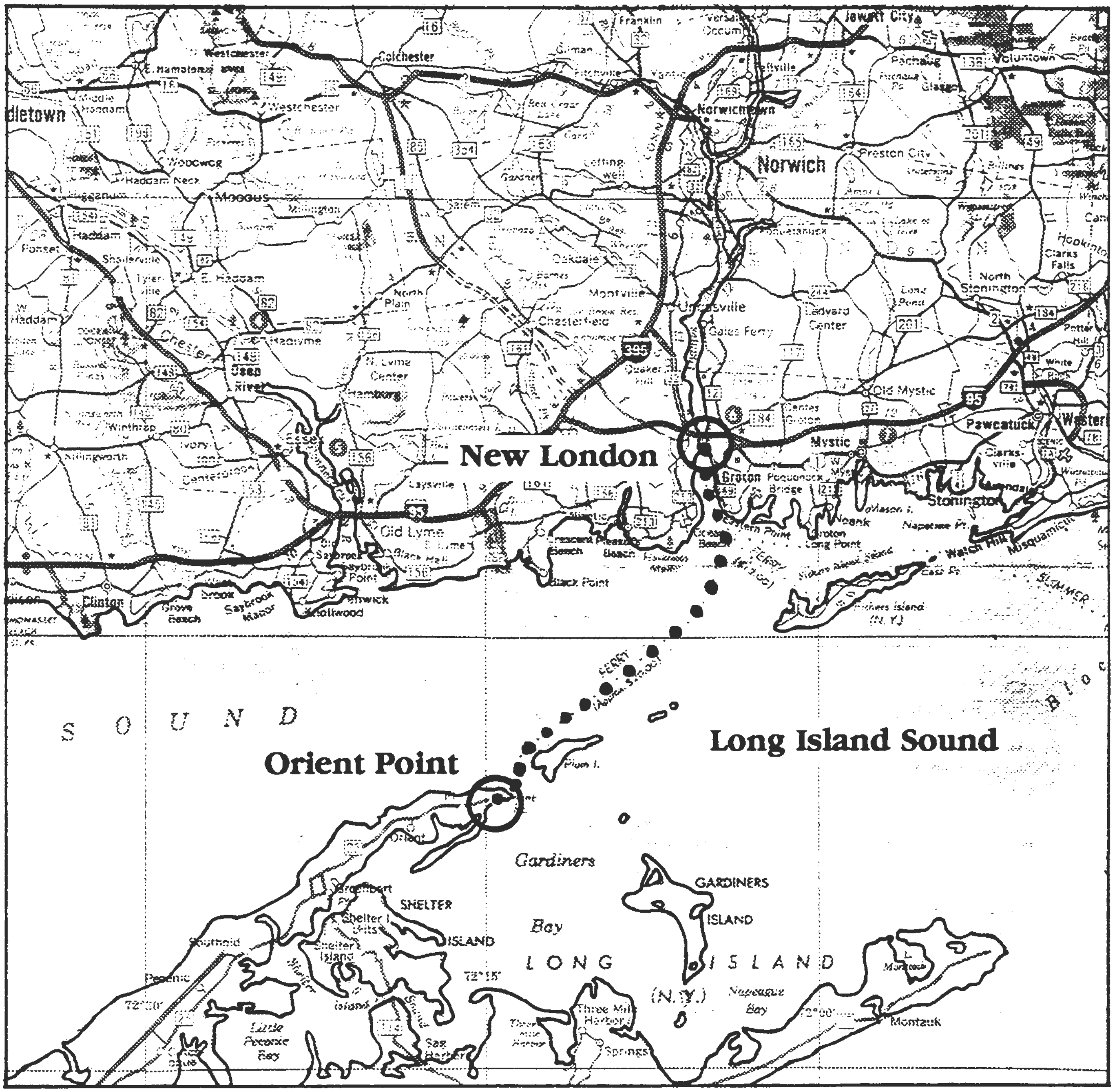


Figure 3.17 - Cape May NJ to Lewes DE

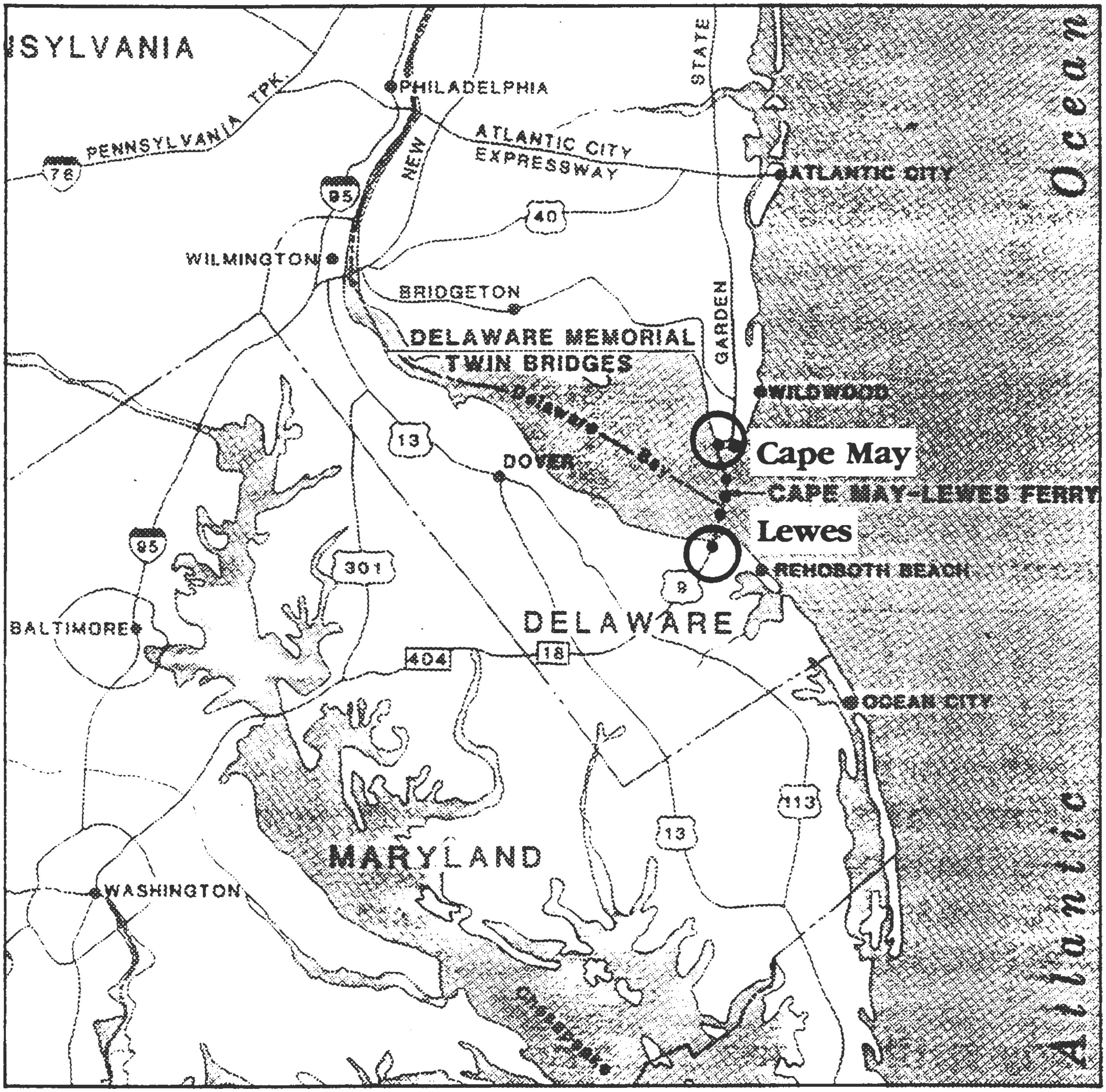


Figure 3.18 - North Carolina to Cape Hatteras

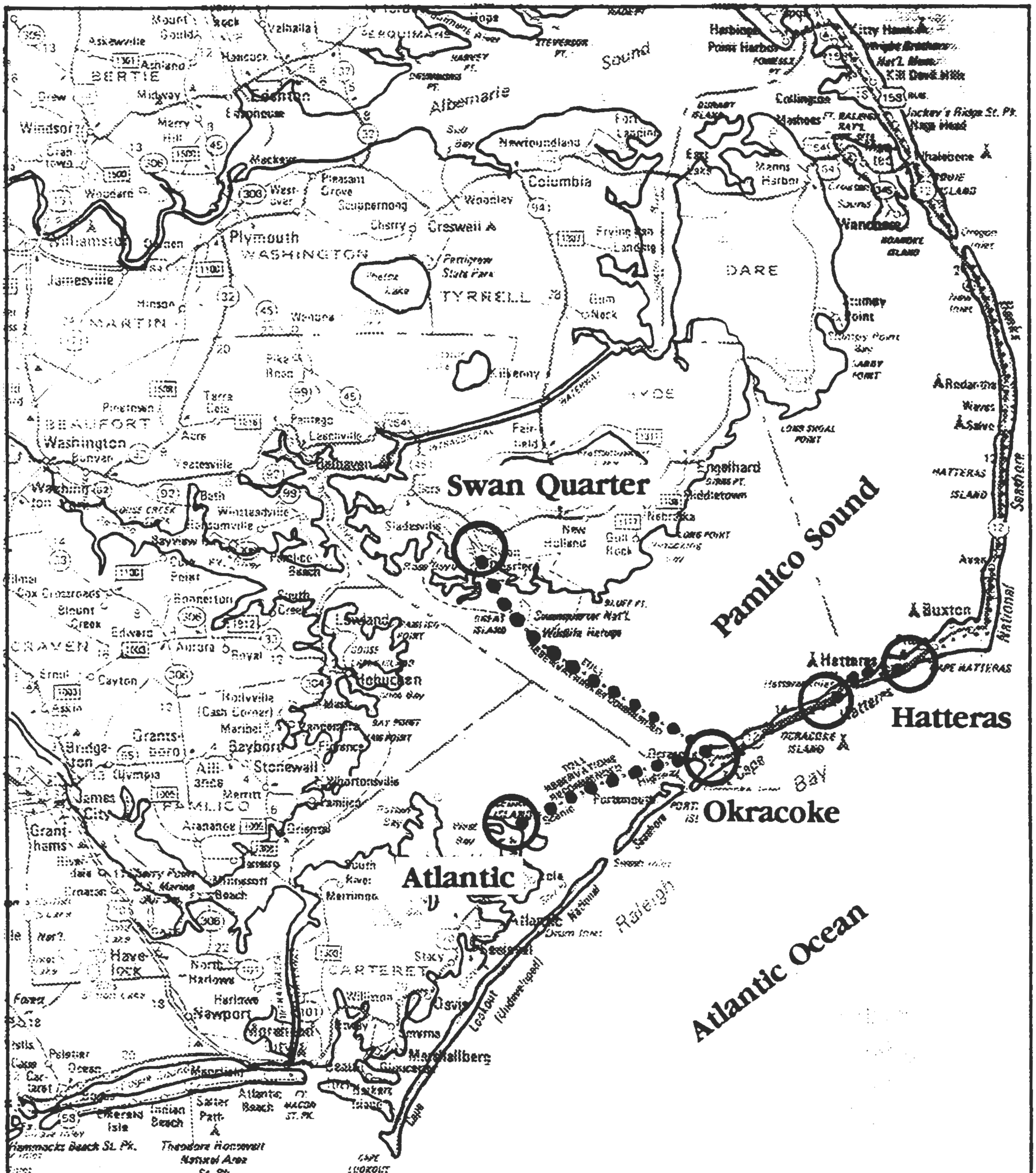
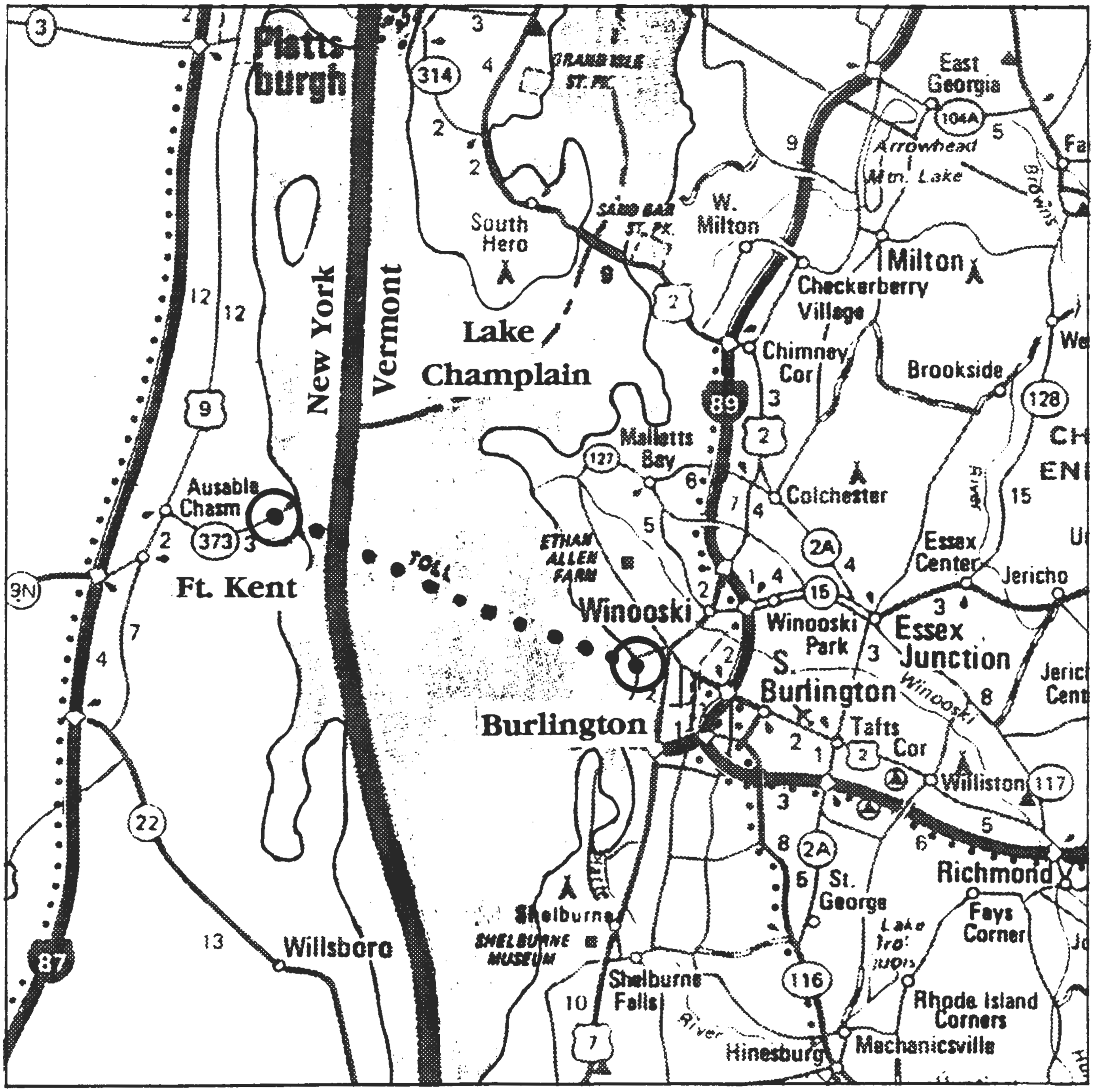


Figure 3.19 - Burlington VT to Ft.Kent NY



privately managed service has been in operation in one form or another since 1825. The route connects Burlington and I-89 to Ft. Kent and the Adirondacks in New York. The route is served by 4 double-ended passenger ferries, which range in age from 46 to 80 years. The operations are seasonal from May to October and are used predominantly for recreational travel.

The Lake Champlain ferry service is an example of one of the longest running ro-ro marine highway links in the U.S. The two major north-south Interstate highways which have been built on either side connecting from Boston and New York to Montreal have diminished the use of the ferry connection as a trade route. However, the heavy influx of summer and fall tourists and vacationers is a significant économic factor in the region and the ferry system plays an important role both as a short route across the lake as well as an excursion activity itself.

19. Long Island to Fire Island; (Great South Bay, New York, Figure 3.20) Fire Island National Seashore and a dozen of the small residential communities along the slender barrier island are connected to Long Island and the greater New York metropolitan area by a fleet of privately operated passenger and supply ferries. One operator, Fire Island Ferries,Inc., with 15 vessels services nearly 60% of the annual 1.4 million visitors to the island. "Mainland" Long Island towns serve as departure points and include Bay Shore, Sayville, and Patchogue. The operations are seasonal from March to September. Other ferry services and privately owned power boats provide the remainder of the visitor transportation.

The Fire Island ferries collectively constitute the primary transportation system for the 17 separate communities on the island. The 32 mile long sand island has no continuous linear road system between towns making the ferry links effectively the only public travel connections. The fragile barrier island seems to have achieved a balance between the sensitive environmental constraints of the National Seashore area and the visiting population permitted by the ferry system and the limited accommodations in the towns.

20. Port Clinton/Catawba Point to Put-In-Bay; (Lake Erie, Ohio, Figure 3.21) Put-in-Bay on South Bass Island in western Lake Erie is connected to Port Clinton and Catawba Point on the Ohio shore by two seasonal ferry services catering to vacationers. The longer Port Clinton route provides a high speed passenger service via jet-powered catamaran operated by the Put-in-Bay Boat Line and makes the 12 mile trip in 25 minutes. The shorter Catawba route provides ro-ro vehicle service at a slower speed and makes the 5 mile trip in 20 minutes. Put-in-Bay is located along a portion of Ohio's Lake Erie shore noted as its Vacationland between Cleveland and Toledo. The Victorian town and other family recreational attractions draw hundreds of thousands of visitors to one of the few islands in Lake Erie. The high speed catamarans were introduced in 1989 and have proven to be a success for day-trippers and passengers not needing their vehicles on island.

The privately operated competing services to Put-in-Bay demonstrate how new technologies can be successfully introduced in a competitive water transportation market even when the season is short. The combined passenger and vehicle ferry services are characteristic of island tourism routes which are necessary for the economic survival of the small year round population (400). No viable road, tunnel or bridge options exist for the Bass Islands.The predominantly seasonal use may be attributed to their remoteness from urban areas combined with the icing from severe lake winters.

21. Staten Island to Manhattan; (New York Harbor and Hudson River, New York, Figure 3.22)

The Staten Island ferry carries over 20 million passengers a year, and remains the best known and heaviest traveled single route in the U.S. The charter for a ferry service between Staten Island and Manhattan dates back to 1712, and the demand seems to have increased steadily despite the addition of bridges and tunnels providing alternative routes. The publicly operated vehicle and passenger ferry contributes significantly to the New York City transit system because of the large numbers of commuters carried, with some vessels accommodating up to 6,000 passengers. The crossing time is 25 minutes on the traditional older technology double-ended vessels.

The Staten Island Ferry is noteworthy in many respects because it operates on a different scale than other routes in the U.S. The issues of passenger loading and unloading are of primary importance when each ferry is handling up to 6,000 passengers. The intermodal connections of the system are also important with the subway connections at the Battery terminal and the bus and park and ride options at the Staten Island terminus. With the reconstruction of the Manhattan terminal during the next few years, more opportunities will arise to further improve the already efficient process of loading and off-loading of riders. The system is also a prime example of combining commuter and tourism functions, commonly associated with ferry routes in busy urban harbors, and assisted by the lower fares often found in publicly operated and subsidized operations.

22. Mississippi River Bridge Authority Ferry System; (Mississippi River, Louisiana and Mississippi, Figure 3.23) The lower Mississippi River is crossed by a number of vehicle ferry routes which connect various communities and work destinations. The ferries serve as road and highway linkages, many of which have been in operation for more than a century. The New Orleans ferries to Gretna and Algiers, and the Algiers to Chalmette have survived as high capacity vehicle and passenger routes serving commuters work trips despite the construction of the I-10 bridge across the Mississippi. The routes upriver and down river from New Orleans provide links in lieu of bridges, and save motorists long trips and substantial numbers of VMTs. The upriver routes include: New Roads-St.Francisville north of Baton Rouge; Plaquemine, White Castle-Carville, Lutcher-Vacherie, and Edgard-Reserve south of Baton Rouge. The downriver routes south of New Orleans include Belle Chasse-Scarsdale, and Pointe a la Hache-West Pointe a la Hache. The Angola Penitentiary ferry is unique in that it is open only to prison employees and helps keep the correctional facility isolated. Most of the routes are state operated by the Mississippi River Bridge Authority, with several run by the local parish governments.

The lower Mississippi ferry systems serve as good examples of how traditional ferry connections have been maintained and have allowed for fewer bridges to be built along the wide and heavily used river. Because the residential densities are generally low in this region of agricultural and river related industry, and because there is limited east-west Interstate traffic (I-10 and I-12), the capacity of the ferry systems seems to meet the needs. In a sense the Mississippi River is still the main transportation corridor and the cross river links are secondary. The free or low cost fare structure helps reinforce the sense that the ferries are extensions of the state road network.

23. Newport and Point Judith to Block Island; (Atlantic Ocean and Narragansett Bay, Rhode Island, Figure 3.24) Block Island is connected to the mainland by a privately operated passenger and vehicle ferry system, with connections to Pt.Judith and Newport on the Rhode Island shore. Although the island tourism business is largely seasonal, the ferry service operates year round to serve the permanent island population. The vessels are ocean going since Block Island is in the Atlantic. The trips take 1 hour and 15 minutes from Pt. Judith, or 2 hours from Newport. With the immense build up in traffic in Newport during the summer season, only passenger service

Figure 3.20 - Long Island to Fire Island NY

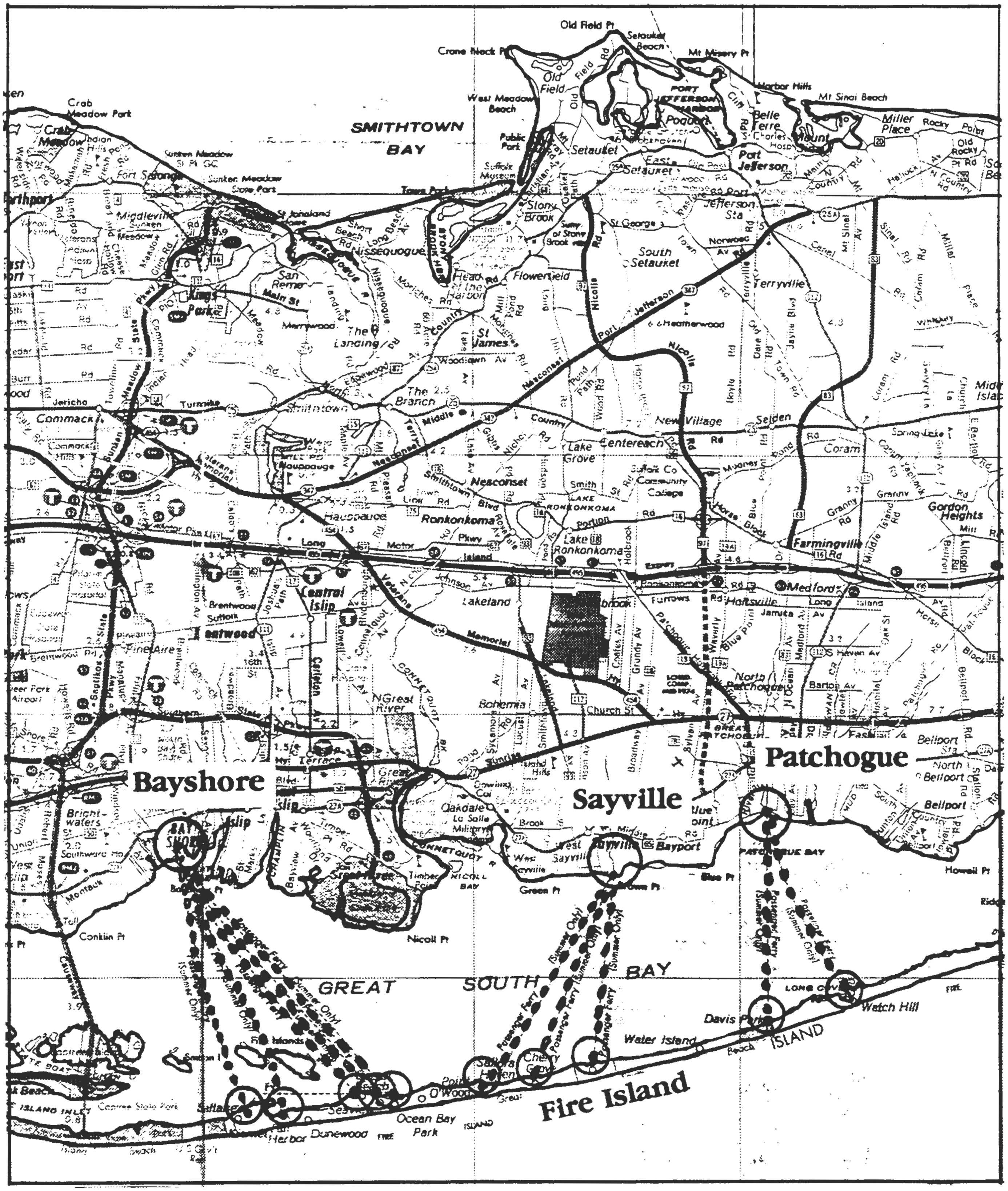


Figure 3.21 - Port Clinton to Put-In-Bay OH

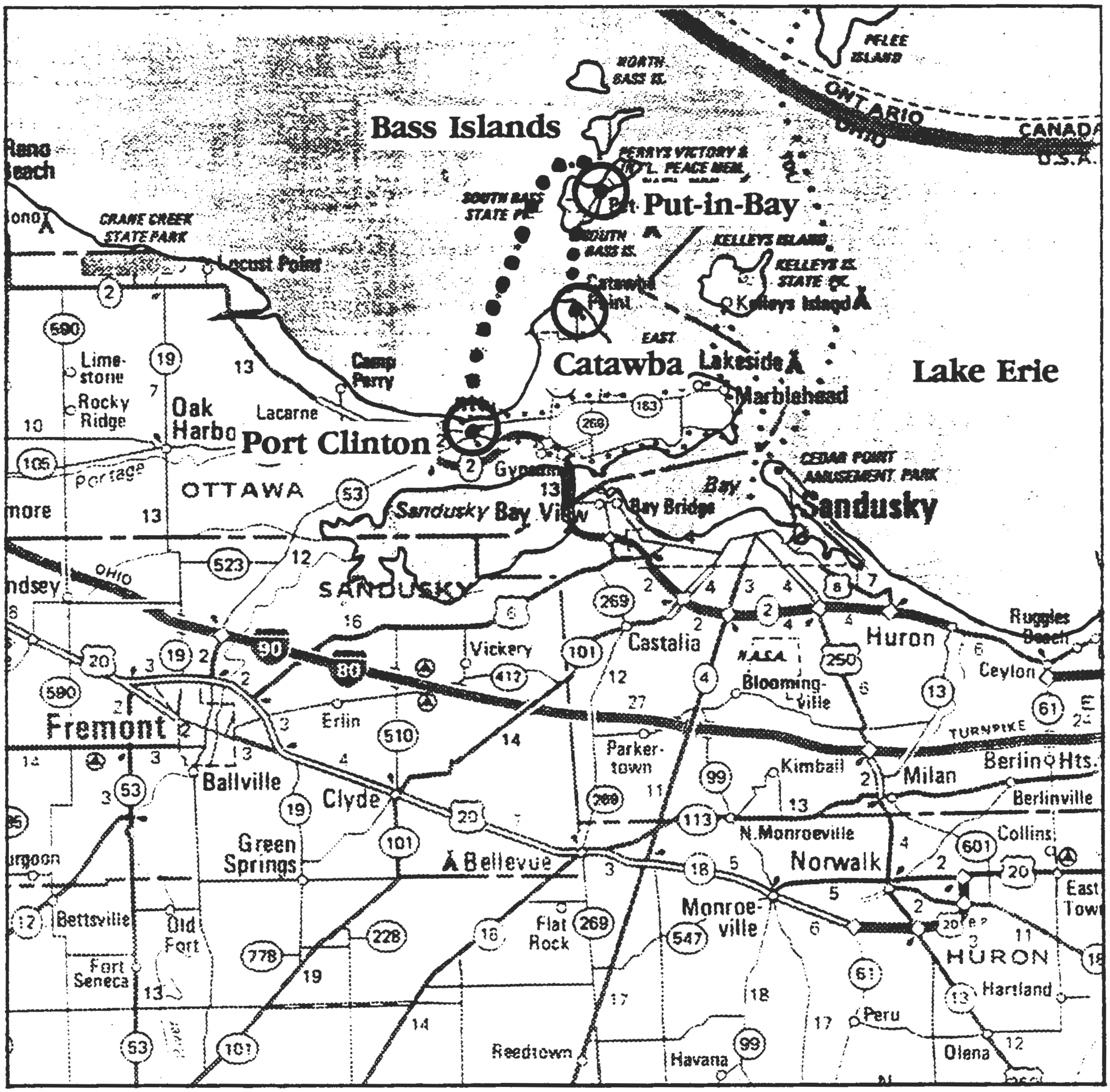


Figure 3.22 - Staten Island Ferry to Manhattan NY

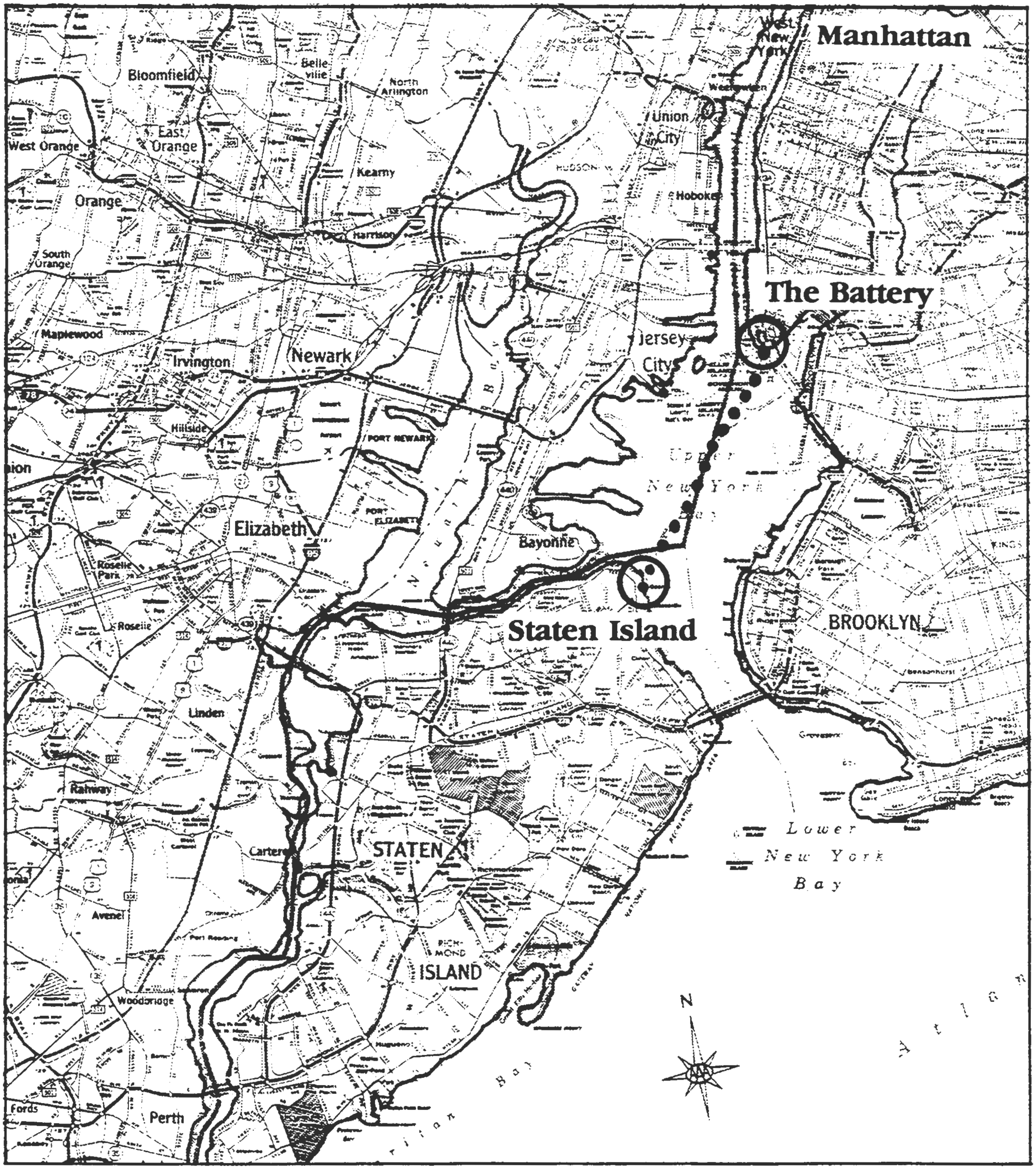


Figure 3.23 - Mississippi River Bridge Authority, Cross River Routes, LA and MS

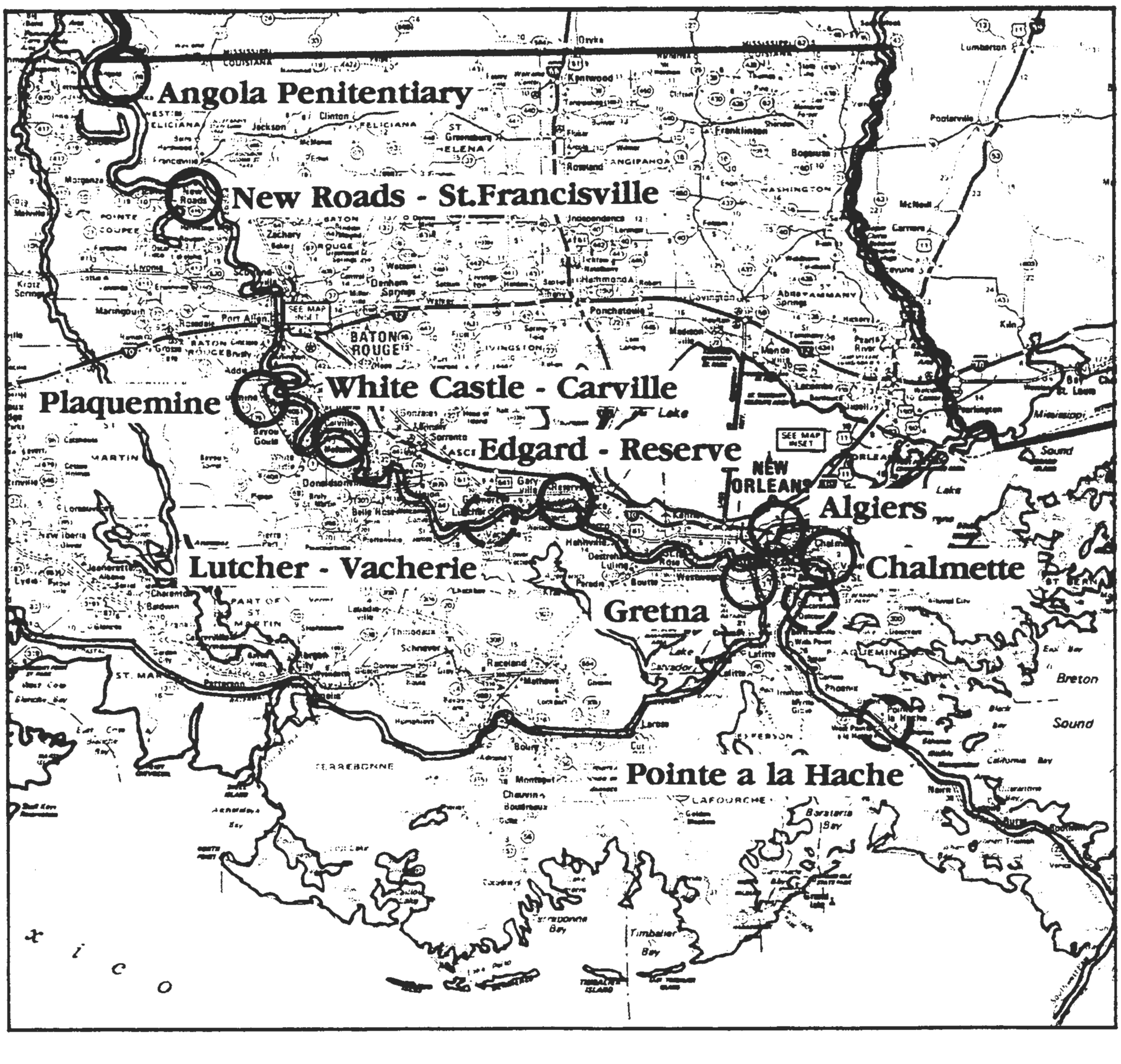
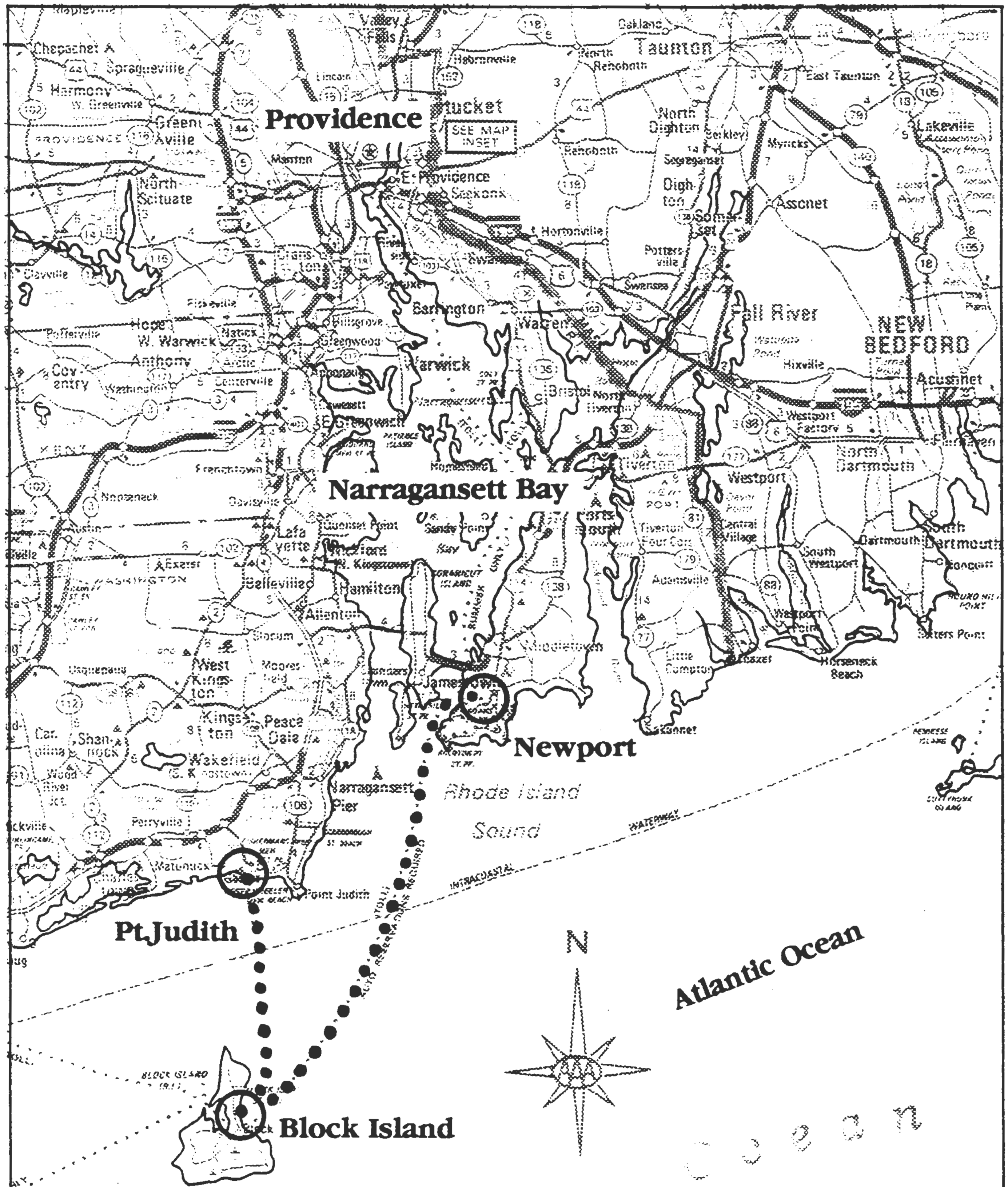


Figure 3.24 - Newport and Pt.Judith to Block Island RI



is offered on that route. The service from Providence to Newport has periodically been available offering connections to Block Island. The ferry systems in Rhode island are all operated by different private operators who have struggled to maintain the vessels and the terminal facilities with limited state assistance.

The Block Island and other Narragansett Bay ferry operations are representative of the many private operations which independently provide valuable public transportation services, often serving a small year round population and a large seasonal tourism population. The state is currently undertaking a study of how ferry operations might be expanded to meet both the economically important tourism demands as well as other commuter functions in the Providence area to make better use of the dominant waterways, reduce traffic on the highway system, and avoid building new bridges and roads. The unique geography of the state with its central bay and chief attractions on islands (Newport and Block) should lend itself readily to the reintroduction of ferry routes to relieve roadway congestion.

24. San Francisco to Vallejo (existing and proposed); (San Francisco Bay, California, Figure 3.25) The highspeed catamaran service from Vallejo to San Francisco's Embarcadero Terminal was started in 1986, with the intention of providing commuters an option to driving or taking the lengthy BART transit ride. The service is operated by the Red and White Fleet and carried 213,000 passengers in 1990. The route covers a distance of 24 nautical miles and takes 60 minutes one-way including loading and unloading. The moderate year round weather and protected watersheet conditions in San Francisco Bay are generally excellent for the highspeed catamaran operation, and are problematic only during periods of fog. With the strong encouragement of the Vallejo residents a masterplan was completed in 1991 for expanding capacity on the highspeed Vallejo service as well as proposing new routes and tying in with other existing Bay routes. The state legislature was then required to follow through with funding appropriations for capital improvements, by direction of a public referendum.

The Vallejo service is significant for two reasons; as an example of a precedent setting application of highspeed vessel technology with the catamaran in 1986, and for completing a masterplan for expansion coupled with state capital funding through a bond referendum. The successful application of the highspeed catamaran established a precedent for serving lengthy water routes as passenger ferry transit alternatives to land-based services. The enthusiastic endorsement by the public at local and state levels for ferry service expansion also represents an important breakthrough as part of a more comprehensive approach to balancing regional transportation systems. Alternative parallel rail and highway systems exist for the Vallejo route, but have become increasingly overcrowded, which led to the search for other transit modes.

25. Cross Corpus Christi Bay (proposed); (Corpus Christi Bay, Texas, Figure 3.26) In 1989, the Corpus Christi Regional Transportation Authority completed a study plan for implementing a new high-speed water transit service for Corpus Christi Bay. The plan recommended a phased set of routes to serve the major work and recreation destinations scattered around the bay, including the downtown on the east shore, the U.S.Navy Homeport to the north, the Naval Air Station to the south, and Padre Island and Port Aransas to the west. One of the primary routes would connect the Homeport to the NAS, a distance of 31 miles through the center city by existing highway compared to 9 miles across the bay. The study estimated that the ferry service would reduce the trip time by 40%, and that in the first year of service the system would carry between 350,000 and 450,000 passengers. Projected benefits from the service would include reductions in motor vehicle travel and associated reductions in air pollution, traffic congestion, and traffic accidents. The ferry system was also projected to have positive impacts on a sluggish local economy, through new real estate development and job creation. High-speed catamarans were recommended for the service for the semi-protected bay conditions. A first phase demonstration project was implemented in late 1993, and the plans are still under consideration by the transportation authority,but as yet have not been implemented.

In principle the proposed Corpus Christi plan presents an interesting case for specific urban applications of water transit systems even when there are relatively low densities of settlement (less than 800 per square mile). As long as there specific commuter and /or recreational destinations to be served such as the several dispersed but relatively high volume traffic generators including the downtown and the naval stations around Corpus Christi Bay, ferry systems may prove to be preferable to land-based systems. The applicability of the high-speed vessel technology is also of importance since without the speed advantage the water routes would not be competitive with land-based highway alternatives. There were also interesting environmental considerations in the relatively shallow waters of Corpus Christi Bay which posed limitations on vessel type and routes. As in many other areas where existing and new systems are discussed the unique combination geographical characteristics of the water area and the landside development patterns are of major importance to the specific applicability of water versus land-based alternatives.

3.13 Recommended Short List of 9 Systems for Detailed Analysis

The survey list of 25 systems was evaluated to determine which ferry operations might be most usefully studied in more detail. The intention was to include representation of all typology groups and the full spectrum of system characteristics_(section 2.2). The short list also needed to examples with a range of major choice determinates (section 2.1) and issues which might influence future water transportation systems. For purposes of the short list selection, those locations which had multiple routes described within a single water body or port area were combined to define a ferry "network" which could then be related to a regional transportation system rather than consider individual routes in isolation. For example in New York, the three systems described in the survey, though distinct in terms of management and operation, are all serving the same basic transportation need of weekday commuting to Manhattan, and are therefore grouped as a single network. Other urban ferry routes aggregated into composite systems included Boston, Seattle, and San Francisco. As an example of a larger regional system, the Cape May/Lewes ferry and the Norfolk/Chesapeake Bay Bridge Tunnel were combined. Since mostof these systems function either directly or indirectly as integral components of largermetropolitan or regional transportation networks, it seemed appropriate to evaluate them in the context of their larger decision-making and planning processes.
The 9 systems selected for more detailed analysis included the following:

1. **Seattle Ferry System**
2. **Cape May - Lewes Ferry and Norfolk/Chesapeake Bay Bridge - Tunnel**
3. **Alaska Marine Highway**
4. **Boston Harbor Ferry Network**
5. **San Fransisco Bay Network**
6. **New York City and Cross Hudson Network**
7. **Portland - Casco Bay Ferry Lines**
8. **Mississippi River Bridge Authority Network (Louisiana)**
9. **San Juan Ferry System**

Figure 3.25 - San Francisco to Vallejo CA

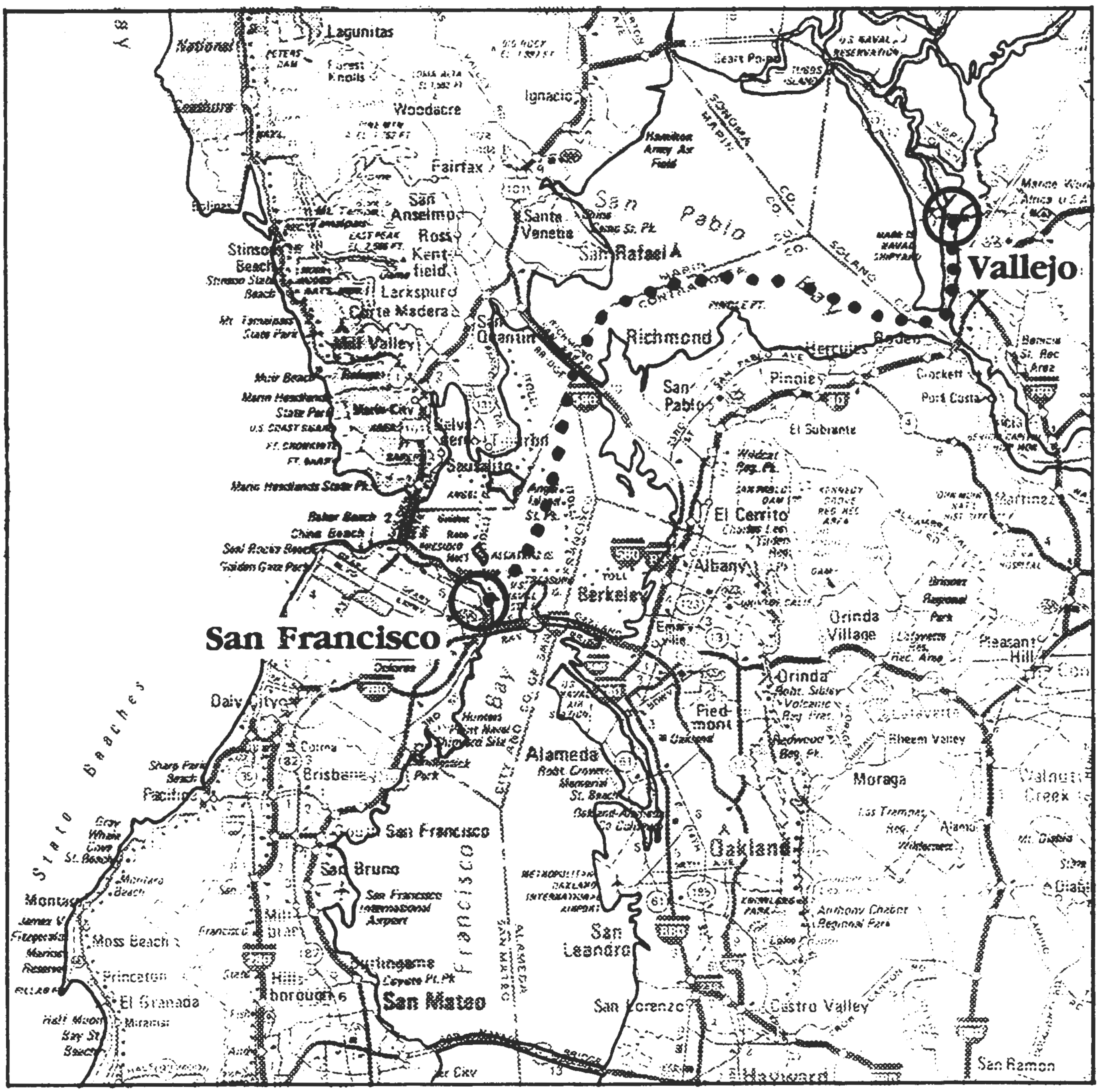
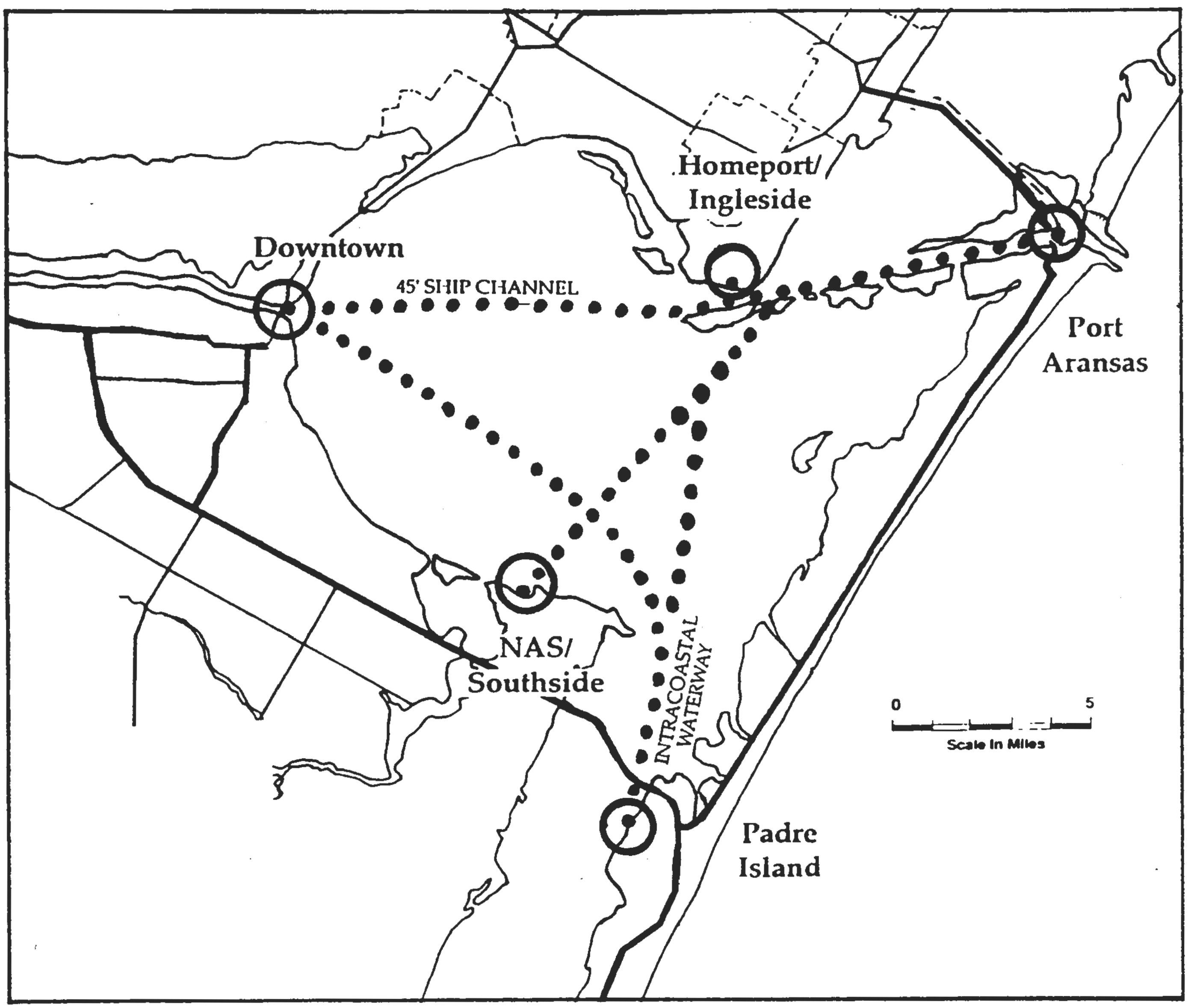


Figure 3.26 - Corpus Christi Bay (Proposed System)



3.2 Detailed Survey of Representative Examples by Type - Nine Ferry Systems

3.21 Comparative Summary Analysis (Table 3.3)

The 9 systems were selected based on factors described in the following matrix, shown in Table 3.2 with summaries of each given in three main evaluative categories; 1) typologies included in the system, 2) dominant distinguishing characteristics, and 3) transportation, environmental, geographical and planning determinates.

In Table 3.3 the 9 systems selected are compared based on a summary of data collected and described in the log sheets in Appendix A. The matrix includes the aggregated ferry networks for Boston, New York, San Francisco, and the Norfolk/Cape May corridor and the siingle operator systems for the remaining cities. The primary issues related to each system are noted and described in more detail with each individual description.

3.22 Systems Descriptions; Decision-making Factors

The selected 9 systems are described below with particular attention paid to the historical factors in choosing between the water and land based systems for the various routes included. In the case of proposed expansion of a particular network, a summary of the plans and decision process is also included. Each system is sufficiently different that measures of cost effectiveness are only possible within the context of the particular network's objectives. The issues of joint transportation use for transit as well as excursion or tourism are also explored for each. the descriptions conclude with an assessment of the significance of each as a model and precedents for other applications.

1. Seattle Ferry System:

o Seattle to Bainbridge Island
o Seattle to Bremerton
o West Seattle to Vashon Island

The system is the one of the older commuter ferry systems which is state owned and operated. The initial decision to invest in a ferry system across Puget Sound instead of building bridges was appears to have been a pragmatic determination that the cost and difficulty of building bridges was excessive, and without the ferry connection economic growth would be limited. With a major work destination in Bremerton and the only highway connection a long and congested route through Tacoma, as shown in Figure 3.27, the choice the state of acquiring and expanding the privately operated ferry fleet appears in hind sight to have been an enlightened regional transportation decision. The extraordinary growth in the Seattle to Tacoma corridor has consumed all highway capacity available during the past three decades, and the residential and employment growth on the west side of Puget Sound and on Bainbridge and Vashon Islands, though less dramatic, has nonetheless required constant upgrading and expansion of the ferry routes.

The system today represents the most efficient high volume, combined passenger and auto ferry in the U.S. It is a tribute to the Washington State Department of Transportation that the system has been as innovative and well managed during its 30 years of operation. As economic factors change, however, the state is beginning to consider national trends towards privatization and explore the financial feasibility and cost-benefits of other operations and management approaches.

The individual routes perform different transportation functions. For example Bainbridge to Seattle is the highest volume commuter route and carries both passengers and vehicles during peak weekday periods. The longer Bremerton to Seattle route is used partially for commuters and partially as a general vehicular highway link. The two Vashon Island links to east and west serve to connect the island to the mainland as well as serving commuter needs.

There are several important issues raised by the Seattle system which may deserve more detailed evaluation:

o Regional Transportation Decision of Ferry over Bridge/Tunnel - Long term commitment and follow through on a regional (and state-wide) planning decision which has assisted in metropolitan growth and land development in the Seattle-Tacoma corridor.

o Incremental Expansion and Service Improvements - The state ferry management has developed a highly responsive and efficient combined commuter system and marine highway which serves as a model for other urban areas.
o Ferry System as an Integral Component of an Urban Transportation Network - The system has demonstrated how essential a combined passenger and ro-ro operation can serve as both a commuter mass transit system and a through traffic highway link.

2. Cape May to Lewes Ferry and Norfolk to Cape Charles Bridge-Tunnel Regional Highway Link (Figure 3.28)

o Cape May NJ to Lewes DE Ferry (Garden State Parkway)
o Norfolk to Cape Charles VA Chesapeake Bay Bridge-Tunnel (Routes 58, 13, 113 and 9)

The ferry and tunnel-bridge combination is of note because it was planned and implemented as a regional, interstate plan to promote tourism, development and commerce as an alternative to the well established inland route, I-95, from North Carolina through Washington DC and Baltimore to the New Jersey Turnpike. The two initiatives were implemented not long after the I-95 corridor approached completion with the filling of the remaining gaps in the system. While the two plans were executed independently by Virginia for the bridge tunnel and by Delaware and New Jersey for the ferry system, the new highway linkage route was clearly intended to provide a shorter trip time and distance advantage for travelers or trucks interested in bypassing Washington and Baltimore. Since the two ports of Norfolk and Baltimore have long been locked in competition for freight, the improved peninsula highway option was in part intended to offer some of the freight carriers an optional route up the coast.

As described earlier, the system has yet to fully realize its potential for several reasons; 1) the highway connections from Norfolk southwest to I-95 in North Carolina are not yet complete, 2) the two-lane highway from the bridge-tunnel north along the DelMarVa peninsula of necessity passes through many smaller towns, and is congested during the summer season, 3) the highway connections on the New Jersey side are limited and the Garden State Parkway has limited truck

Table 3.2 - Comparative Analysis of 9 Systems

Key:

System Types:
1. Ferry /Bridge or Tunnel
2. Ferry/Parallel High. or Rail
3. Ferry to Island(s)
4. Ferry + Bridge or Tunnel
5. Ferry + Highway or Rail
6. Ro-Ro Highway Link

Characteristics:
A. Commuter(C),Recreat(R),High.(H)
B. Volume: High(H),Medium(M),Low(L)
C. Internat'l(I),Int'state(S),Int'city(C)
D. Public(PB), Private(PR)
E. Existing(E), New(N), Proposed(P)

System	1	2	3	4	5	6	A	B	C	D	E	COM-MENT
1.Seattle	o		o		o	o	C,R	H,M	C,I	PB	E,N,P	High Vol. Commuter Service
2.Cape May-Norfolk	o	o		o	o	o	H, R	M	S	PB	E	Regional Economic Develop't
3.Alaska	o	o	o			o	CH R	M	I,C	PB	E,N	Primary Transport System
4.Boston	o	o		o	o		CR	HM	C	PB+ PR	E,N,P	Expanding Pub-Priv Urban
5.San Francisco	o	o		o	o		CR	H	C	PB+ PR	E,N,P	Expanding Public Urban
6.New York			o	o	o	o	CR H	H	S,C	PB+ PR	E,N,P	Expanding Pub-Priv High Vol.
7.Portland Casco Bay	o		o			o	CR H	M,L	C	PB/ PR	E,N	Commuter -Tourism Islands
8.Miss.Riv. Ferries	o	o				o	CH R	H,L	C	PB	E	Rural/Urb. High/Low Vol. River
9.San Juan -Old San Juan		o			o		CR	M	C	PB	N	Urban By-Pass High Tech

TABLE 3.3 - Detailed Survey of Systems by Type (9 Systems)

Key:

Type:
1.Ferry/Bridge or Tunnel
2.Ferry/Parallel to High.
3.Ferry to Island(s)
4.Ferry + Bridge or Tunnel
5.Ferry + High. or Rail
6.Ro-Ro/Highway Link

Characteristic:
A.Commuter/Recreation or Tour
B.High/Low Volume
C.Int'national/Int'state/Int'city
D.Public/Private
E.New or Expanding System

Ferry System	Type	Charac-teristics	Pub./ Priv.	Pass./ Ro-Ro	Vol. Riders	System Age	Tech.	General Relevance
1.Seattle-Winslow/ Bremerton etc.	1,3, 5,6.	Com/Re High, Int'city, Expand.	Pub./ State	Pass. + Ro-Ro	P/6.4m V/3.3m	42 y. (1951)	Med.- Ro-Ro	No alt./ Public/ High vol./ Commuter
2.Cape May-Lewes & Norfolk-Eastern - Shore	6,5	Tour, Low, Int'st.	Pub./ NJ,DE	Pass. + Ro-Ro	P/1.1m V/.36m	29 y. (1964)	Low- Ro-Ro/ ocean	Long haul ferry/ bridge highway link
3.Alaska Marine Highway	3,1,2,6	Com/Re Low Int'nat	Pub./ State	Pass. + Ro-Ro	P/0.4m V/0.11 m	24 y. (1959)	Low- Ro-Ro/ ocean	Long haul, all use ro-ro link
4.Boston-Hingham/ Logan etc.	4,5	Com.,M. Int'city Expand.	Pub./ Priv.	Pass.	P/1.1m	20 y. (1983)	Low (Crew Boats)	Expanding pub/priv., varied use
5.San Francisco/ Golden Gate, Oak.	1,2, 4,5	Com./Re High, Int'city Expand.	Pub. + Pub./ Priv.	Pass.	P/1.3m	23 y. (1970)	High- mono, cats	Model public, high vol. commuter
6.New York City/Cross Hudson, Bayshore	3,4, 5,6	Com., High Int'st. Expand.	Pub., Priv. Pub./ Priv.	Pass. + Pass./ Ro-Ro	P/23.9 m	7 y. (1986) 88 y. (Staten)	Low/ Med./ High	Highest volume, urban,new private
7.Portland/ Casco Bay	1,3	Com/Re Med.Vo.	Pub. Auth.	Pass./ Ro-Ro	P/0.6m	122 y. (1871)	Low- ocean	Oldest continuous to islands
8.Miss.River Bridge Au./ Algiers, St. Charles etc.	1,2, 6	Com./Hi Med., Int'city	Pub.	Pass./ Ro-Ro	NA	Varies by Route	Low- Ro-Ro	Ro-ro riv. highway link
9.San Juan-Old San Juan	2,5	2,5	Pub.	Pass.	P/2.1m	4 y. (1989)	High- cats	New, high tech, inter modal

Figure 3.27 - Seattle Ferry System

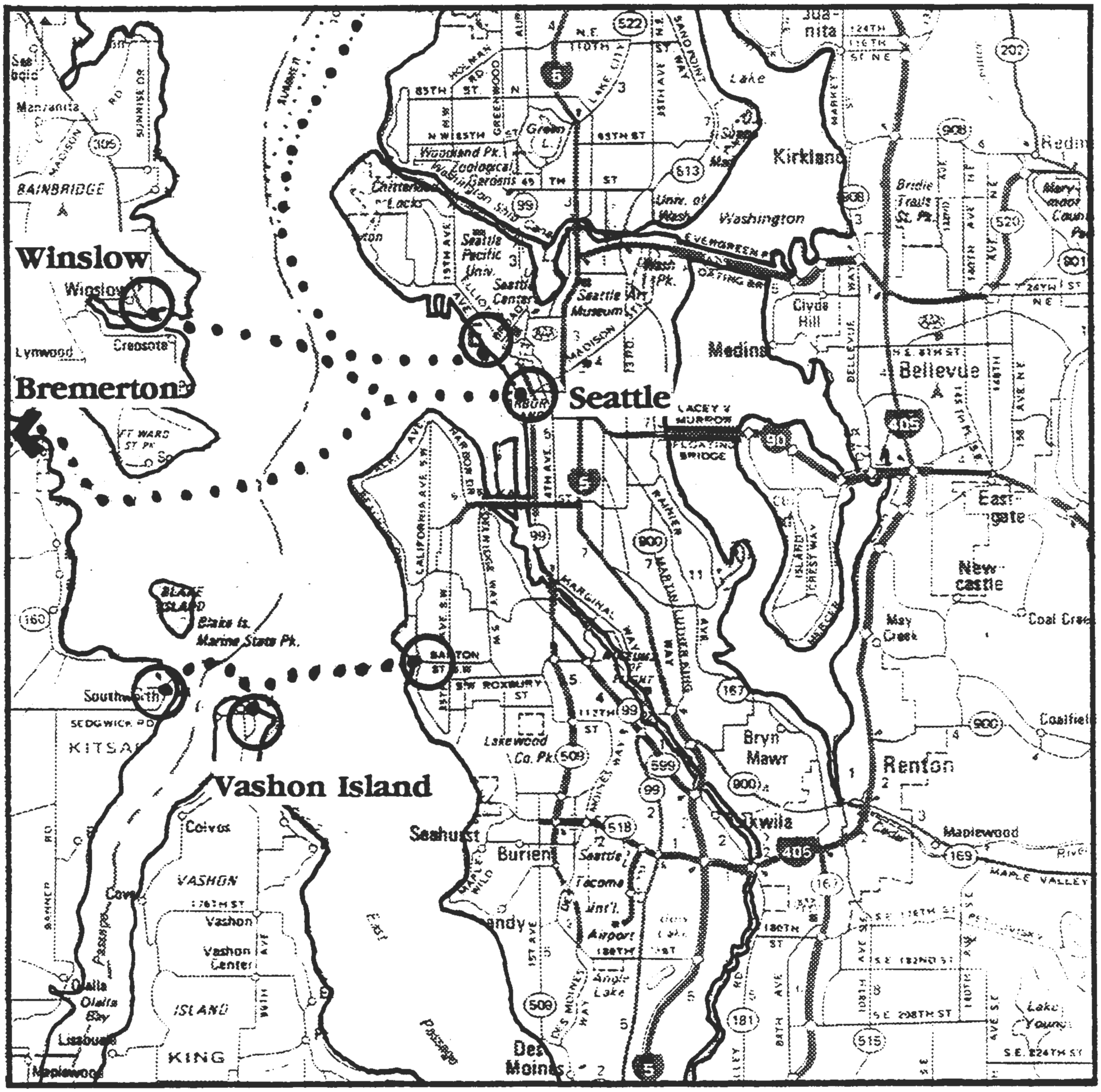
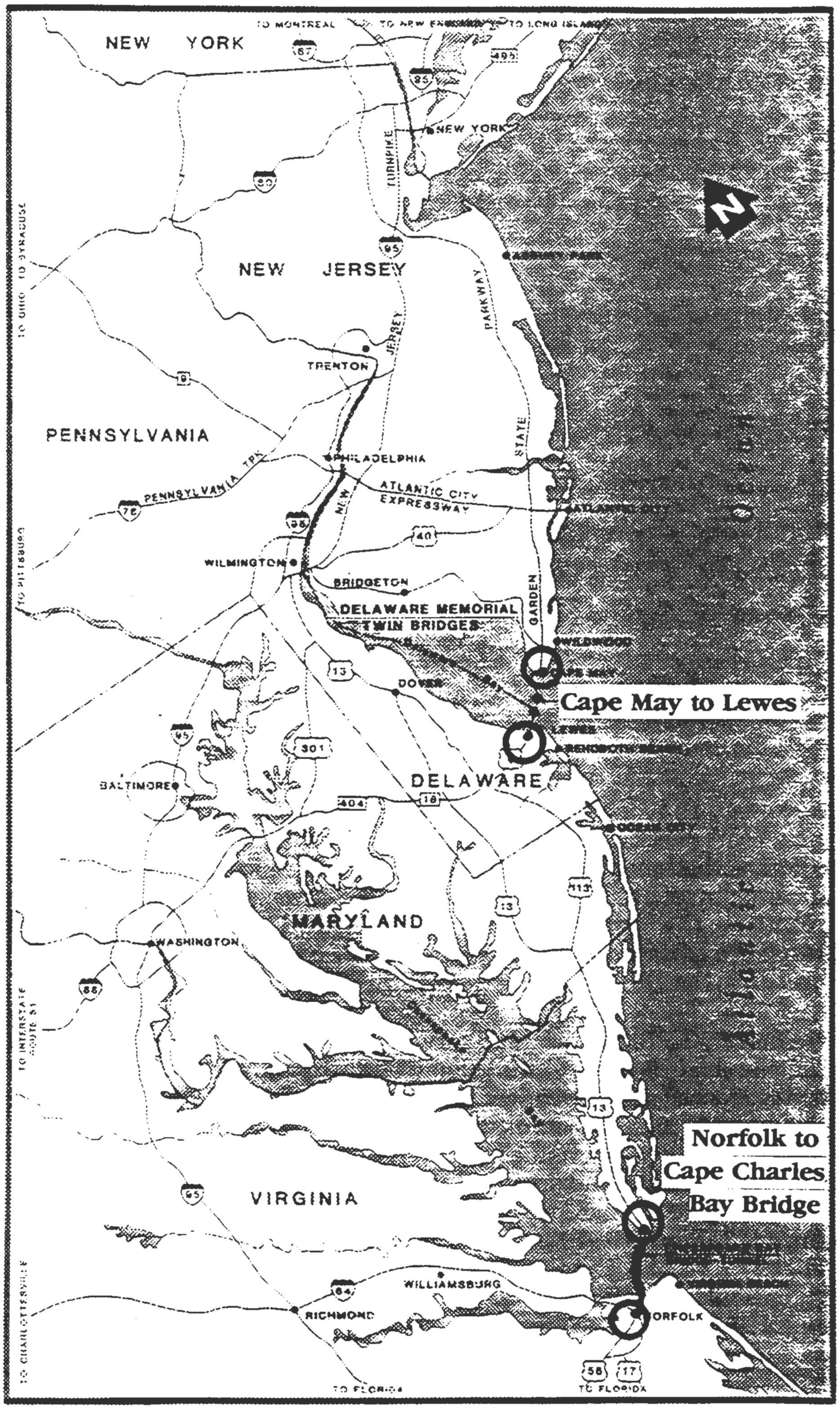


Figure 3.28 - Cape May/Lewes and Norfolk/Chesapeake Bay Bridge Tunnel



access north of Atlantic City, and 4) the alternative route is not well publicized. However as the congestion mounts and travel delays become more frequent around the urban centers along I-95, the route will undoubtedly be recognized as a serious alternative for long distance travellers, and tourists looking for new attractions such as the Norfolk waterfront and older emerging attractions such as Cape May and the peninsula shore. In 1993 feasibility planning was underway to consider higher speed, passenger only service to augment the slower crossings of teh vehicle ferries during teh busier summer months, and add more bus connector routes and park and ride facilities at either end to increase interstate tourism.

Other evaluative issues of note for the regional highway link include the following;

o Environmental; the Chesapeake Bay Bridge-Tunnel might have serious problems being built today as opposed to the 50's and early 60's, because of the impacts of the causeway on the mouth of the bay. Similar projects may have greater difficulty in being built in the future, and would at least require a different structural solution. The Cape May - Lewes terminals and channel approaches might also require modification, but at least are legitimate maritime uses.

o Contributions to Economic Development; as described, there may be much greater long term opportunities along the four state corridor, and some cooperative planning might be useful. Ironically, the state of Maryland, which was not one of the contributors, has seen the greatest amount of shore development since the link was completed.

o New Ferry Technologies; If some of the higher speed ro-ro catamarans were available at the time the bridge and ferry were planned, an interesting cost-benefit comparison might have been made between the bridges and conventional ferry link and a higher speed/high volume ferry link system. With the current levels of investment in the conventional ferry, it would be difficult to make such a transition now even if the vessels were available in this country. The proposed highspeed passenger ferries, on teh other hand, might be feasible, particularly if they could also be used for other Delaware Bay services including excursions or up bay connections to Dover or other coastal sites.

o Intermodalism; Current intermodal connections for passengers include some feeder bus connections. If the I-95 corridor continues to increase in congestion and if the broader expansion of tourism takes place in the four state corridor, there may be opportunities for expanding bus and possibly rail service linking various points along the peninsula and New Jersey.

3.Alaska Marine Highway (Figure 3.29)

o Southeast Alaska System (including international route to Prince Rupert,Canada, and interstate route to Bellingham WA)
o Southwest Alaska System (including Prince William Sound Ferry Routes)

The Alaska Marine Highway with its three clusters of routes is clearly one of the moreunique ferry systems in the country if not in the world. Because of the combination of climate and geography, the traditional ferry transportation links are extremely well suited to the important saesonal functions that the system fills. Alaska has a diverse intermodal transportation network combining whatever modes that work. Recent economic development has included expansion of traditional businesses as well as a rapidly expanding tourist trade. Conventional landuse development is even beginning to appear in some of the larger cities such as Anchorage. Statewide travel is limited by teh climate and the terrain. and teh combined high cost and long distances of overland infrastructure are likely to constrain major changes in the basic land-based transportation systems. particularly along teh coast. The ferry systems are therefore likely to remain intact and expand capacity and routes as demand warrants. As in Washington state, the ferry system plays an important enough role in the average person's day to day life that there is strong voter support for funding and improving the ferry network, which in turn is reflected in the dedicated management by the state transportation departments.

The Alaska ferries are also unique in their role as an international system. While other private systems fill a similar ro-ro function such as the Maine to Nova Scotia, and Washington to British Columbia ferries, these are primarily for seasonal tourism, while the Alaska system provides a more diversified transportation function as a primary highway link. Other evaluative issues include the following;

o Urban Passenger Commuter Link; While only marginally a commuter link, some routes on the Alaska system clearly serve as business links between communities separated by water and mountains. and are used for basic business transit purposes because there are no alternatives.

o Highway Links; The chief attribute of the Alaska system is that it is the most extensive system of ferry routes as highways in the U.S. It is similar to other island links in providing residents of the areas it serves as there primary connection with the outside world and with each other. In the category of ferries to islands the Alaska system represents the largest and most complex.

o Economic Development; The key to past and future economic expansion and growth is clearly linked to the ferry system. Conventional urban waterfront development linked to ferry terminals is less likely, while expansion of the seasonal use of the system for tourism is likely to continue.

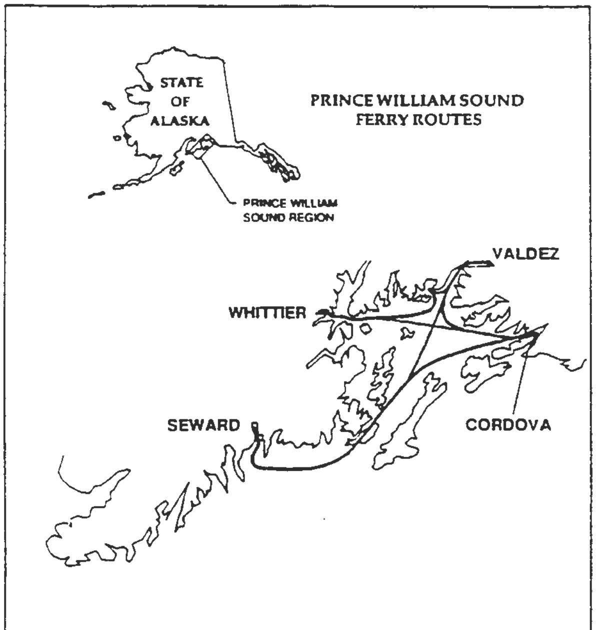
o Public-Private Partnerships; It remains to be seen if the explorations of privatizing transportation services being considered in other parts of the country, or reorganization of what seems to be a very efficiently managed system will offer any cost benefits.

4. Boston Harbor Ferry Network (Figure 3.30)

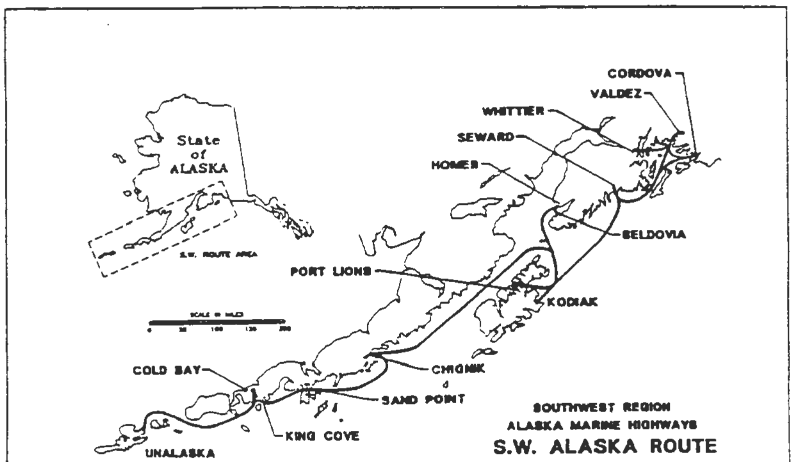
o Hingham to Rowes Wharf (South Shore)
o Hull to Rowes Wharf (South Shore)
o Downtown to Logan Airport
o Long Wharf to Navy Yard
o Mass. Water Resources Authority(MWRA) (not included in summary data)
o Expansion Plan

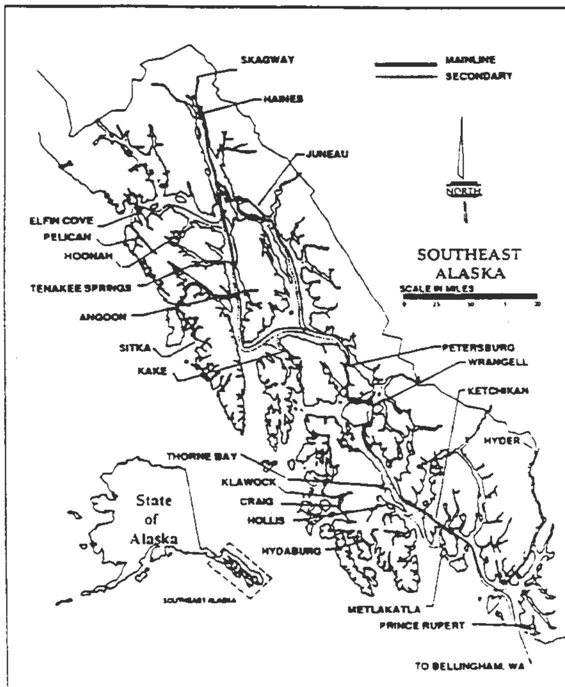
As a whole network the Boston Harbor system presents a variety of contrasting typologies and characteristics. as well as an interesting mix-and-match management approach. Several of the routes are run by the MBTA including Hingham/Boston (Rowes), Hull/Boston, and Long Wharf/Navy Yard. These are treated as integral components of the transit network and are priced to be consistent with landside commuter rail trips. The Airport Shuttle (Downtown to Logan) is a joint public private operation between the Rowes Wharf developer and port authority

Figure 3.29 - Alaska Marine Highway



(All Prince William Sound routes are Federal Aid Secondary)





SOUTHEAST ALASKA FERRY ROUTES

Figure 3.30 - Boston Harbor Ferry Network

BOSTON INNER HARBOR WATER TRANSPORTATION STUDY

PROPOSED NETWORKS
2010 PEAK

O - Terminal Site
- Berthing / Service

ROUTES :

1. Rowes - Logan
2. North Station - Fan Pier - World Trade
3. Pier 4 (CNY) - Long - Russia
4. North Station - Pier 4 (CNY) - Logan
5. Pier 11 (CNY) - Russia
6. Hingham & Hull

Key	Terminal Site
	DOWNTOWN :
1	Long Wharf
2	Central Wharf
3	Rowes Wharf
4	Northern Avenue Bridge
5	Russia Wharf
6	North Station
	SOUTH BOSTON :
7	Fan Pier / Pier 4
8	World Trade Center
9	Pier 7
	CHARLESTOWN :
10	Pier 1 / Constitution Wharf
11	Pier 4
12	Pier 11
	EAST BOSTON :
13	Eagle Street
14	East Boston Piers
15	Boston Marine
16	Logan South

(Massport), and is priced to compete with airport cabs and limos. The MWRA water transit network is a mitigation measure to carry large numbers of construction workers across the harbor on several routes to avoid trips through residential neighborhoods, and reduce traffic through the tunnels and on the highway system. Recent (1988 and 1989) and current studies (completed in 1994) have projected a masterplan for future routes and services in the system (shown in Figure 3.30) responding to new travel demands caused by downtown growth andwaterfront development and as a mitigation device for another major ($7 billion) infrastructure project, the Central Artery/Third Harbor Tunnel which is likely to cause travel delays over the course of construction.

The system operates over relatively short distances with generally low tech vessels. It has demonstrated that water transit services can be successful as year round services even in a harsh climate. A distinguishing characteristic of the management and operations of the MBTA and MWRA services is the public/private mix whereby the public entities handle all management and marketing, and the vessel operations are put out to bid on a rotating basis. The MBTA and MWRA subsidize the services, but try to secure cost effective operations through bid services and limited privatization. This has also allowed the existing excursion fleet to compete for routes and services to the extent that their vessels meet the bid specifications, which in turn have been kept fairly broad and have not necessitated new vessel construction. While the low tech and diversified fleet (some have described as "mosquito"), the routes allow for such a system and the ridership has supported the no frills services.

Important issues associated with the collective Boston system include the following;

o Incremental Decisions for Ferry Routes Parallel to Tunnels/Bridges or Highways/Rail;
Each of the individual routes was determined by the need to either mitigate traffic or to provide an attractive alternative to less efficient land-based modes.

o Masterplan for System Expansion; The state DOT (EOTC), the MBTA, and Massport combined efforts to prepare a masterplan for longer distance commuter and inner harbor shuttle services.

o Ferries as Long-Term Mitigation for Landside Traffic Congestion; The Hingham service was one of the first to be used to provide mitigation for traffic during the widening and repair of the Southeast Expressway during the early 1980's and continued to operate with steadily increasing ridership after the project was completed. The current MWRA system is the largest by volume in the Boston Harbor and mitigates neighborhood and cross harbor traffic.

o Public/Private Management and Operations; The MBTA and MWRA mixture of public management and competitively bid private operations is an innovation which can provide a cost efficient service utilizing the existing fleet and operators.

5. San Francisco Bay Ferry Network (Figure 3.31)

o Sausalito to San Francisco (Golden Gate)
o Larkspur to S.F. (Golden Gate)
o Tiburon to S.F.
o Vallejo to S.F.
o Oakland to S.F.

o Expansion Plan

The San Francisco ferries have long been symbolic of the city itself, as a trip on the great Bay is mandatory for visitors. The Golden Gate Ferry System is the prime example in the U.S. of water transit routes planned as a deliberate alternative to other landside options for accommodating increasing commuter traffic around the north side of the bay. The well documented, publicly mandated planning process which led to the system implementation was as innovative and instructive as the vessels and terminal systems which it created. The more recent Vallejo to San Francisco route established the first daily operation of a highspeed catamaran commuter route in the U.S. and opened the way for longer ferry routes than were traditionally considered viable.

The combination of the two routes started nearly 20 years apart and the widespread Bay Area acceptance of ferry commuting led to the recent referendum vote by Californians to expand ferry transit state wide, including new vessels and routes in the Bay. Starting with a mandate to expand the Vallejo service, a bay-wide plan for new routes,vessels and connections was put forward in 1992, and is serving as the blueprint for expansion. The new initiatives were driven by the long-standing interest in accommodating increasing travel without building new landside infrastructure, but also by the growing interest in improving air quality, and increasing options for water transit around the bay.

The San Francisco Ferry system has also pioneered the use of ferry routes for both weekday commuter transit and off peak recreational uses. The suburban areas offer superb attractions for city dwellers to escape to the countryside. The communities and ferry system have encouraged such recreational uses by providing bicycle and jogging paths connecting to the ferries as well as accommodation of equipment on the vessels. The trips across the bay are an attraction by themselves for many. These successful year round multiple uses of the Larkspur, Tiburon and Sausalito routes are certainly in part attributable to the combination of climate and landscape to be found around the Bay.

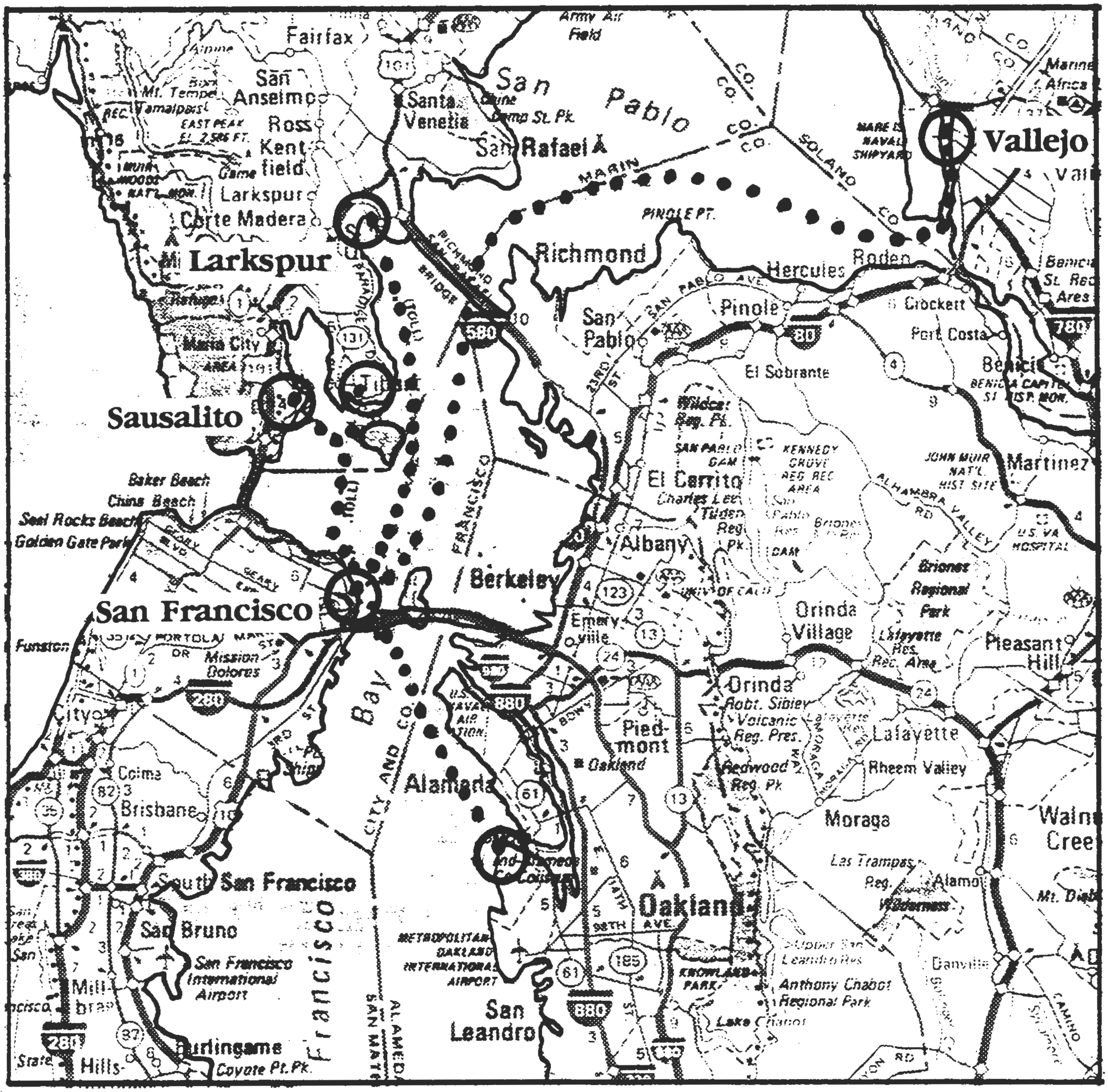
Significant characteristics and precedents established by the San Francisco Bay ferry system include;

o First Modern Ferry as Choice over New Highway/Bridge/Rail; The Golden Gate System established an early precedent for a public mandate for water transit as a cost efficient and environmentally preferable choice over land based options.

o Combined Use of Ferry System for Commuter Transit and Recreation; Multiple uses evolved from Sausalito to Tiburon to Larkspur, adding ridership and revenues to the publicly subsidized system.

o First use of Highspeed Vessel Technology to Establish Longer Routes; Both the Golden gate System and the Vallejo route established new standards for commuter routes by shortening travel time through higher speed vessels. The expensive Golden Gate monohulls have proven durable and suitable for the medium volume of ridership served, and the Vallejo "Catamarin" demonstrated that peak use, long haul routes could be successful.

Figure 3.31 - San Francisco Bay Ferry Network



6. New York City and Cross Hudson Network (Figure 3.32)

o Staten Island to Whitehall
o Weehawken (Port Imperial) to Midtown
o Hoboken to Battery Park City
o Bayshore to Brooklyn to Pier 11
o Marine Terminal (Laguardia Airport) to Midtown and Pier 11
o Expansion Plans

The cross Hudson routes introduced during the 1980's were among the first high volume passenger ferry services to be successfully introduced by the private sector at market rate fares in response to demand for alternatives to land based highway and rail travel. In the busiest commuter market where most trips involve crossing a water body, the combined highway/tunnel/bridge and commuter rail/subway system became overloaded in the mid-1980's. At the same time increasing numbers of Manhattan employed workers were moving to suburbs and commuting up to 2 hours each way to work. The Bayshore, Weehawken and Hoboken ferries all were started on the premise that commuters would pay a premium for a convenient park and float system which delivered them close to their Manhattan destinations. In many respects they were all following the well established lead of the highest volume passenger ferry in the U.S., the Staten Island Ferry, which had been carrying commuters across the Hudson for nearly a century.

The New York routes are all ones which have parallel landside systems combined with bridge and tunnel crossings. While the city has one of the most heavily used transit networks in the world, there is little or no ability to expand capacity. Auto traffic is constrained by lack of parking and a limitation on expansion due to density of Manhattan development. As the infrastructure began to reach its capacity limits particularly for mid-town and lower Manhattan trips, the free market mechanism took over, and new travel options began to appear.

Plans for expanding ferry networks on the New York side are underway as the City is looking for self-sustained private systems to fill in the routes identified as having potential ridership. In addition the Bayshore route is planning to expand services to Manhattan from Monmouth County, New Jersey, utilizing highspeed vessels operated privately from a publicly developed terminal.

Lessons to be learned from the New York systems include;

o Privately Operated Systems in Response to Increasing Congestion; First examples of high volume, privately operated systems without subsidy in cross Hudson routes.

o Highest Volume Public Route Continues to Operate; The Staten Island Ferry continues to fill a multiple roll as a passenger commuter route, a ro-ro highway link, and a romantic recreational service, simultaneously.

o Public Policy to Facilitate Marketable Private Services; The City of New York has provided and managed dock space and served as a catalyst for new services, recognizing that in the current market some routes may be self-sustaining.

7. Casco Bay Lines, Portland (Figure 3.33)

o Portland to Casco Bay Islands

The passenger, freight and vehicle service which operates from downtown Portland to six islands by Casco Bay lines is a pure example of a ferry providing the only daily transportation link for year round residents. The system provides commuter service for residents of the larger islands including Peaks, Great Diamond and Long. Since the service was initiated in 1871, there appear to have been no serious attempts to provide bridge or tunnel connections to the relatively small and sparsely populated islands. The operations themselves reflect the character of the harsh climate and the individualistic islanders. The vessels are built to serve the routes daily, and navigate in occasionally fierce weather, wind, and tide conditions of the coastal setting. The passenger vessels are slow but sturdy and built to be capable of landing at a variety of exposed dock locations.

The recently completed downtown waterfront terminal facility provides a good example of an intermodal facility in a moderate sized urban area. In addition to a comfortable and congenial waiting and ticketing space with covered access to the vessels, the site includes a bus dropoff and holding area, a taxi stand, a postal and freight handling area, a remarkably compact staging area for ro-ro vehicles, a parking garage which is shared with the downtown, a small park and good pedestrian connections to the Old Port section of the downtown. The narrow channel along the pier is shared with a variety of commercial fishing vessels. The array of modal options effectively connects the islanders with the many services and institutions spread throughout the Portland metropolitan area, most of which are well beyond walking distance. Since all but two of the islands are within the city limits, with one having recently seceded, the system ties the islanders to the public services such as schools and hospitals and avoids the problem of having to duplicate such services on the islands. In such a manner the cost of operating the ferry on a regular daily schedule is more cost efficient than paying for small duplicated services on the islands. Without the frequency and reliability of the ferry system, year round communities on the islands would by now have been either greatly diminished if not vanished altogether.

Notable features of the Casco Bay system include the following.

o Example of a Ferry Connecting Islands to the City; The system is an interesting example of a year round ferry transportation link in an urban setting, where there are no viable bridge or tunnel connections.

o Year Round Commuter and Seasonal Tourism Ferry Cross-subsidy; The heavy seasonal use of the system by summer residents and visitors provides revenue which compensates for the relatively low ridership during the remaining 9 months of the year.

o The Longest Continuous Daily Service of any System in the U.S.; Operating continuously on a daily basis since 1871, the system continues to support year round island communities as part of the city of Portland.

Figure 3.32 - New York Metropolitan Area Ferry Network

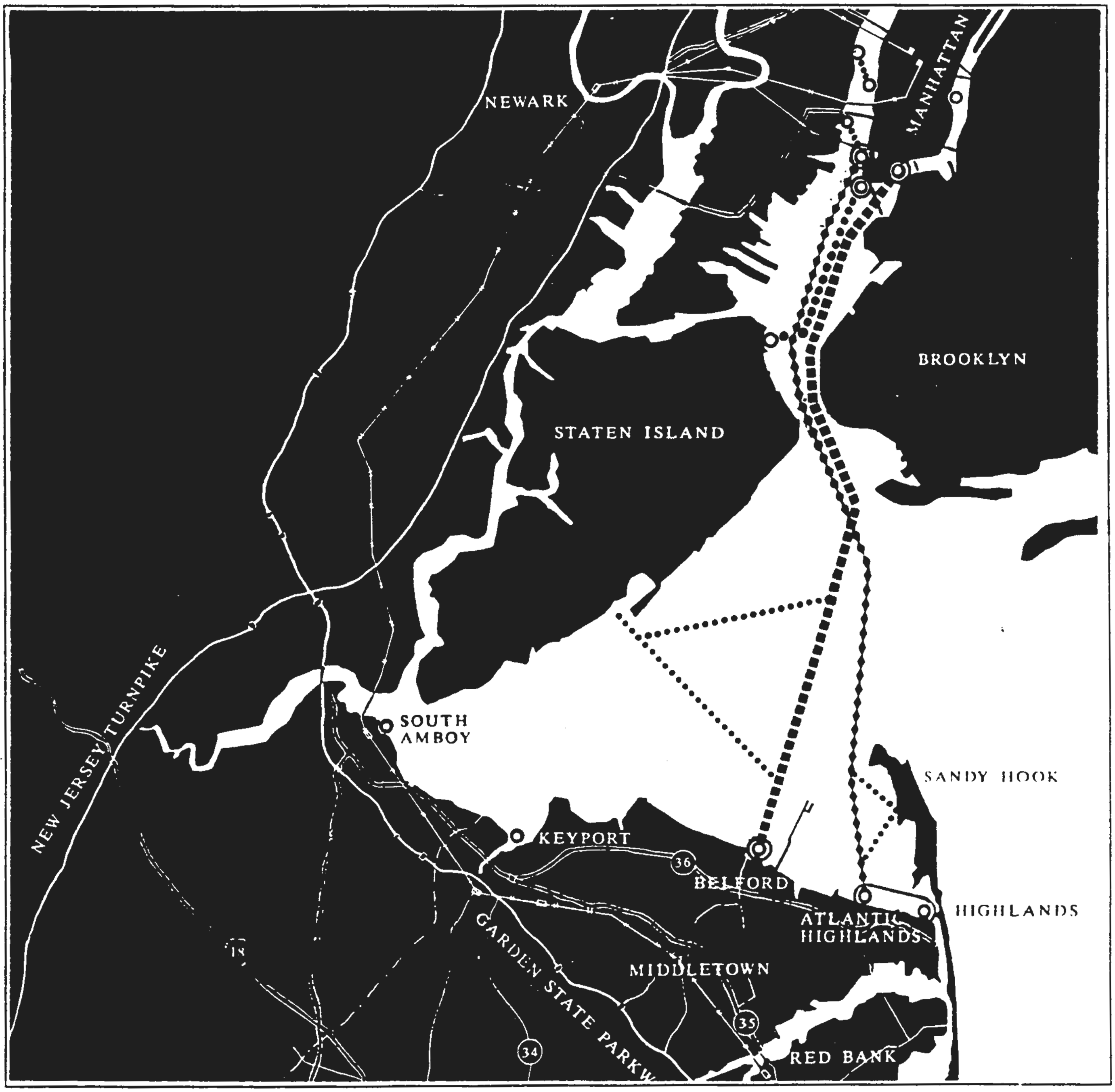


Figure 3.32 - New York Metropolitan Area Ferry Network

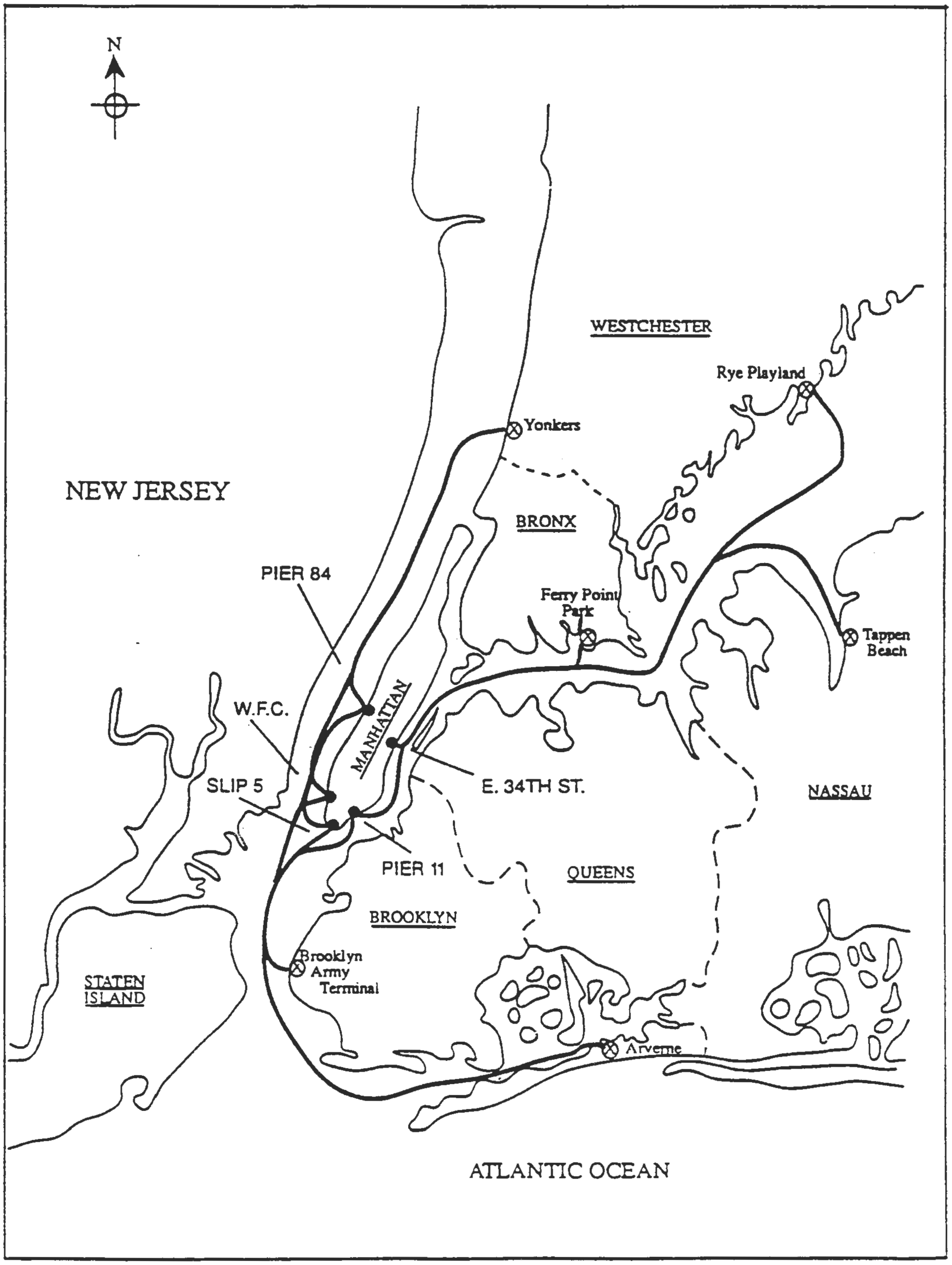
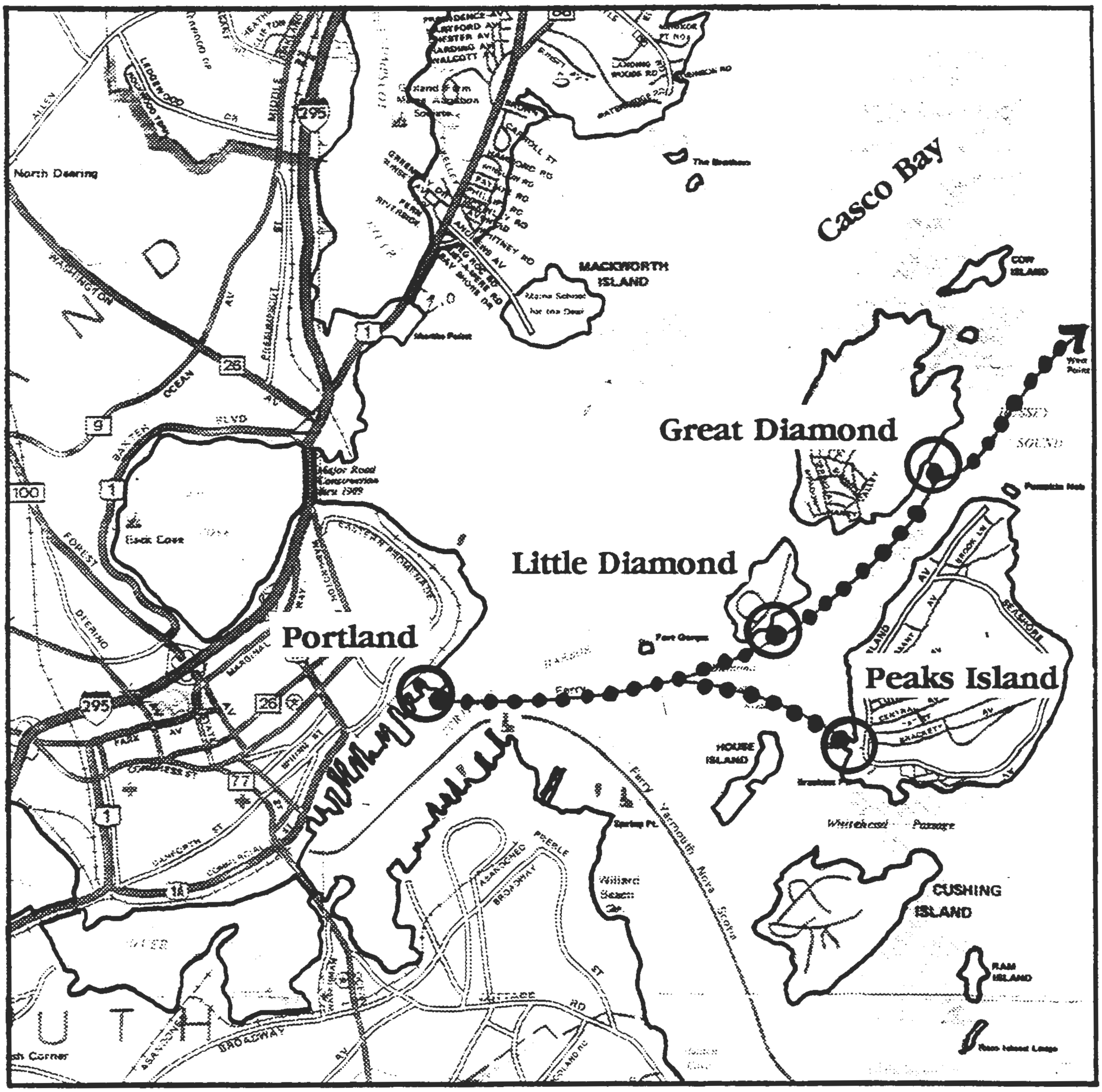


Figure 3.33 - Casco Bay Ferry System



8. Mississippi River Ferry Network (Figure 3.34)

o Pointe a la Hache*
o Belle Chasse*
o Chalmette to Algiers(MRBA)
o New Orleans to Algiers (MRBA)
o New Orleans to Gretna (MRBA)
o Edgard to Reserve (MRBA)
o Lutcher to Vacherie
o White Castle to Carville (MRBA)
o Plaquemine (MRBA)
o New Roads to St. Francisville (MRBA)
o Angola Penitentiary(MRBA)

The cross Mississippi ferry routes are perhaps most typical of the majority of traditional and contemporary systems in the U.S.. They fall into two categories; the higher volume urban routes in New Orleans, and the rural routes at various locations up and down river. The system provides basic ro-ro and passenger connections between towns and roads on the opposite side of the nation's largest and busiest river. The bridge connections which exist, even in New Orleans, are widely spaced in part due to difficulties and cost of construction, but moreover to minimize the navigational hazards of frequent bridges to the long and swiftly travelling shipping and barge rafts which negotiate the winding river. The river is now and has historically clearly been regarded as the primary transportation system, with the highways, bridges and ferries as secondary. Many similar systems exist further up the Mississippi and Ohio Rivers.

The routes are also characterized by two public management types, with most of the crossings operated by the state agency called the Mississippi River Bridge Authority, and the remainder operated by the local county or Parish governments (those noted with an asterisk in the above list). Several of the services were originally operated privately, but found the low volumes of riders were not adequate to sustain the routes economically. They were gradually taken over by the state or local governments when the hardships of long alternative vehicular trips via distant bridges were experienced, often adding as much as 60 to 80 miles to a work trip. The rural cross river routes providing cross river highway or town connections by ferry are in effect simply vehicular links in the local road system. The bridges are generally located only where there are Interstate river crossings, which are scarce in Louisiana. Present environmental regulations would most likely preclude any new highway bridges along the lower reaches of the river, if there were any increasing high volume or new demand.

The three New Orleans routes are different in function and much higher in volume than their rural counterparts. The Algiers, Gretna and Chalmette routes serve primarily as peak hour commuter carriers, following routes which connect major city streets as they have done for most of the 20th century, and carry large numbers of workers from residential areas predominantly on the north side of the river to industrial and maritime jobs on the south side. While Interstate alternatives exist to the ferry, for many trips passengers and vehicles can make shorter and quicker trips by ferry.

Distinguishing characteristics of the Mississippi River system include the following.

o The Rural Routes are Typical of Majority of U.S. Marine Highway Links: The low volume, short ferry crossing is typically the most cost effective way of providing links in the local road networks.

o The River as the Primary Transportation System, Ferry Crossings as Secondary; All of the routes recognize the river commercial navigation as primary particularly in the wide, swift, and winding lower reaches.

o Expansion or Contraction of the System is Unlikely; Since there is little growth likely in the east west transportation demand, and because the predominantly wetland character of the delta region presents environmental limitations on new roadways, the system is seen as relatively static.

o State Operation of Ferry Routes as Links in the State Road Network; The state takeover of the private ferry routes as essential though unprofitable highway or town links is typical of many low volume links which are crucial to the economic survival of the regions served.

9. San Juan Ferry System (Figure 3.35)

o San Juan (Agua Guagua) to Old San Juan to Catano

The recent expansion of the San Juan Bay ferry system represents an interesting application of the high-speed catamaran technology to a medium distance commuter and recreational use, and the development of an intermodal terminal to maximize utility of the system to the metropolitan area. The new passenger ferry route from Old San Juan near the cruise ship terminals to a newer area close to the financial district of Puerto Rico's capital city, combined with the 30 year old route from Old San Juan to Catano, a resort hotel area, to form a triangular loop. The Agua Guagua route provides primarily commuter service, while the Catano route is predominantly for tourism needs.

While San Juan has grown into a sprawling metropolis, the city's urban center continues to be concentrated along a densely developed corridor extending from old San Juan to the New Center financial district of Hato Rey. The dominance of this corridor as an activity center in the urban region and the heavy reliance on surface transportation have combined to create serious congestion problems along the city spine. Both ferry routes combine to help reduce traffic on the narrow and congested streets connecting the original colonial city center of Old San Juan around the peninsula to the other two terminal areas.

The intermodal facilities at the new Agua Guagua terminal near Hato Rey are carefully tailored to the specific surface transportation of San Juan. The terminal includes bus connections to the residential and shopping areas, auto drop-off and parking, and accommodation of the jitney bus system which serves as an essential transit mode in Puerto Rico. A small waterfront park and recreation area was incorporated into the 10 acre site development. The terminal also includes vessel fueling and servicing facilities. The vessels themselves are noteworthy as single level, 150 passenger catamarans, capable of operating at 20 to 25 knot speeds for portions of the route. The single level versions of the catamaran were used to allow for clearance under the low city street bridges which would have been extremely difficult and costly to alter. The $80.7 million project funding was assisted by DOT/UMTA grants including both the terminal and vessels.

Figure 3.34 - Mississippi River Bridge Authority Ferry System

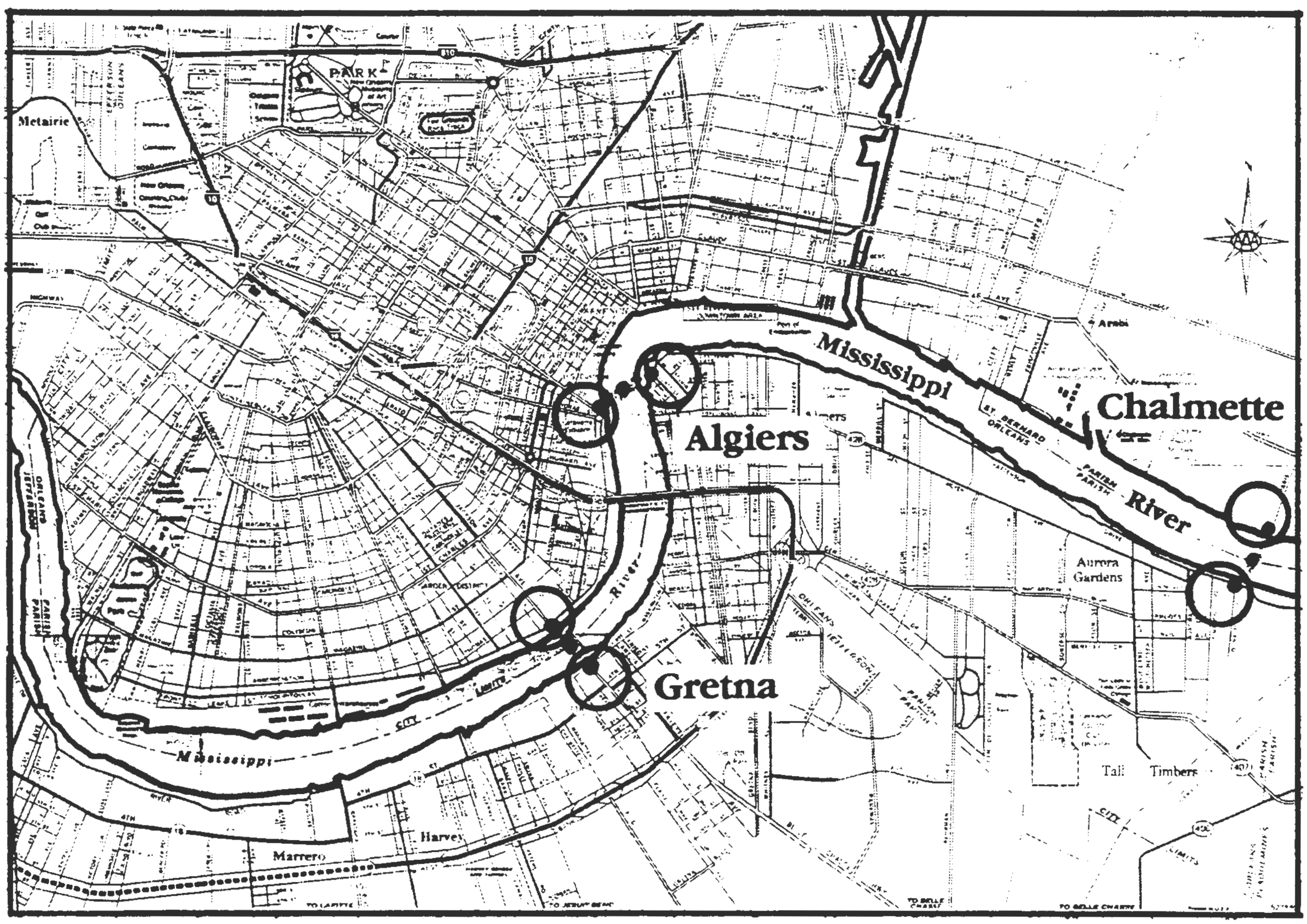
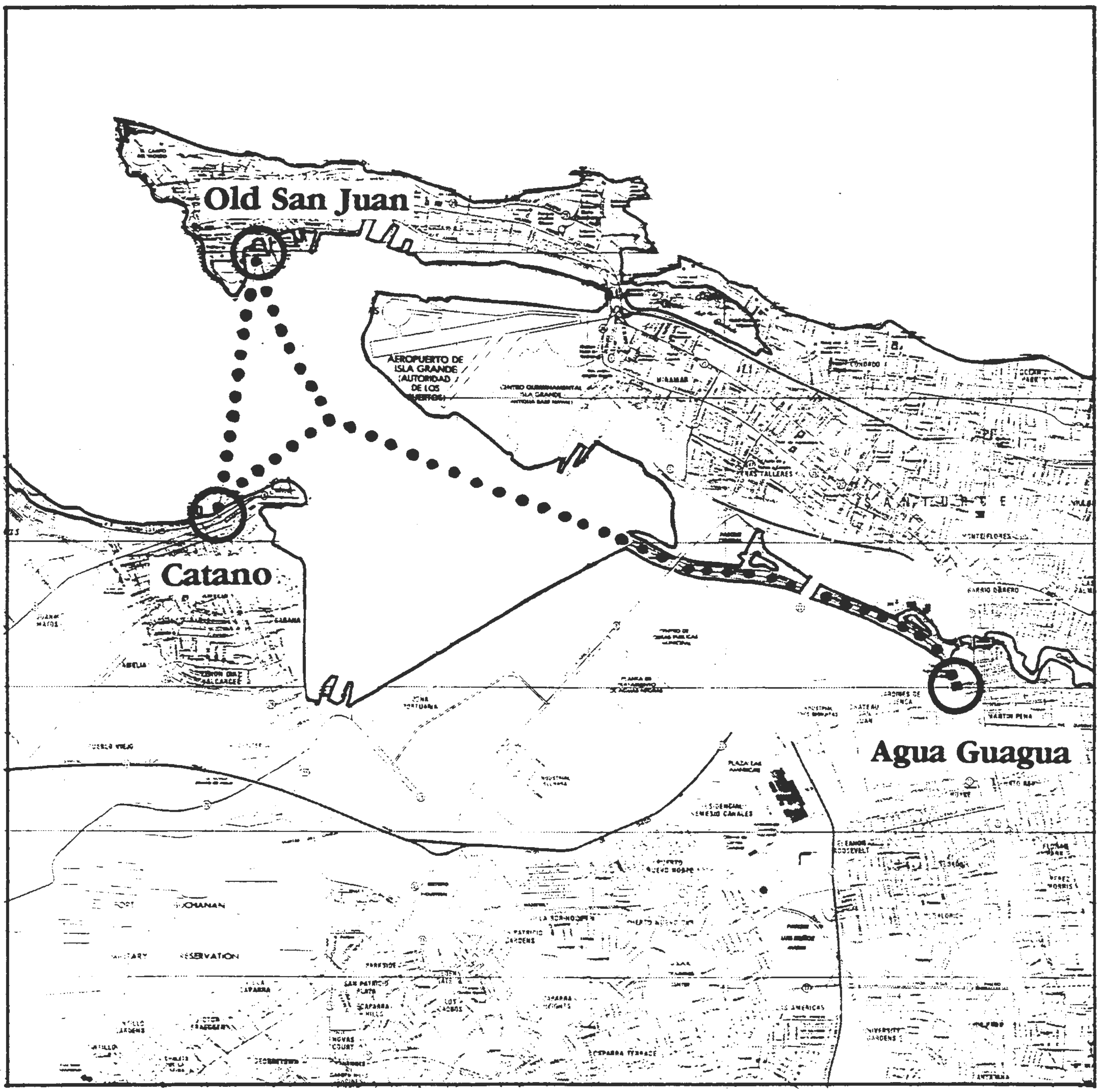


Figure 3.35 - San Juan Ferry System



It was reported that the Agua Guagua to Old San Juan route was no longer in service as of teh spring of 1994, but no reasons were available as to teh causes.

Key issues and innovations included in the San Juan system include the following;

oInnovative Use of High Speed Vessel Technology; The single level, high speed cats have proven to be both popular with an increasing ridership and efficient for the routes. By converting to the new faster vessels, it was possible to decrease operating costs per passenger while increasing ridership with the new and old routes combined. the net result was a decrease in public operating subsidy with the sizable long term capital investment.

o Intermodal Terminal Design; The inclusion of multiple surface transportation modes at the new terminal has made the system accessible to a broad population and user base. Inclusion of local jitney service connections is an appropriate response to contextual conditions.

o Long Term Public Capital Investment; The substantial capital costs of providing a new terminal, new high-tech vessels and canal dredging (to allow for vessel passage and storm water drainage), represents the type of long term, system-wide investment needed to achieve significant increases in ridership and corresponding reductions in landside traffic within a fixed infrastructure such as exists in many older cities.

4.0 Phase 1 Findings and Evaluative Criteria for Selection of Case Study Systems

4.1 System Planning Determinates: Decision-making Factors for Water-based versus Land-based Transportation

The detailed surveys of the 9 systems combined with the general surveys of the 25 systems have provided a basis for preliminary findings on the primary decision-making factors which may play a role in future choices between water and land based modes, as well as determinations of whether or not to expand existing systems. The categories of planning determinates are discussed in terms of likely contexts for choices and their relative importance to existing and emerging new systems. From the analysis of systems initiated during the past 40 years, including the two "historical" examples of Coronado and the Chesapeake Bay Bridge and Tunnel, as well as Seattle, it seemed useful to distinguish between choice determinates in three generalized time frames. Therefore three periods were identified; 1) for historic or older systems planned before 1970, 2) for currently operating systems or those planned between 1970 and 1990, and 3) for new systems recently planned and for those future systems after 1990.

4.11 Historic and Older System Determinates (Planned prior to 1970)

The context for transportation planning in the 1950's and 1960's should be noted as a backdrop for consideration of ferry system determinates. The era was one of extensive highway infrastructure construction including bridges and tunnels, and resulted in the termination of many private ferry services as new vehicular crossings were completed. Even the ferry services to islands which were necessary, began to be financially troubled and, as in the case of Seattle and Washington State were acquired by public agencies and were declared an extension of the highway network. The concept of waterborne passenger transit seemed to be embraced primarily in the case of necessity. The state decision to implement Alaskan Marine Highway certainly could be viewed as a choice of coastal water transport or none at all. The planning of the Golden Gate Ferry System in San Francisco in the mid 1960's appears to have been one of the first to make a deliberate choice between feasible land based and water based alternatives primarily for commuter passenger trips. The Cape May/Lewes ferry was also innovative in creating a long sought ferry link for purposes of regional development through completion of a long haul coastal highway route. The following observations pertain to the types of priorities reflected in pre-1970 planning.

Transportation Needs and Demand Levels: The era was marked by the rplacement of many ferry routes by bridges, tunnels and highways.

- large numbers of low speed/variable capacity ferry systems closed as a result of improved fixed new highway links (bridges,tunnels and causeways) in urban and rural areas, reflecting massive increases in auto and truck use and reflecting a general decline in transit ridership and rail cargo.
- new ferry systems started up in response to specific new transportation demands and limited options for land based highways, bridges or tunnels.
- continuation of island ferry connections for year round communities, and increases in services for expanding seasonal tourism.

Environmental Issues: Environmental concerns tended to be very general in nature because of limited awareness and pubic concern. Prior to the NEPA regulations, environmental response tended to be localized and few constraints were placed on bridge, tunnel or highway construction.

Geographical Conditions: On the other hand, local geographical considerations historically played a dominant role in choice of mode. However as technological advances made bridge and tunnel construction increasingly viable and highway trust funds became available for Interstate and other highway links, more and more ambitious bridge and tunnel projects were built in areas where vehicular traffic demand warranted higher capacities than the ferries could provide. Some routes remained geographically "unbridgeable" including islands and other difficult waterways.

Economic Development: Considerations were generally the same as those for highway plans, and would be included on a regional, but not necessarily on a localized basis. Exceptions included some urban areas such as the Coronado to San Diego Bridge which also had aspects of military need involved.

Cost Effectiveness: For historical systems the private operators gauged cost-effectiveness of their operations largely on whether or not they were profitable. When an operator found a particular route or service did not have sufficient demand to stay in business, the service would find another market or the vessel would be sold to another market area altogether. Because of the long useful life of the vessels, they might serve a wide range of geographical locations with similar route needs. By mid-century many older systems became redundant or no longer profitable. Where the services were still needed as in Seattle the state or public entities began to acquire and operate the systems, often with a subsidy and cost-effectiveness began to be measured as minimizing losses rather than maximizing profits. San Francisco's Golden Gate system became one of the first newly planned systems to consider cost-effectiveness in terms of trade-offs in capital expenditures between land and water based alternatives, and concluded that operating a ferry at a loss was cheaper in the long run and met regional transit objectives better than building a new bridge or rail system.

4.12 Current System Determinates (planned from 1970 to 1990):

The currently operating systems divide themselves between public and private systems and are seen to have evolved in various ways from their predecessors. The 70's and 80's were characterized by substantial regional transportation changes in many urban waterfront cities which led to the adaptation of existing networks and the addition of new ones. In non-urban ro-ro systems and in ferry to island services the changes were less noticeable except for a trend towards state or public management of financially troubled routes. The effects of new vessel technologies were not felt until the late 80's when higher speed passenger catamarans began to appear on longer routes. Many systems reliance on older vessel stock and proven designs was based on absence of new technologies and to a certain extent the limitations imposed by the Jones Act on the purchase and operation of foreign built vessels in domestic waters.

Transportation Needs;

- Essential passenger and ro-ro routes continued to operate and became accepted as legitimate links in highway and transit systems.

- Federal funding became possible for ferry systems if they were state sanctioned and operated, as national transportation policy evolved.
- Changing transit needs and opportunities in congested urban waterfront areas led to new public and private initiatives to reduce congestion, combined with decreasing options to build new highways and tunnels.
- Benefits of intermodal transit planning were tested in urban and non-urban ferry systems.

Environmental Factors: The most dramatic changes affecting mode changes may have been caused by increasing environmental awareness and legislation including federal NEPA and state laws.

- Protection of shorelines, wildlife habitat, and water quality began to impact ferry and bridge/tunnel planning; existing systems often were less affected than new ones, and ferries were often less disruptive than permanent linking structures.
- Community impacts, urban density, air quality standards and new transit initiatives affected landside transportation choices.
- Permitting processes on federal, state, and local levels became excessively time-consuming in many areas by the late 1980's and relegated ferry transit to primarily to the public sector.
- Water transportation began to be used successfully as temporary mitigation measures for landside infrastructure projects which were disruptive to existing traffic or transit systems.

Cost-Effectiveness: In many instances, particularly in urban areas and public systems, cost-benefit analysis became measured increasingly in terms of transportation and environmental trade-offs.

- Public transit system measures of cost-effectiveness began to include subsidy levels of ferries compared to land-based transit.
- Private operators found in some cases that providing a break-even transit service at cost could be offset by more profitable off-peak excursion services using the same vessels and crews.
- New vessel technologies were used successfully to introduce new, longer routes or improve service on existing routes.

Geographical Conditions; Considerations of geography and natural factors remain the primary determinate for system feasibility. Demographic patterns in urban areas began to combine with other geographical factors to open up new routes.

Economic Development; Ferry routes were introduced or expanded in selective locations to enhance economic opportunities, or to promote new projects or work destinations by providing a new and/or novel transit service, while also serving to reduce new traffic impacts.

- Private waterfront development projects introduced new ferry systems to promote a variety of residential, hotel, and office uses.
- Public ferry systems were introduced to support development or redevelopment of waterfront land areas, and provide transit access by water.
- Private operators sought out new markets and introduced new or sometimes recycled traditional vessel types to find new applications of ferries.
- Recreational and excursion ferry markets expanded in many areas both seasonally and year round, particularly to islands and in urban centers which experienced major tourism growth.

4.13 Future System Determinates (planned after 1990)

In considering how future decision making factors may change in level of importance, it is useful to reflect on recently implemented systems and current planning efforts for expansion of existing and provision of new systems. As with all the ferry networks considered, any generalizations must be qualified by the importance of the specific context in which a system operates. However, the survey analysis may suggest several trends in water transit planning which are worthy of further consideration. There are several decision categories in which the balance appears to be shifting.

Transportation Needs and Demand Levels: Transportation needs will continue to be paramount in any process concerning choice of water or landside transit and vehicular movement. The rural highway and town connections across waterways are likely to continue with periodic upgrades of vessel technology, but only when existing vessels come to the end of their useful lives since there is little operating revenue to offset costly new capital expenditures. Some fleets such as Casco Bay Lines, the Cape Cod to Islands and Cape May - Lewes systems actually have chosen not to change vessel technology to maintain consistency of service and terminals. However, as new high-speed vessels technologies are increasingly proven to be feasible regarding durability, operating cost efficiency, and production under the Jones Act, new water routes for commuter and recreational passenger systems will emerge, where slower traditional vessels could not compete. The increasing emphasis on intermodal land and water transit connections should also result in new techniques for increasing ridership. These new transportation innovations are most likely to take place in the urban waterfront contexts which are existing or potential sites for ferry operations, including the survey sites of Norfolk, Corpus Christi, and Narragansett Bay as well as non-survey sites such as Miami, and Baltimore.

Environmental Priorities: The factors which may combine in different proportions as water versus land based systems are the increasing environmental pressures to ease traffic congestion, improve air quality, and provide cost efficient alternatives to individual auto travel. Water transportation has great potential in many waterfront settings to respond to these combined pressures. However as the map of the 25 ferry survey sites (Figure 3.1) illustrates, the geographic distribution of water transit settings is uneven across the states, which places such initiatives at the state and more often regional level of decision making, rather than as a broad-based national level. The more broadly mandated environmental concerns are encouraging more efficient travel options and energy consumption, including water transporrtation where appropriate.

A related environmental issue for several recent systems involving intermodal travel, is the recognition that recreation and tourism services provided by ferries can function as integral components of balanced regional transportation systems. In situations where seasonal travelers can be encouraged to leave their private autos and board water transit, reductions in vehicle miles travelled (VMTs) can be achieved, with corresponding traffic reductions and air quality gains. A highspeed ferry service from Boston to the vacation destination of Martha's Vineyard which operated from 1988 to 1990 might have been considered as a long haul service achieving VMT reductions, while extensive water taxi networks such as the Baltimore and Fort Lauderdale service function as short haul services achieving similar environmental ends.

Cost Effectiveness: In the cases of larger urban areas where landside infrastructure modifications are difficult, and ferry systems are expanding, there seem to be two financial management approaches for these new transit services. In cities such as New York and Boston there is a trend towards privately operated water transit as a supplement to existing landside transit, with (Boston) or without (New York) public subsidy. In other cities which have a tradition and/or necessity for public funding and operations such as San Francisco, Seattle, and New Orleans, there appears to be continuing support for water transit as an integral part of the public transit system. For those areas encouraging market driven private ferry systems, or public/private hybrids, the public investments and planning efforts tend to be focused on facilitating the ferry systems in a variety of ways; 1) by constructing, maintaining and managing appropriately located terminal and berthing facilities, 2) providing market analysis and system operations planning, and 3) by offering economic incentives in terms of joint development opportunities at terminal sites. For those jurisdictions commited to publicly funded systems, there is an ongoing search to find more cost-efficient ways of providing the service and minimizing public subsidies. These may include; 1) offering schedules and routes which capture more recreational users such as San Francisco, Portland, and Alaska, or 2) conversely exploring other ways to add more commuter users such as San Juan and Norfolk-Portsmouth to existing recreational focused systems.

Economic Development: While ferry services are rarely the primary catalyst for economic growth, they are capable of helping to sustain economic development, such as continuing to serve offshore islands reliant on such services for seasonal visitation. In some instances new development may be seen as depending on water transit connections, as in the case of the new hotel at Bird Island Flats at the Logan Airport end of the shuttle from Rowes Wharf in Boston, or the proposed Spy House Harbor mixed use development next to the projected ferry terminal for the Bayshore in New Jersey. There are also likely to be new island and peninsula development sites discovered or rediscovered which can only be reached by boat and will be dependent on ferry routes for their success. Many undeveloped areas similar to the Florida Keys or other barrier islands might have great difficulty building new bridges or causeways at present or in the future because of environmental regulations. Similar land development opportunities in the future may have to rely primarily on ferry options for transportation.

4.2 Case Study Selection Criteria for Phase 2

Based on the foregoing decision factor descriptions and observations, the 9 case study examples may be evaluated for case study selection by considering how each reflects the issues of the various categories and what range of cases might be most useful to evaluate in greater depth. The following Table 4.1 presents a matrix which differentiates the systems by characteristic as a means of identifying similarities and differences.

4.3 Summary of Phase 1 Findings and Recommendations for Case Studies

The surveys conducted in Phase 1 have been useful in identifying general trends and directions water based transportation systems have taken with respect to land based alternatives in the past 30 years. They have also suggested some of the shifts in transportation policy and planning which may influence choices between land and water based movement systems in the future. Of the approximately 300 systems operating in the U.S. today, the surveys indicate that a small number of predominantly urban routes are accounting for the majority of passenger trips. Conversely the larger number of systems, predominantly non-urban, are carrying relatively few passengers on routes for which there are either no landside alternatives, or where those that exist are circuitous. Since both sets of systems are likely to continue to play important roles in their respective regional transportation networks, the more detailed Phase 2 case studies should include representative examples of both the higher volume urban and lower volume non-urban ferry routes.

Characteristics and decision-making factors which should be covered by the final case study systems selected included the following accompanied by the most representative examples;

o High Volume Urban Commuter Routes Without Feasible Land Based Alternatives;(Most likely to be publicly operated as part of a regional or state transportation system). **Seattle, Portland.**

o High/Medium Volume Urban Commuter Routes With Land Based Alternatives; (May be public or privately operated). **San Francisco, New York.**

o Non-Urban or Rural System Without Land Based Alternative; (most likely public). **Mississippi River.**

o Non-Urban or Rural Low Volume Highway Link; (most likely public). **Mississippi River.**

o Urban System with Regional Planning Process Determining Water Based Choice for New Routes: **New York, San Francisco.**

o Routes Utilizing New Technologies to Provide Cost Effective Service: **New York (Bayshore), San Francisco (Vallejo).**

o Routes Determined by Emerging Environmental Priorities: **New York, San Francisco.**

o Intermodal Systems Including Passenger and/or Ro-Ro Services: **Seattle, New York (Staten Island), Portland, Mississippi (New Orleans).**

o Mixed Commuter and Recreational Routes: **All Systems**

o Routes Supporting Economic Development: **All Systems.**

o Routes in Various Geographic Locations and Water Conditions: **All Systems.**

The list of systems recommended for more detailed case study analysis in phase 2 consisted of the following; **Seattle, San Francisco, Mississippi River, New York, and Portland.**

Table 4.1 - Comparative Analysis of 9 Systems by Similarities and Differences

System	Alt. Routes Yes/ No	Urban Long/ Short	Rural Long/ Short	Existing System	Expanding System	New System	Relevance
1.Seattle	No	Med.& Short	-	•	•	-	Commute ThruTraff Tour/Rec
2.Cape May-Norfolk	Yes (Bridge)	- Long	Long -	• •	_ -	- -	ThruTraff Tour/Rec
3.Alaska	No	-	Long	•	-	-	Island ThruTraff Tour/Rec
4.Boston	Yes	Short	-	•	•	•	Commute Tour/Rec
5.San Francisco	Yes	Med.& Short	-	•	•	•	Commute Tour/Rec Ves'lTech
6.New York	Yes & No	Med.& Short	-	•	•	•	Commute Tour/Rec Ves'lTech
7.Portland Casco Bay	No (Islands)	Med.& Short	-	•	-	-	Commute Tour/Rec Island
8.Miss.Riv. Ferries	No	Short	Short	•	-	-	Commute ThruTraf
9.San Juan -Old San Juan	Yes	Short	-	•	•	-	Commute Tour/Rec Ves'lTech

Appendix

A. System Data Logs

A.1 Seattle Ferry System

A.2 Cape May - Lewes/ Norfolk - Cape Charles

A.3 Alaska Marine Highway

A.4 Boston Harbor Network

A.5 San Fransisco Bay

A.6 New York and Cross Hudson

A.7 Portland - Casco Bay Lines

A.8 Mississippi River Ferry Network

A.9 San Juan Ferry System

Table A.1 Ferry System Data Log - 9 Systems **2/23/93**

SYSTEM: Seattle Ferry System **LOCATION: Puget Sound WA**

ROUTE(S): 1) Winslow, 2) Bremerton, 3) Vashon Island

1. System Description:

o Service Type:	Passenger/Ro-Ro; Commuter/Recreation
o Years of Operation:	1951 to present
o System Management:	Public (WA State Ferries)
o Dock Management:	Public (same)
o Passengers/Year	1) Winslow - P/3,488,116, V/1,824,857 2) Bremerton - P/1,576,487 3) Vashon - P/1,316,739, V/1,470,038

2. Route Characteristics

o Route(s) (map):	-3-
o Trip Distance/Time:	1) 8.5m/35min., 2) 18m/1hr., 3) 5m/35min.
o Schedule:	Daily
o Water Body/Type:	Puget Sound
o Environmental Issues	wake/wash

3. Alternative Transportation Modes:

o Primary Alternative(s) (map):	Through Takoma by highway.
o Secondary Alternative(s):	-
o Potential Alternatives:	-

4. System Management and Economics:

o Management Type:	Public, WA state DOT
o System Capital Costs:	NA
o Annual Operating Costs (Yr.1990):	NA
o Fare Receipts/Total System Income:	NA
o Subsidies:	Yes
o Transit/Recreational Income:	NA

5. Cost-Effectiveness:

o Capital Costs:	NA
o Operating Costs:	NA
o Environmental Benefits:	Major auto commute reduction
o Other Benefits:	Metro land-use growth management

6. Terminal Facilities:

o Terminal Locations (map):	7
o Modal Connections:	Intermodal terminals
o ADA Compliance:	Partial

System: Seattle

o Auto Parking/Bus Parking:	Good
o Terminal Management:	Efficient loading/offloading
o Joint Development:	Limited by State DOT
o Environmental Issues:	-

7. Vessel Technology:

o Type and Size:	1) 440ft.; Ro-ro and passenger
o Passenger Capacity:	1) 2000
o Vehicle Capacity:	1) 206
o Vessel Speed:	1) 15 knots
o Vessel Capital Cost:	NA
o Vessel Maintenance Costs:	NA
o Servicing:	NA
o Environmental Issues:	wake/wash
o Potential Vessel Alternatives:	limited

Table A.2 Ferry System Data Log - 9 Systems

SYSTEM: Cape May-Lewes Ferry **LOCATION: NJ and DE**

ROUTE(S): 1)Cape May NJ-Lewes DE

1. System Description:

o Service Type:	Long haul ro-ro highway link
o Years of Operation:	1964 to present
o System Management:	Public (Delaware River and Bay Authority
o Dock Management:	(same)
o Passengers/Year (1989)	P/1,050,000; V/360,000

2. Route Characteristics

o Route(s) (map):	Cape May NJ to Lewes DE
o Trip Distance/Time:	17mi./70 min.
o Schedule:	15 trips/day(summer); 4 trips/day(winter)
o Water Body/Type:	Mouth of the Delaware River/Atlantic Ocean
o Environmental Issues	Shoals, marsh (NJ)

3. Alternative Transportation Modes:

o Primary Alternative(s) (map):	Delaware Bay Bridge/I-95
o Secondary Alternative(s):	-
o Potential Alternatives:	-

4. System Management and Economics:

o Management Type:	Bi-state authority
o System Capital Costs:	$14.5m (1 vessel-1985)
o Annual Operating Costs (Yr.1989):	$9,334,916
o Fare Receipts/Total System Income:	$9,137,224
o Subsidies:	$197,692
o Transit/Recreational Income:	NA

5. Cost-Effectiveness:

o Capital Costs:	NA - long term
o Operating Costs:	$9.4m.
o Environmental Benefits:	Reduced traffic congestion on I-95 from NC to NJ
o Other Benefits:	Regional tourism, alt. truck route/Eastern Shore

6. Terminal Facilities:

o Terminal Locations (map):	2 - Lewes and Cape May
o Modal Connections:	Bus links, park and ride, bike paths
o ADA Compliance:	Partial
o Auto Parking/Bus Parking:	Both terminals
o Terminal Management:	Authority
o Joint Development:	Tourist Information, gift and food concessions
o Environmental Issues:	Wash and wake affect adjacent seasonal recreational uses (DE)

System: Cape May-Lewes Ferry

7. Vessel Technology:

o Type and Size:	Ro-ro/passenger,320 ft., 320 tons
o Passenger Capacity:	800 pass.
o Vehicle Capacity:	100 cars
o Vessel Speed:	16 knots
o Vessel Capital Cost:	$14.5m (1985)
o Vessel Maintenance Costs:	$2.6m (1989)
o Servicing:	at terminals
o Environmental Issues:	wake/wash
o Potential Vessel Alternatives:	limited by shoal draft, beam seas

Table A.3 Ferry System Data Log - 9 Systems

SYSTEM: Alaska Marine Highway **LOCATION: Alaska**

ROUTE(S): 1)Southeast Routes
2)Southwest Routes

1. System Description:

o Service Type: Long haul, ro-ro/passenger/mail/cargo/supplies
o Years of Operation: 1959 to present
o System Management: Public (Alaska Marine Highway System)
o Dock Management: (same)
o Passengers/Year P/413,000, V/111,000

2. Route Characteristics

o Route(s) (map): 1) Southeast, 2) Southwest; 3,500 miles
o Trip Distance/Time: 1200 mi./3.5 days to 17 mi./1 hr.
o Schedule: Year round
o Water Body/Type: Open ocean to protected sound
o Environmental Issues Extreme weather, education programs

3. Alternative Transportation Modes:

o Primary Alternative(s) (map): Air on some routes
o Secondary Alternative(s): -
o Potential Alternatives: -

4. System Management and Economics:

o Management Type: State
o System Capital Costs: $916,000 (1990)
o Annual Operating Costs (Yr.1990): $66,301,000
o Fare Receipts/Total System Income: $36,122,000
o Subsidies: $30,200,000
o Transit/Recreational Income: 80/20

5. Cost-Effectiveness:

o Capital Costs: NA
o Operating Costs: $66,301,000/yr
o Environmental Benefits: Avoided coastal highway construction
o Other Benefits: Increasing tourism and recreational use

6. Terminal Facilities:

o Terminal Locations (map): 31 ports of call
o Modal Connections: Bus, auto, air
o ADA Compliance: Partial
o Auto Parking/Bus Parking: Varies
o Terminal Management: State
o Joint Development: NA
o Environmental Issues: NA

System: Alaska Marine Highway

7. Vessel Technology:	
o Type and Size:	Ocean going ships; 193 ft./933 tons to 418 ft./3946 tons
o Passenger Capacity:	236 to 971; 4107 total
o Vehicle Capacity:	40 t0 180; 713 total
o Vessel Speed:	13 to 17 knots
o Vessel Capital Cost:	varies
o Vessel Maintenance Costs:	varies
o Servicing:	varies
o Environmental Issues:	Ship wake ansd wash
o Potential Vessel Alternatives:	New vessel tech.; last vessel built 1974

Table A.4 Ferry System Data Log - 9 Systems **2/23/93**

SYSTEM: Boston Harbor Ferry Network **LOCATION: Boston MA**
ROUTE(S): 1)Inner Harbor Shuttle(expansion), 2)Rowes-Logan Airport 3)Hingham Commuter Ferry,

1. System Description:

- o Service Type: Passenger commuter and airport shuttle
- o Years of Operation: 1) 1989 (4y.), 2) 1985 (8y.), 3) 1984 (9y.)
- o System Management: Public/MBTA (1,3); Public-private (2)
- o Dock Management: Public (1,3); Pub/priv (2)
- o Passengers/Year 1) 194,817,, 2) 181,530, 3) 605,290

2. Route Characteristics

- o Route(s) (map): 3 routes, 5 terminals
- o Trip Distance/Time: 1) 1.1mi/15 min., 2).9mi/10 min., 3) 9mi/25 min.
- o Schedule: 1) daily, 2) daily, 3) 5 days
- o Water Body/Type: Inner harbor (1,2), outer harbor (3)
- o Environmental Issues: Wake, noise

3. Alternative Transportation Modes:

- o Primary Alternative(s) (map): Transit, highway (parallel), tunnel, bridge;
- o Secondary Alternative(s): -
- o Potential Alternatives: Improved vessel technology

4. System Management and Economics:

- o Management Type: Public/private
- o System Capital Costs: Vary by route
- o Annual Operating Costs (Yr.1990): Vary
- o Fare Receipts/Total System Income: Vary
- o Subsidies: 50% (approx.)
- o Transit/Recreational Income: Varies by route

5. Cost-Effectiveness:

- o Capital Costs: NA
- o Operating Costs: NA
- o Environmental Benefits: Reduced traffic, VMT'S
- o Other Benefits: Increasing recreational use, mitigation for highway construction

6. Terminal Facilities:

- o Terminal Locations (map): 1) Charlestown Pier 4/Long Wharf, 2) Rowes/Logan Airport, 3) Hingham/Rowes
- o Modal Connections: Bus, auto, pedestrian
- o ADA Compliance: Partial
- o Auto Parking/Bus Parking: Varies by route
- o Terminal Management: Public (State, MBTA, BRA, Massport), private (Rowes Wharf)
- o Joint Development: Rowes Wharf, Logan Airport (hotels)
- o Environmental Issues: Wake/wash,

System: Boston Harbor Ferry Network

7. Vessel Technology:

o Type and Size:	1) 45ft. crew, 2)45ft. crew, 3) 90ft. to 120ft.
o Passenger Capacity:	1) 49p., 2) 49p., 3) 149-300p.
o Vehicle Capacity:	-
o Vessel Speed:	20-25 knots
o Vessel Capital Cost:	Varies
o Vessel Maintenance Costs:	"
o Servicing:	"
o Environmental Issues:	Wake/wash, noise
o Potential Vessel Alternatives:	Low wash catamarans

Table A.5 Ferry System Data Log - 9 Systems **2/23/93**

SYSTEM: San Francisco Bay Ferry Network **LOCATION: San Francisco CA**
ROUTE(S): 1)Golden Gate Ferry System, 2)Vallejo San-Francisco(expansion) 3)Oakland/Alameda-San Fran. (expansion)

1. System Description:

o Service Type:	Passenger; commuter and recreation
o Years of Operation:	1)1970 (23y.), 2)1986 (7y.), 3)1991 (2y.)
o System Management:	1) public, 2) pub/priv., 3) private
o Dock Management:	Public
o Passengers/Year	1) P/1,520,000, 2) P/250,000, 3)not operating

2. Route Characteristics

o Route(s) (map):	-3-
o Trip Distance/Time:	1) 5.5mi./25min.(Sausalito), 11.3mi./45min.(Larkspur), 2) 26mi./55min., 3) NA
o Schedule:	1) daily, 2) 5 days, 3) 5 days
o Water Body/Type:	San Francisco Bay
o Environmental Issues	Wake/wash, debris

3. Alternative Transportation Modes:

o Primary Alternative(s) (map)	1) Highway/bridge, 2) highway, BART, 3) highway/bridge, BART
o Secondary Alternative(s):	-
o Potential Alternatives:	1) New bridge, BART, 2) none, 3) none

4. System Management and Economics:

o Management Type:	1) Public, 2) pub/priv. 3) public
o System Capital Costs:	1) high, 2) high (proposed), 3) NA
o Annual Operating Costs (Yr.1990):	1) $9m
o Fare Receipts/Total System Income:	1) $3.5m
o Subsidies:	1) 60% state and local
o Transit/Recreational Income:	1) 67/33

5. Cost-Effectiveness:

o Capital Costs:	1) high, 2) high, 3) NA
o Operating Costs:	1) high, 2) high (proposed), 3)NA
o Environmental Benefits:	Traffic reduction, air quality improvements.
o Other Benefits:	Recreational use during off-peak

6. Terminal Facilities:

o Terminal Locations (map):	Embarcadero terminal, Sausalito, Larkspur, Vallejo, Oakland
o Modal Connections:	Good at both ends
o ADA Compliance:	Good at most terminals
o Auto Parking/Bus Parking:	Good
o Terminal Management:	1) public, 2)public/priv., 3) NA
o Joint Development:	Limited by BCDC and public mandate
o Environmental Issues:	Wake/wash at Larkspur, Vallejo

System: San Francisco Bay

7. Vessel Technology:

o Type and Size:	1) Highspeed monohull, 2) highspeed catamarans, 3) NA
o Passenger Capacity:	1) 300-500, 2) 250
o Vehicle Capacity:	none
o Vessel Speed:	1) 25 knots, 2) 30 knots
o Vessel Capital Cost:	1) $12m., 2) $2m.
o Vessel Maintenance Costs:	NA
o Servicing:	At terminals
o Environmental Issues:	Wake/wash
o Potential Vessel Alternatives:	Low wash catamarans

Table A.6 Ferry System Data Log - 9 Systems 2/23/93

SYSTEM: **New York and Cross Hudson** **LOCATION:** **New York City/New Jersey**

ROUTE(S):1)Staten Island Ferry **3) Bayshore-Manhattan**
2) Cross Hudson Routes (Weehawken and Hoboken) 4) Proposed New York Expansion

1. System Description:	1)	2)	3)	4)
o Service Type:	Pass./Ro-ro Commuter,	Passenger Commuter,	Highspeed Pass.Comm.	
o Years of Operation:	1905	1987	1986	
o System Management:	Public	Private	Private	
o Dock Management:	Public	Private/Public	Private/Public	
o Passengers/Year	21m.	2.65m.	.24m.	
2. Route Characteristics				
o Route(s) (map):	1	4	1	7
o Trip Distance/Time:	5mi./25 min.	1mi./10min.	20mi./50min.	
o Schedule:	Daily	5 days	5 days	
o Water Body/Type:	Upper NY Bay	Hudson River	NY Bay	
o Environmental Issues:	Wake/wash	-	Wake/wash	
3. Alternative Transportation Modes:				
o Primary Alternative(s) (map):	Bridge/tunnel	Bridge/tunnel/rail	Bridge/tunnel/rail	
o Secondary Alternative(s):	-	-	-	
o Potential Alternatives:	Highspeed vess.tech	-	-	
4. System Management and Economics:				
o Management Type:	Public	Private	Private	
o System Capital Costs:	NA	NA	NA	
o Annual Operating Costs (Yr.1990):	NA	"	"	
o Fare Receipts/Total System Income:	NA	"	"	
o Subsidies:	NA	"	"	
o Transit/Recreational Income:	NA	"	"	
5. Cost-Effectiveness:				
o Capital Costs:	NA	"	"	
o Operating Costs:	NA	"	"	
o Environmental Benefits:	Traffic Reduction and air quality			
o Other Benefits:	-	-	-	
6. Terminal Facilities:				
o Terminal Locations (map):	Staten Is./Battery	2NJ,2Manhattan	Highlands/Pier 11	
o Modal Connections:	Rail/bus/auto	Rail/bus/auto	Auto/rail	
o ADA Compliance:	Partial	Good	Partial	
o Auto Parking/Bus Parking:	yes	yes	auto	
o Terminal Management:	public	private	private/public	
o Joint Development:	no	future	no	
o Environmental Issues:	Wake/wash	no	wake/wash	

System:

7. Vessel Technology:

o Type and Size:	Pass./ro-ro	pass./100ft.	pass./80ft.
o Passenger Capacity:	1300-6000	150-300	250
o Vehicle Capacity:	25-45	-	-
o Vessel Speed:	12 knots	20 knots	35 knots
o Vessel Capital Cost:	NA	NA	$2.5m.
o Vessel Maintenance Costs:	"	"	NA
o Servicing:	"	"	"
o Environmental Issues:	Wake/wash	-	Wake/wash
o Potential Vessel Alternatives:	Pass.only	-	Low wash

Table A.7 Ferry System Data Log - 9 Systems **2/23/93**

SYSTEM: Portland - Casco Bay Islands **LOCATION: Portland ME**
ROUTE(S): Downtown Portland to 6 Islands

1. System Description:

- o Service Type: Pass. and Ro-ro
- o Years of Operation: 1871 - present
- o System Management: Public authority
- o Dock Management: Public
- o Passengers/Year 600,000

2. Route Characteristics

- o Route(s) (map): 6 islands to downtown
- o Trip Distance/Time: 2.5 - 10 mi./ 20-50 min.
- o Schedule: year round/ 7 days
- o Water Body/Type: Portland Harbor / Casco Bay
- o Environmental Issues Winter storms,wake

3. Alternative Transportation Modes:

- o Primary Alternative(s) (map): Private
- o Secondary Alternative(s): -
- o Potential Alternatives: -

4. System Management and Economics:

- o Management Type: Public authority
- o System Capital Costs: NA
- o Annual Operating Costs (Yr.1990): $1,505,481
- o Fare Receipts/Total System Income: $975,661
- o Subsidies: $530,000
- o Transit/Recreational Income: 360/600 summer/year

5. Cost-Effectiveness:

- o Capital Costs: NA
- o Operating Costs: NA
- o Environmental Benefits: No alts.
- o Other Benefits: Allows year round island population

6. Terminal Facilities:

- o Terminal Locations (map): 7
- o Modal Connections: New multi-modal terminal
- o ADA Compliance: Partial
- o Auto Parking/Bus Parking: Good/downtown:300cars/6 busses
- o Terminal Management: public
- o Joint Development: concessions,downtown parking
- o Environmental Issues: all piers multi-functional

System: Portland - Casco Bay Islands

7. Vessel Technology:

o Type and Size:	4 passenger/90ft, 2 ro-ro
o Passenger Capacity:	250-350
o Vehicle Capacity:	1-12 cars
o Vessel Speed:	8 knots
o Vessel Capital Cost:	NA
o Vessel Maintenance Costs:	$350,000 (1990)
o Servicing:	at downtown terminal
o Environmental Issues:	low speed, low wake
o Potential Vessel Alternatives:	higher speed, low wake

Table A.8 Ferry System Data Log - 9 Systems 2/23/93

SYSTEM: Mississippi River Ferry System **LOCATION: Louisiana**
ROUTE(S): 8 by Mississippi River Bridge Authority
3 by Local Parishes

1. System Description:
o Service Type: passenger/ro-ro
o Years of Operation: varies by route
o System Management: public; state/parish
o Dock Management: "
o Passengers/Year: 1) New Orleans, 2) Miss.River/State, 3) Parishes,

2. Route Characteristics
o Route(s) (map): see map
o Trip Distance/Time: varies
o Schedule: year round, 7 days
o Water Body/Type: Mississippi River
o Environmental Issues: river navigation, flooding

3. Alternative Transportation Modes:
o Primary Alternative(s) (map): bridges at infrequent intervals
o Secondary Alternative(s): -
o Potential Alternatives: more bridges

4. System Management and Economics:
o Management Type: state and parish
o System Capital Costs: NA
o Annual Operating Costs (Yr.1990): NA
o Fare Receipts/Total System Income: minimal fares
o Subsidies: high
o Transit/Recreational Income: NA

5. Cost-Effectiveness:
o Capital Costs: NA
o Operating Costs: "
o Environmental Benefits: traffic reduction along circuitous routes
o Other Benefits: avoids costly bridge constructiion

6. Terminal Facilities:
o Terminal Locations (map): see map
o Modal Connections: New Orleans
o ADA Compliance: varies by route
o Auto Parking/Bus Parking: "
o Terminal Management: public
o Joint Development: no
o Environmental Issues: varying river level

<u>System:</u> Mississippi River Ferry System (LA)

<u>7. Vessel Technology:</u>

o Type and Size:	varies
o Passenger Capacity:	"
o Vehicle Capacity:	"
o Vessel Speed:	"
o Vessel Capital Cost:	"
o Vessel Maintenance Costs:	"
o Servicing:	"
o Environmental Issues:	no
o Potential Vessel Alternatives:	newer tech.

Table A.9 Ferry System Data Log - 9 Systems **2/23/93**

SYSTEM: San Juan **LOCATION: San Juan PR**
ROUTE(S): 1) Agua Guagua-Old San Juan
2) Catano-Old San Juan

1. System Description:

o Service Type:	Passenger, commuter/recreation
o Years of Operation:	1) 1989, 2) 1962
o System Management:	public
o Dock Management:	"
o Passengers/Year	2.1m.

2. Route Characteristics

o Route(s) (map):	triangular
o Trip Distance/Time:	1) 4 mi./18 min., 2) 1.4 mi./10 min.
o Schedule:	yr. round/daily/15hrs.
o Water Body/Type:	San juan bay
o Environmental Issues:	wake in canal

3. Alternative Transportation Modes:

o Primary Alternative(s) (map):	arterials/highway/bus/jitney
o Secondary Alternative(s):	city streets
o Potential Alternatives:	additional ferry routes

4. System Management and Economics:

o Management Type:	public
o System Capital Costs:	$80.7m.(1989)
o Annual Operating Costs (Yr.1990):	$3m.
o Fare Receipts/Total System Income:	$1.4m.
o Subsidies:	53%
o Transit/Recreational Income:	50%

5. Cost-Effectiveness:

o Capital Costs:	$80m.
o Operating Costs:	$2m. yr.(projected)
o Environmental Benefits:	traffic reduction, air quality
o Other Benefits:	tourism, recreation

6. Terminal Facilities:

o Terminal Locations (map):	3
o Modal Connections:	bus,jitney,auto,pedestrian
o ADA Compliance:	good
o Auto Parking/Bus Parking:	Agua Guagua
o Terminal Management:	public
o Joint Development:	no
o Environmental Issues:	dredging of canal, wake in mangroves

System: San Juan

7. Vessel Technology:

o Type and Size:	high speed catamaran, 80ft.
o Passenger Capacity:	150
o Vehicle Capacity:	-
o Vessel Speed:	25 knots
o Vessel Capital Cost:	$2.1
o Vessel Maintenance Costs:	NA
o Servicing:	NA
o Environmental Issues:	wake/wash
o Potential Vessel Alternatives:	low wash catamarans