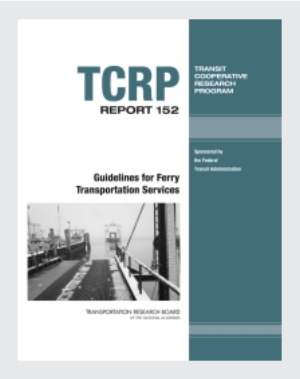

Guidelines for Ferry Transportation Services

DETAILS

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AUTHORS

Anthony Bruzzone; Transportation Research Board

TRANSIT COOPERATIVE RESEARCH PROGRAM

TCRP REPORT 152

Guidelines for Ferry Transportation Services

Anthony Bruzzone
ARUP NORTH AMERICA LTD
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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions,* published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), Transportation 2000, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

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The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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Lawrence D. Goldstein, *Senior Program Officer*
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AUTHOR ACKNOWLEDGMENTS

Lauren Dong
Arup North America Ltd

Ian Austin
URS Corporation

Tom Fox
The Fox Group

Veronica Raymonda
Quantum Market Research

FOREWORD

By Lawrence D. Goldstein
Staff Officer
Transportation Research Board

TCRP Report 152 examines the history and characteristics of ferry systems throughout North America and, based on this review, develops guidelines for planning, marketing, operating, and managing a ferry system as a component of an overall transportation network. These guidelines examine the potential benefits of and impediments to ferry transportation services and help establish planning, operational, and management benchmarks: (a) ability to increase capacity of the local, regional, or national transportation network; (b) potential to reduce travel congestion; (c) degree of potential environmental mitigation; (d) potential effect on local and regional economies; (e) procedures for measuring cost-effectiveness; and (f) ability to contribute to disaster/emergency preparedness. Included are criteria that transportation system planners and decision makers can use to evaluate the viability of proposed ferry services as a function of specific location, travel demand, and overall market conditions.

The guidelines are aimed at policymakers who are considering ferry services as a transportation option, entrepreneurs who are considering investing in new or expanded ferry services, and existing operators who could use the "how-to" portions of this research. The guidelines identify those factors that help create competitive ferry service in specific markets, particularly where roads and bridges are congested, where ferries can offer direct paths of travel, and where markets are large enough to support capital and operating expenses associated with provision of ferry services.

Ferry service in the United States has experienced resurgence in popularity and interest in the past 10 to 15 years. Increasing levels of automobile congestion across the country, the rising cost for expanding public transit, and the development constraints on new infrastructure have in some locations combined to make waterborne transportation an attractive alternative. While ferry transportation is one of the oldest forms of public transit in the United States, it is only recently that ferry services were recognized as another public transit operation in league with buses, trains, and subways. In response to potential changes in market conditions, the objective of this research was to prepare a practitioner's guide for the ferry industry: to review experience of existing systems; to extract typical planning, development, and operating parameters; and to help establish a systematic planning and development procedure.

To prepare this study, the research team began with a broad literature search, reviewed planning documents available from many levels, and supplemented that review with an in-depth study of eight ferry systems operating in various places throughout the United States as well as in British Columbia. A major component of this research was a review and analysis of best practices based on a thorough study of experience. Additional information is contained in the two appendices that accompany the guidelines: Appendix A, which provides

a bibliography, and Appendix B, which summarizes the ferry operators' survey that was used to gather original data on each system included.

The product of this research is a set of ferry system planning and development guidelines incorporated into two major sections. The first section reports on the background research underpinning the analysis. This section includes information gathered through implementing the eight case studies—documenting specific system planning, development, and operating experience. It also summarizes unique experience with special circumstances, from the heroic disaster response the New York Harbor ferries handled three times over the last decade (9/11, the Northeast Blackout, and US Airways Flight 1549's landing in the Hudson), to the response to special environmental conditions that can be a pitfall in system realization when not adequately addressed as part of the planning process.

The research stresses that no individual ferry system is typical. In many ways, each system is unique; however, each offers examples of practice and system information resources adaptable to specific market area conditions. What emerges from this study is an ordered approach to the ferry service planning and development process, leading the user through two significant phases: actual strategic planning and preparation of an effective business plan for implementation and system operation. These guidelines focus on strategic planning issues, suggesting criteria for consideration during the planning and development process. The guidelines also examine how ferry system planning should be integrated into the statewide transportation planning process and summarize the role of federal regulatory agencies. Based on the review of the related literature together with the case study analysis, the guidelines conclude that successful ferry system planning and development requires strategic placement of the ferry product and preparation of a comprehensive business plan that incorporates the following components:

- Business description and vision;
- Definition of the market;
- Description of products and services;
- Organization and management;
- Planning, marketing, and sales; and
- Financial management.

CONTENTS

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.

PART 1

Background Information and Case Studies

SECTION 1

Introduction

Background

The purpose of this research is to investigate the state of ferry transit operations in North America and to develop practitioners' guidance for the planning, marketing, operation, and management of ferry transportation systems. The research is intended to present a uniform understanding of the status of ferries as well as options for how to approach planning and operational activities. This guidebook is intended for use by operators large and small, in publicly or privately owned operations, for the development of ferry operations as a solution to a transportation need.

This research was developed through literature searches of previous studies, reviews of existing government and state documents, telephone interviews with a broad selection of ferry operators, in-depth case studies of eight ferry operators/ferry systems geographically dispersed across the North American continent, and peer review of the interim documents.

The main body of this report contains the case studies and a guidebook. Two appendices provide additional information to support the work documented within the main body of the report. Appendix A provides a listing of literature review sources, and Appendix B documents the results of a survey of ferry operators that was developed and implemented in this research.

Objectives and Methodology

The overall purpose of the research reported herein was to develop guidance for selecting water/ferry transit as the appropriate solution to an access requirement and guidance for operating ferry services.

An initial task was to develop a definition of ferry service in order to focus the practice guidelines. Additional tasks focused on segmenting ferry service types, identifying appropriate roles for ferry service, and spotlighting operational practices to ensure well-operated and safe ferry systems. The end result is a list of criteria that decisionmakers and potential ferry operators can use to test the viability of potential services and operations.

An important output of the research is a ferry service development process work flow that outlines the steps necessary to take a ferry project from conception to initiation (see Figure 1-1).

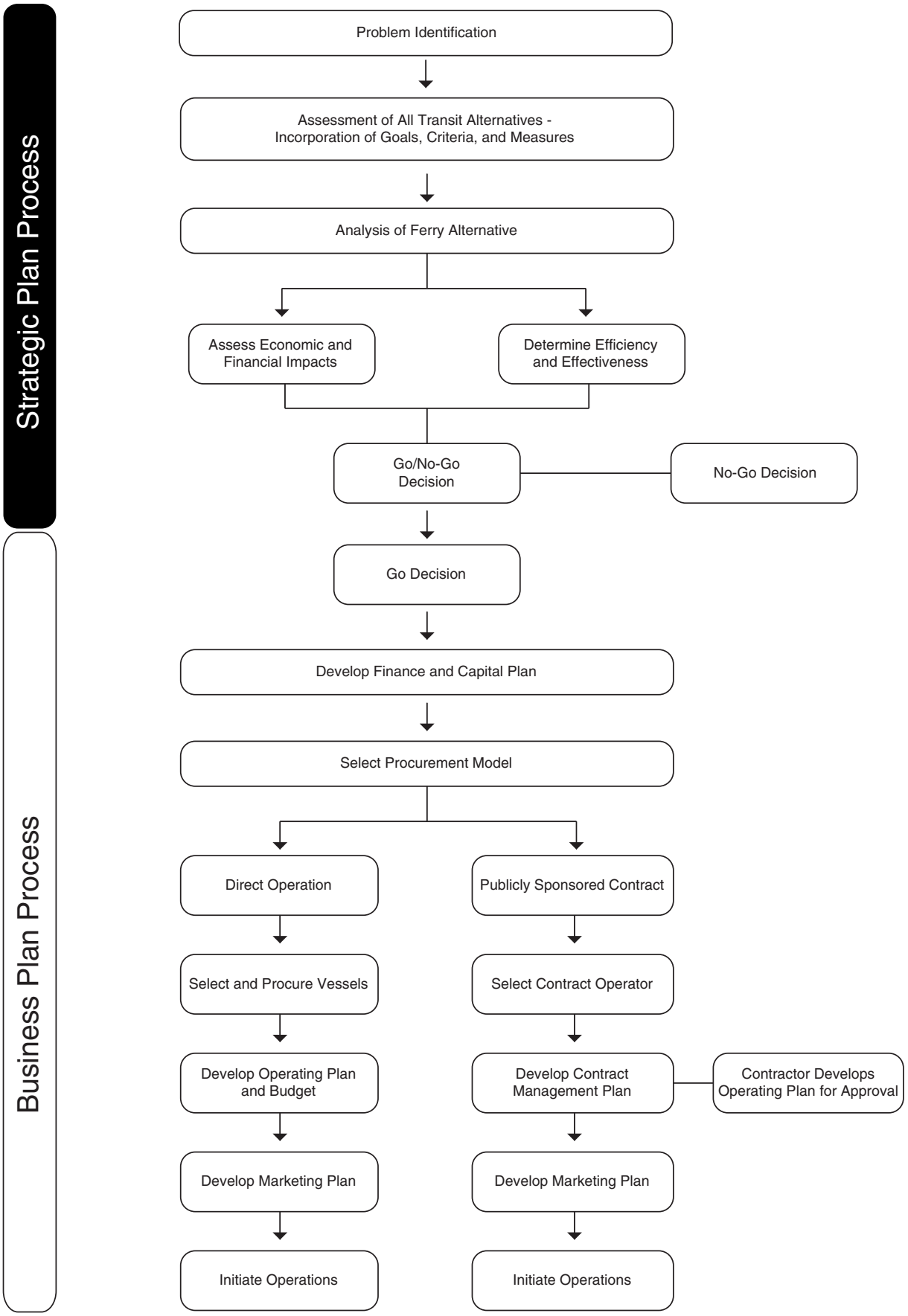

Figure 1-1. Ferry service development process.

Report Organization

This report is divided into two parts. Part 1 provides background information on ferry service and presents case studies of ferry service. Part 2 presents guidance for practitioners and policymakers.

Part 1 includes Sections 1 through 5. Following Section 1 (this section), which introduces the study, is Section 2, which provides a definition of the ferry services considered herein. Section 3 identifies ferry service typologies, and Section 4 lists the stakeholders and institutions affecting ferry services in the United States. Section 5 presents case studies of eight ferry operators (whose experiences and findings impact the report guidance).

Part 2 includes Sections 6 through 9. Section 6 is an introduction to and summary of the practitioners' guide to ferry services. Section 7 focuses on strategic planning issues. Section 8 expands on Section 7 by providing discussion of the key issues (often logistical) in ferry management and operations and approaches to these issues. Section 9 discusses ferry services within an overall strategy (either a corporate, private-sector strategy or a metropolitan or statewide transportation strategy) and then provides guidance on developing a business plan for the ferry operation.

SECTION 2

Definitions and Types of Ferry Services

An important initial task is to define the ferry operations considered in this guidance. In the context of this research, ferry transportation is a transportation route similar to that provided by a highway or a railway.

Definitions

Merriam-Webster's Collegiate Dictionary defines the noun form of the word "ferry" as "a place where persons or things are carried across a body of water (as a river) in a boat" (Merriam-Webster Inc., 2003), and *The New Oxford Dictionary of English* defines ferry as "a boat or ship that carries people, vehicles and goods across a river or across a narrow part of the sea" (Oxford University Press, 1998). The *Random House Unabridged Dictionary* defines a highway as "any public road or waterway" (Random House, 1997).

Government legal definitions take this ordinary language and refine the definition of ferry service more specifically to be a transportation service using a boat or vessel as a common carrier for passengers or passengers and vehicles (as a highway is open to all users), in a highway use (for purposeful travel between two points), within a specific "narrow" waterway. A vessel, therefore, traveling from New York to Lisbon, is not a ferry because it is not a narrow waterway. A freight-only service is also not a ferry. Given these definitions, this research considers ferry service as a passenger transportation service that can also provide vehicle transportation, but that does not include non-point-to-point sightseeing marine services or freight shipping. Marine services that serve purposeful travel to and from recreational areas are considered ferries.

The Bureau of Transportation Statistics (BTS) of the U.S. Department of Transportation acknowledges two types of ferry public transit modes: Ferry Transit (BTS Ferry Transit) and Ferry Intercity (BTS Ferry Intercity). BTS Ferry Transit is defined as scheduled ferry service running between points within a city or the same metropolitan area while BTS Ferry Intercity is defined as scheduled ferry service running between points that are not within the same metropolitan area or are not located in any metropolitan area (RITA, accessed April 8, 2010).

In at least two states (North Carolina and Washington) and one territory (U.S. Virgin Islands), the state ferry systems are considered as part of the overall state highway system, as they provide critical linkages as part of the state's transportation system.

On April 8, 2010, the U.S. Maritime Administration (MARAD) released its final rule defining the new Marine Highway Program that was originally established on October 9, 2008. While the term "marine highway" has been loosely used to describe ferry transit service, the new MARAD rule firmly defines the term "marine highway" to refer exclusively to short sea transportation. Thus, the term "marine highway" does not refer to ferry transit, but the word "highway" can be

used to refer to ferries within a state's highway system. In the states of Washington and North Carolina, the state-operated ferry systems are considered as part of the states' highway system, waterway routes that are an extension of the roadway system. In this instance, ferry routes are part of an overall highway system.

Based on the U.S. government documents discussed above and on the case studies developed for this project, ferry service can be categorized into the following:

- Transit (no vehicle access):
  - Ferry Urban—consisting of scheduled service between points within a city or metropolitan area (Under the BTS scheme, this would be BTS Ferry Transit).
  - Ferry Intercity—consisting of scheduled service between metropolitan areas (Under the BTS scheme, this would be BTS Ferry Intercity).
- Highway
  - Ferry Essential—consisting of scheduled service between points outside a metropolitan area or between metropolitan areas and providing vehicle access (primarily BTS Ferry Intercity although some are categorized as BTS Ferry Transit) almost always in areas without direct roadway access.

Types of Ferry Service

Varying types of ferry service are provided across the country. As defined in the second edition of the *Transit Capacity and Quality of Service Manual* (Kettleson & Associates, Inc., et al., 2003), the various service configurations include water taxis, passenger ferries, and automobile ferries.

Water Taxis

Water taxis are small watercraft that typically serve short cross-waterways or waterway circulation routes. Water taxis do not operate on fixed routes or use time-based schedules; rather, they operate on an on-demand basis, with service being variable throughout the day, depending on demand. (Because water taxis do not operate on a fixed route, they are not considered in this research. There are some marine services that have all the other aspects of ferry services—scheduled service, purposeful trips, and so forth—which are marketed as water taxis; however, in this study they are considered ferries.)

Passenger Ferries

Passenger ferries are larger vessels that have higher passenger capacities and speeds than water taxis and that typically serve short- to moderate-length routes. This kind of ferry service will be referred to as "ferry transit" in this report. Passenger ferries operate on fixed routes with time-based schedules. Examples of passenger ferries operating within a metropolitan area include the New York Harbor cross-Hudson ferries, operated by NY Waterway, NY Water Taxi, and other carriers using 120–150 passenger-only vessels.

Some passenger-only ferries operate between metropolitan areas or provide access to rural areas. These are categorized as Ferry Intercity, and examples include the U.S. Virgin Island ferries, the Victoria Clipper from Seattle, Washington, to Victoria, British Columbia, and the various ferry services operating between Cape Cod and Martha's Vineyard in Massachusetts.

Automobile Ferries

Automobile ferries—also known as roll-on, roll-off (RO-RO) ferries—transport vehicles as well as passengers. They are typically used on longer routes across major bodies of water and on

low-volume rural roads crossing rivers. Automobile ferries operate on fixed routes with time-based schedules. Examples of automobile ferries include state ferry systems in North Carolina, Washington State, and in British Columbia. Some of these services can be categorized as BTS Ferry Transit (i.e., the Washington State ferry system, which connects Kitsap County to Seattle with ferry routes as short as 10 miles), but most are BTS Ferry Intercity since they generally connect areas that are distinct metropolitan areas or connect metropolitan areas to rural areas. For the purposes of this report, any vessel on a fixed route that carries automobiles will be referred to as "ferry highway."

SECTION 3

Ferry Service Typologies

This research included a literature review of research on ferries over the last 20 years. This work identifies current ferry industry practices and procedures based on the literature review and an extensive survey of ferry operators that was developed for this report.

The 2008 National Census of Ferry Operators (from BTS) reported that ferries operated on more than 350 routes spanning 37 states and three U.S. territories, as well as connecting to seven international destinations. BTS estimates that more than 100 million passengers use U.S. ferries annually. The largest ferry systems were the Staten Island Ferry, which carried 23 million passengers, and the Washington State Ferry, which carried 13 million foot passengers and 11 million vehicles and vehicle passengers (RITA, accessed April 8, 2010).

Ferry Functions

Ferries provide three basic transportation functions in the United States within the definition of ferry service. These functions are the fundamental backbone of ferry service, with a hierarchy of importance in relation to regional landside transportation networks (Norris, 1994):

- **Essential ferry routes with no viable land-based alternatives** (called Ferry Essential in this report). These are essential ferry routes that provide year-round service to island or water-isolated areas that cannot be reached by road, bridge, or tunnel. These routes typically are operated by a public entity that is part of the regional transportation network, although they may be operated by private entities under government authorization. The routes are seen as marine highways to offshore communities that provide passenger, vehicle, and freight transfer to the mainland. Examples include the North Carolina Ferry System, Washington State Ferry, British Columbia Ferry System and the U.S. Virgin Island ferries, among others.
- **Complementary ferry routes that are more efficient than land-based alternatives.** These routes compete aggressively with automobile and potentially other public transit modes for time savings and accessibility. These routes are often commuter oriented. A good example is the Staten Island Ferry in New York, which provides a direct, 5-mile connection between Manhattan and Staten Island. The corresponding automobile trip is about 16 miles.
- **Optional ferry routes with equivalent land-based alternatives.** Optional ferry routes provide alternatives to automobile travel that may represent some time savings, exhibit greater reliability, and provide more amenities. The main goal of increased travel options is to provide alternatives to roadways, bridges, and tunnels that may be congested and overcrowded, thereby encouraging people to change travel modes. In the San Francisco Bay Area, the Vallejo Ferry operates on a 30-mile route between downtown Vallejo, a redeveloping industrial town, and downtown San Francisco. Both the ferry route and the parallel Interstate 80 are about the same distance to downtown San Francisco. However, during the peak period, Interstate 80 is extremely

congested, with travel times approaching about 70 minutes, while the trip on the 34-knot (39-mph/63-kph) ferry is scheduled to be about 55 minutes, a savings of about 20 percent (Vallejo Baylink Ferry, accessed December 3, 2010).

Ferry service can be further divided by geography. A typical ferry route is, on average, 11 to 30 minutes, although routes exceeding 2 hours are also common (up to about 40 miles or 65 kilometers). Ferries travel on waterways that are intercoastal (along the coastline), intracoastal (lakes, rivers, bays, and sounds), and international. These waterways cross urban, coastal, and rural regions (Norris, 1994):

- **Urban areas.** Services provide trips within a metropolitan commuting area, with fixed schedules, sometimes with consistent "clock" headways, but sometimes with inconsistent frequencies. Often, fixed-frequency schedules vary daily to accommodate commuters. Services include point-to-point transit (e.g., across a harbor), linear service with multiple stops (e.g., along a waterfront), circulator service (e.g., fixed route but not fixed schedule), and water taxi service (e.g., fixed landings with passenger pickup on demand). One example is the San Francisco Bay Area where six ferry routes connect the suburbs with downtown San Francisco. Other examples include New York, where 21 weekday routes provide scheduled service across the Hudson and the East River into Manhattan. In addition, Seattle and Boston use commuter ferries within highly urbanized areas and Vancouver has a ferry connecting North Vancouver to the central business district (the SeaBus).
- **Coastal areas.** Services provide intercity and inter-island trips on saltwater and large freshwater lakes. Travel times range from 1 hour to 1 day. Service frequency ranges from daily to weekly and may vary seasonally. Examples include the Lake Express and the Lake Michigan Car Ferry, operating from Michigan to Wisconsin across Lake Michigan; the ferries connecting Connecticut to Long Island, New York (Cross Sound and Port Jefferson Ferries); as well as the Washington State Ferry System and the British Columbia Ferry Services (BC Ferries).
- **Rural areas.** Services provide transportation across rivers and lakes where the construction of bridges is not warranted. Typically, these routes are short, carry a limited number of vehicles, and accommodate pedestrians and bicycles, and sometimes even operate on demand. Examples include the Bluewater Ferry operating between Marine City, Michigan, and Sombra, Ontario; the Cave-in-Rock Ferry between Kentucky and Illinois; the Washington Island Ferry in Door County, Wisconsin; and ferry services in North Carolina.

Ferry systems can also be categorized according to other characteristics, including the following (Norris, 1994):

- **Commuter and recreational/tourism ferry.** Many ferry systems historically have operated a combination of commuter and recreational service, especially private operators who want to optimize the use of their vessels. Public operators also offer off-peak and weekend service in addition to commuter routes.
- **High-volume routes.** These routes operate frequently, either as highway ferries or as transit passenger ferries, but do not represent a large number of services.
- **Low-volume highway or transit link.** The vast majority of the ferry routes operating in the United States are relatively small routes with low volumes that serve as substitutes for bridges or tunnels or provide service between islands and the mainland.
- **International, interstate, intrastate, or intercity operations.** Most systems operate within one jurisdiction. Systems that cross state or country boundaries typically have different operating characteristics than those of commuter and recreational/tourism ferries. Systems in Alaska and Washington are examples where additional amenities and services are provided for longer journeys.
- **Public, private, or public/private operations.** In the United States, there are three types of operations that provide waterborne transportation. Public systems provide ferry service where

there is a gap in the transportation network. Private systems operate in the same fashion but without public subsidies; therefore, they tend to be located in places where demand is high enough to generate a profit. A public/private system is one in which a public entity subsidizes the operation of a private contractor.

- **Existing, expanding, or new ferry systems.** Systems can be categorized according to whether they are expanding operations (adding more trips or routes to an existing service), launching a new service, or maintaining an existing level of service (e.g., the Staten Island Ferry in New York).

Ferry Route Typology

This report uses three "identifiers" for ferry routes—Ferry Urban, Ferry Intercity, and Ferry Essential —and then uses a further typology that can be applied to the ferry route identifiers.

Given the wide range of ferry services operating in the United States, understanding the different markets for ferry systems is important for making planning decisions about new routes and services. These markets can be considered part of a typology including the following (Norris, 1994):

- **Ferry in lieu of bridge or tunnel.** While bridges and tunnels have replaced many ferry systems, some systems have not been replaced. More recently, ferry systems have been initiated to avoid constructing a new bridge or tunnel. The ferry service is seen as a lower cost, more efficient alternative to costly infrastructure projects. Good examples include the Washington State Ferry System, where the state purchased the existing private ferry operators until fixed links could be built. A few years later, policymakers decided to abandon new bridges in favor of continuing the ferry system.
- **Ferry in lieu of parallel highway or rail.** Where land availability is constrained or building a new highway or rail route is too costly, the decision to maintain or implement a ferry service is selected. BC Ferries Inland Passage service between Prince Rupert and Port Hardy serves isolated coastal and island communities including Bella Coola, Bella Bella, Klemtu, and Shearwater and is an example of this type of service. The Alaska Marine Highway System also operates on the Alaska portion of the Inland Passage from Prince Rupert to Skagway, with about a dozen stops along the routes (BC Ferries, 2010).
- **Ferry to island(s).** One of the fundamental tasks of ferry systems is to serve areas without other means of access. Connecting islands with the mainland is a common service of many ferries in the United States and is also the backbone for many systems that provide other commuter-oriented routes. Examples include ferry service to Martha's Vineyard and Nantucket (MA), Washington Island (WI), and Mackinac Island (MI), and ferry service in the U.S. Virgin Islands.
- **Ferry in addition to parallel bridge or tunnel.** Water transportation services often operate in parallel with existing bridges or tunnels. Older systems rely on ridership gained from years of operation, while newer systems can be implemented to provide additional commuting options when bridges and tunnels are congested. The best example of this policy decision is the Golden Gate Ferry System. More than 40 years ago, the Bridge District directors decided to increase corridor capacity by instituting a ferry system rather than adding highway and bridge capacity. Today the ferry services provide about 1,600 seats during the peak hour, or the same capacity as about three-quarters of a highway lane. New York implemented a similar policy in the mid-1980s, using ferries to increase cross-Hudson capacity rather than adding new highway lanes. Also in New York, the Staten Island Ferry continues to operate despite the opening of the Verrazano-Narrows Bridge in the 1960s. The Staten Island Ferry continues to provide a direct and fast trip relative to the less direct highway.
- **Ferry in addition to parallel highway or rail.** Similar to ferries that operate along with a parallel bridge or tunnel, ferry service may be introduced parallel to highway or rail to provide

Table 3-1. Ferry service definitions and characteristics.

Ferry Service Definition	Service and Planning Characteristics: In Lieu of Bridge/ Tunnel	In Lieu of Parallel Highway/Rail	To Islands	In Addition to Parallel Bridge/Tunnel	In Addition to Parallel Highway/Rail
Transit					
Ferry Urban	Secondary			Primary	Primary
Ferry Intercity	Secondary	Secondary	Secondary		
Highway					
Ferry Essential	Primary	Primary	Primary		

Primary Characteristics
Secondary Characteristics

congestion relief, to encourage alternative forms of transportation to the automobile, or to be a mitigation measure for landside developments. A pilot project to operate ferries between Oceanside and San Diego in California was attempted in 2003, but was terminated due to low ridership. Both parallel rail service and a high-speed freeway served the same corridor.

- **RO-RO ferry as highway link.** RO-RO ferries provide connections for automobiles and trucks between roads and highways on opposite sides of water bodies without bridges or tunnels. Services are initiated in areas where traffic volume is too low to warrant a bridge or environmental concerns preclude a road crossing. Examples include the Connecticut-to-Long Island ferry services, BC Ferries, Alaska Marine Highway System, and Washington State Ferries.

Table 3-1 summarizes ferry service and planning characteristics as identified in previous research and studies and synthesizes them into an approach that is used in this report.

SECTION 4

Stakeholders and Institutions Affecting Ferry Services

In the United States, ferries have been regulated and chartered due to their historic status as common carriers and "highways." Many of these regulations include state utilities commission "certificates of necessity" establishing routes. Sometimes this economic regulation includes approval of fares and tariffs; other times, states either operate directly or contract for ferry operations as part of their state highway systems, such as when there is no bridge connecting a state highway.

Securing landing rights is another ferry service requirement that usually involves the cooperation and often the approval of a state or local government. The breadth and scope of state regulation varies from little oversight to broad requirements requiring the approval of a regulating body.

In addition to state involvement, the federal government also provides safety oversight and financial support.

Federal Regulatory Agencies

Each of the agencies described below has different involvement with ferries, including providing funding, regulation, and oversight as well as ensuring safety and security onboard vessels and at ferry terminals.

U.S. Department of Transportation

The U.S. DOT develops and coordinates policies that provide an efficient and economical national transportation system, with due regard for need, the environment, and the national defense. It is the primary agency in the federal government with responsibility for shaping and administering policies and programs to protect and enhance the safety, adequacy, and efficiency of the transportation system and services. Within the U.S. DOT, the Office of the Secretary, FHWA, MARAD, and FTA all can provide oversight and assistance for ferry services. In addition, RITA provides multimodal research for U.S. DOT (Habib et al., 1980).

Federal Highway Administration

FHWA coordinates highway transportation programs primarily in cooperation with states. As part of this mission, FHWA also funds ferries through traditional highway programs and specified ferry funding grants.

Maritime Administration

MARAD promotes development and maintenance of an adequate, well-balanced, United States merchant marine. MARAD also administers the Title XI ship financing program, which provides federally guaranteed loans for shipbuilding projects. Ferries are eligible for the Title XI program and have been financed through the program in the past.

Federal Transit Administration

FTA can provide financial assistance for passenger (generally Ferry Transit Urban) ferry services as part of grant programs. Eligible costs include planning, design, and construction (and sometimes operating expenses related to preventative maintenance). Transit systems are required to submit a variety of operational and financial data annually for insertion into the National Transit Database (this reporting affects the formula allocations to transit agencies around the country), and, as part of this reporting, ferry routes are given the same consideration as fixed-rail routes.

Research and Innovative Technologies Administration

During deliberations for the Transportation Equity Act for the 21st Century (TEA-21) in 1998, Congress identified a gap in the understanding of how to evaluate federal funding requests for ferries. To remedy this gap, Congress commissioned a ferry study in 2000 that was carried out by RITA and was called The National Ferry Study. The study included a detailed inventory of all ferry operations and reported on the potential for new ferry operations, fast ferry opportunities, and alternative fuels. The study allowed various ferry-related government agencies and departments to form a partnership in which different agencies had specific tasks and roles. Ferry-related planning, funding, and construction had previously been shared among local, state, and national agencies. The study provided, perhaps for the first time, a clear delineation of agency roles and responsibilities.

U.S. Department of Homeland Security

DHS was created through the Homeland Security Act of 2002. Ferry operators and systems interface with DHS primarily through the U.S. Coast Guard and TSA. International operators also are subject to Immigration and Customs Enforcement (ICE).

U.S. Coast Guard

USCG is an agency under DHS, but can also become a branch of the United States military. The USCG is a maritime, military, and multimission service unique among the military branches for having domestic (and international) maritime law enforcement duties and also being a federal maritime safety and regulatory agency. USCG provides safety oversight for all vessels, including ferries, and conducts annual vessel inspections. All vessels must be USCG certified, and maritime operating personnel require USCG licenses. USCG also mandates safety procedures for crew members and vessel operations and can conduct vessel escorts, security patrols, and other actions to ensure that vessels operating in the United States comply with domestic security standards. Ferries are often included as components of USCG's maritime security plans for urban harbors.

Transportation Security Administration

TSA provides security for the movement of people and commerce in and to the United States. TSA administers the Transportation Worker Identification Credential (TWIC) program, which is a common identification credential for all personnel requiring unescorted access to secure maritime areas and vessels and all mariners holding USCG-issued credentials. Congress directed TSA to issue a biometric security credential to individuals with unescorted access to secure areas of facilities and vessels and all mariners holding USCG-issued credentials or qualification documents.

Other Federal Agencies

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) is a federal agency and a major Army command made up of civilian and military personnel. In the United States, USACE builds waterways and

flood protection projects, which are often used for vessel operation. In addition, USACE regulates some aspects of navigable waters, including enforcing environmental regulation through dredging permits and wetlands protection.

U.S. Environmental Protection Agency

EPA is the federal agency that regulates discharges of pollutants into the water, ground, and air. Ferry operators are subject to EPA regulation on their discharges and emissions. In addition, the EPA administers grant programs that provide new technology designed to reduce emissions and improve efficiency.

U.S. Fish and Wildlife Service (U.S. Department of the Interior)

The U.S. Fish and Wildlife Service is a part of the U.S. Department of the Interior. The U.S. Fish and Wildlife Service may have jurisdiction over ferry docks and landings due to their potential impact on habitat.

State and Local Agencies

State and local agencies exercise regulatory control over shorelines and waterfronts and sometimes exercise economic control over routes, fares, and schedules. The case studies presented in Section 5 of this report indicate a broad range of state and local agencies that impact ferry service. Such impact includes, for example, towns that through their zoning ordinances regulate terminals and other landside facilities, as well as states that regulate state-owned tidelands and control access to state resources such as personnel, funds, and lands.

Funding Sources

It should be noted that funding is fluid, as budgets and funding programs can change annually. The purpose of the following discussion is to identify the range of funding sources currently in use at federal, state, and local levels.

Federal

At the federal level, funding for ferries can come from sources of highway and transit funding as well as from federal loan guarantees, federal tax deferral, and the American Recovery and Reinvestment Act (ARRA).

Highway

Federal funding for ferry vessels, terminals, and other ferry-related expenditures is available under various federal funding categories, including ferry-only funding, transit funding, and, in some cases, highway funding. For example, federal law has allowed states to use non-Interstate funds to build ferry infrastructure (including access roads and other facilities) when the route is part of a designated federally eligible highway (except Interstates). Beginning with the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the Ferry Boat Discretionary Program has provided additional and separate funding for the construction of ferry boats and ferry terminal facilities. The Ferry Boat Discretionary Program was continued through the Transportation Equity Act for the 21st Century (TEA-21) and the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). More recently, the 2009 federal

stimulus bill, officially known as ARRA, authorized several ferry funding programs prior to Congress considering the next transportation appropriations bill.

Transit

FTA can fund ferry boats through its normal formula and discretionary funding sources. FTA funding has been used for vessels, terminals, and other facilities that provide for an urban, mass transit passenger ferry service.

Federal Loan Guarantees

Both MARAD and FHWA (through the Transportation Infrastructure Financing Innovations Act, TIFIA) can provide loan guarantees for ferry operators to purchase vessels. In addition, TIFIA can also fund ferry facilities and other landside projects. These programs are not grants, however, and the funds must be repaid or the government repossesses the assets. As a result, both programs have strict credit and business-plan criteria. While MARAD can finance 90 percent of a vessel, TIFIA is limited to one-third of the project cost.

Federal Tax Deferral

The capital construction fund program (CCF) is a program created to encourage reinvestment by U.S. maritime companies. The fund is not direct assistance, but rather allows the maritime entity (including ferry operators) to defer a portion of tax monies that would otherwise be paid to the U.S. Treasury during the tax year. Like a maritime IRA, the CCF program allows the maritime entity to accumulate and use otherwise taxable earnings for the purposes of acquiring, constructing, or reconstructing vessels built and documented in the United States and operated in the United States foreign, Great Lakes, or noncontiguous domestic trade and in the fisheries. The program is administered through MARAD (for private ferry operators) and requires a contract between the operator and MARAD.

American Recovery and Reinvestment Act

ARRA appropriated millions of federal dollars for the ferry industry to be disbursed through a number of different transportation-related agencies for a number of different purposes. Examples of how the ferry monies were distributed through the various agencies and the types of allocations are the following:

- The Ferry Boat Discretionary Program received $60 million to be dispersed for ferry boat and terminal construction.
- Through the FHWA, ferries could qualify for some of the $27.5 billion stimulus funds as intermodal connectors, bridge improvements, and pavement construction.
- Under the FTA, $323 million was set aside especially for ferries.
- The EPA has set aside $32 million for diesel emission reductions in port areas that ferries may qualify for.
- The U.S. Department of the Interior has $20 million designated for ferries providing improved access to national parks.
- DHS has $150 million in a port security grant to support the TWIC program. Ferry operators can be supported in this grant.

State and Local Programs

Several metropolitan agencies and authorities, as well as states, provide funding for ferry operations and capital improvements. These sources vary from state to state, but they include many of the following:

- **Toll revenues.** Often ferries are either part of a larger toll crossing authority or are cross-subsidized to provide supplemental capacity in a bridge corridor.

- **General transit revenues (often including gas taxes).** These revenues are provided to fund the ferry service as part of the overall transit system.
- **Port revenues.** Some ports and port authorities subsidize ferries to generate additional traffic and support waterfront real estate development.
- **Development revenues.** Some ferries are financed through either special taxes or real estate fees to provide access to remote development sites or areas poorly served by other transportation services.

SECTION 5

Ferry Case Studies

Eight ferry operators were carefully selected for case studies to represent the wide breadth of the ferry business. The selected operators include small Midwestern vehicle and passenger ferries, passenger-only ferries in New York Harbor, and ferries in the U.S. Virgin Islands and the Pacific Northwest.

Initial Survey of Ferry Operators

The case studies were guided by the initial findings from a survey of more than 40 ferry operators, which led into focusing on narrower topics for further development in the research program.

The survey was conducted through telephone interviews from May through July 2009. The telephone interviews covered the same topics as the literature review:

- Ferry planning
- Ferry operations
- Ferry funding
- Ferry disaster response, safety, security, and risk
- Ferry environmental assessment, planning, and mitigation
- Ferry marketing

The survey sample included representatives of the full range of ferry operators, from very small operators to those operators that carry more than a million passengers, from seasonal operators to year-round operators, and from privately owned and operated systems to publicly operated systems at the federal, state/provincial, and local levels. The sample also included operators from various geographic regions. The survey was designed to allow for multiple respondents from the same operator to answer questions, which occurred during interviews with larger operators. A $100 incentive was offered to encourage participation so that the desired number of interviews would be completed.

Forty-three interviews were completed. The survey respondents answered anonymously during the reporting process. Characteristics of the respondents include the following:

- Of the fifteen publicly owned ferries surveyed, one is a federal agency, seven are state or provincial governments, and seven are local operators.
- Twenty of the ferry operators surveyed are privately owned and operated, while seven are publicly owned but operated by private companies under contract.
- Fourteen ferries are seasonal, while sixteen operate year-round.
- The number of passengers carried annually ranged from less than 500 to 2 million.

- Twenty-five respondents operated one to two lines, ten respondents had three to six lines, and six respondents had seven or more lines.

The complete results of the survey are included in Appendix B.

About the Case Studies

Based on the findings from the ferry operator survey, the research team focused on in-depth case studies of eight ferry systems or operators. In some cases, the case study focused on one operator; in other cases, entire systems comprising multiple operators in one region were considered.

The eight ferry systems/operators selected for the case studies were

- Connecticut–Long Island (New York) ferry services
- New York Harbor ferries
- North Carolina Department of Transportation Ferry Division
- U.S. Virgin Islands ferry services
- Washington Island Ferry Line (Wisconsin)
- Seattle Metropolitan Ferry System (Washington)
- Hawaii Superferry Service
- BC Ferries (British Columbia, Canada)

It should be noted that the Hawaii Superferry system was not implemented; however, as a case study, it provides important examples of actual and potential causes of failure. Based on both the case studies and on the earlier survey of ferry operators, ferry services in North America can be broadly categorized as either passenger systems in primarily metropolitan/urban areas or as essential highway extensions in more rural areas and island and coastal communities. Within these categories, the planning, marketing, and expectations of each type of service are dissimilar, even while the actual operations of the vessels are similar.

Each of the eight case studies opens with "Quickfacts," a table listing basic data about the service including service category, number of routes, number of vessels, annual number of passengers, annual number of vehicles, and the age of the fleet. Each case study continues with sections describing the ferry operator/system history, organizational structure, operational structure, financial structure, and planning issues.

Connecticut–Long Island (New York) Ferry Services

Quickfacts

Operator	Service Category	# of Routes	# of Vessels	Annual Passengers	Annual Vehicles	Fleet Age (years)
Port Jefferson Ferry	Highway–Ferry Essential	1	3	1,000,000	380,000	7–24
Cross Sound Ferry	Highway–Ferry Essential/ Transit–Ferry Intercity	1	8	1,300,000[a]	450,000	21–69
Viking Ferry Lines[b]	Transit–Ferry Intercity	1	1	~2,000	n/a[c]	5

[a] Includes 195,000 fast-ferry passengers.
[b] Please note that because Viking Ferry Lines has limited service (only on weekends during the summer), limited analysis is provided below.
[c] Not applicable.

History

Modern daytime ferry service between Connecticut and Long Island began in 1884 when the Bridgeport & Port Jefferson Steamboat Company (Port Jefferson Ferry) began operation from the Connecticut shore to the midpoint of Long Island, New York. While other maritime services had operated (often on a weekly or twice-weekly schedule), the new daily scheduled service (during all seasons except winter when service was provided 3 days per week) transported Long Island farmers and their agricultural products to Connecticut and allowed Bridgeport merchants to sell products to farmers in turn (Sheahan & Conniff, 1983).

The Port Jefferson Ferry began with one vessel; in 1889, the owners purchased a larger, 600-passenger vessel. When automobiles became common, the Port Jefferson vessels were retrofitted to carry them, and this became an increasingly important revenue source for the company. By the 1920s, traffic had increased enough to require a second vessel. The Depression caused traffic to drop, but with World War II passenger and freight traffic increased. In the late 1960s, the company had purchased a used vessel to add to the fleet. While there was recurring consideration of bridging Long Island Sound, the projects never occurred, and the Port Jefferson Ferry continued to be the primary access from Central Long Island to Connecticut. In the 1980s, the company added two new, faster vessels: the *Grand Republic* and the *Park City.* Two additional vessels were purchased in 1999 and 2003.

Service from Stonington, Connecticut, to Greenport, New York (terminal of the Long Island Railroad), began in the mid 1800s. By the 1940s, the service evolved into the New London (Connecticut) to Orient Point (New York) route that currently operates (Cambridge Systematics, Inc., et al., 2005).

In 1975, John Wronowski purchased the New London Freight Lines ferry service and changed the name of the ferry service operating between New London and Orient Point to Cross Sound Ferry Services Incorporated. Starting with three vessels purchased from the previous operator, Cross Sound began an incremental but consistent capital improvement program. In 1978, the company developed a new ferry terminal just to the north of the existing New London Amtrak Station. New vessels were purchased in 1977, 1979, and 1983, and in 1984, the company purchased and rebuilt an existing vessel. In 1989, 1998, 1999, and 2003 additional vessels were added to the fleet (Cross Sound Ferry Service, Inc., 2008).

In 1995, Cross Sound added a high-speed ferry to complement its conventional vehicle ferry. The Connecticut casinos had increased walk-on passengers to the point where the existing passengers were being inconvenienced. The Sea Jet 1 is a wave-piercing catamaran designed in Australia and built in Washington state. Both the ride-control system and the water jets were initially unreliable, but over a period of about 5 years, Cross Sound staff brought the vessel to a high level of service reliability (Interview with Cross Sound Ferry, January 7, 2010).

Both Cross Sound and the Port Jefferson Ferry report that passenger volumes have declined by about 10 to 15 percent and vehicular volumes are about 10 to 25 lower than 2004, which represents the highest year. In addition, both carriers noted that truck volumes, which are primarily agricultural and construction related, declined by as much as 40 percent

Organizational Structure

Both the Port Jefferson Ferry and Cross Sound Ferry Service are privately owned and are part of larger maritime enterprises.

The Port Jefferson Ferry was purchased in 1961 by the McAlllister Towing and Transportation Company, which operates 70 tugboats and 24 tractor tugs in 12 ports. The Port Jefferson Ferry owns the terminal in Port Jefferson but leases a terminal in downtown Bridgeport from the Bridgeport Port Authority.

Table 5-1. Connecticut–Long Island ferry system routes.

Operator	Route	Service Season	Service Schedule	Crossing Time
Port Jefferson Ferry	Bridgeport–Port Jefferson	Year-Round Departures	60 min—peak season and peak days 90 min—other times	75 min
Cross Sound Ferry	New London–Orient Point	Year-Round Departures	60 min	90 min
Viking Fleet Ferries	New London–Montauk	Seasonal	Selected sailing days	60 min

Cross Sound Ferry Service is part of the Wronowski Marine Companies, which includes Thames Towboat Company, Thames Shipyard & Repair, and Block Island Ferry Services. The Wronowski enterprises employ up to 400 people and have an annual payroll of approximately $16 million. All facilities used by Cross Sound Ferries, including terminals and vessels, are owned by the company. It should be noted that the company has received public funding to repower its vessels to reduce fuel consumption and emissions.

Operational Structure

System/Service Routes

Three private operators provide service across Long Island Sound, as shown in Table 5-1 and Figure 5-1.

Figure 5-1. Connecticut–Long Island ferries route map.

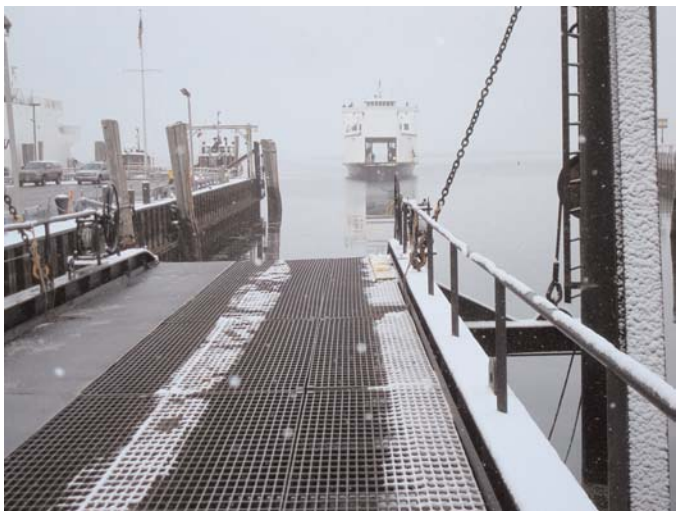

Figure 5-2. Port Jefferson ferry approaching the Long Island terminal.

Bridgeport–Port Jefferson Ferry. The Bridgeport–Port Jefferson route is operated by Port Jefferson Ferry. The crossing time between Bridgeport, Connecticut, and Port Jefferson, New York, is about 75 minutes one way. Port Jefferson Ferry uses three vessels to provide ferry service: the Grand Republic, the P. T. Barnum, and the Park City. Figures 5-2 and 5-3 show photographs of Port Jefferson ferries.

The Bridgeport ferry terminal is located in downtown Bridgeport and is adjacent to the Bridgeport train station. Bridgeport is Connecticut's largest city and is about 60 miles east of New York City. The company leases about 3.5 acres, including the terminal and dock, from the Bridgeport Port Authority. The facility provides space for automobile queuing, as well as limited kiss-and-ride capacity. The Bridgeport Port Authority is planning to build an onsite garage for the ferry terminal; in the meantime, automobile parking is also available in structured parking on the other side of the train tracks and freeway. There is a large structured lot close to the ferry terminal, and ferry passengers are allowed to use it on weekdays and on weekends when there are no stadium/

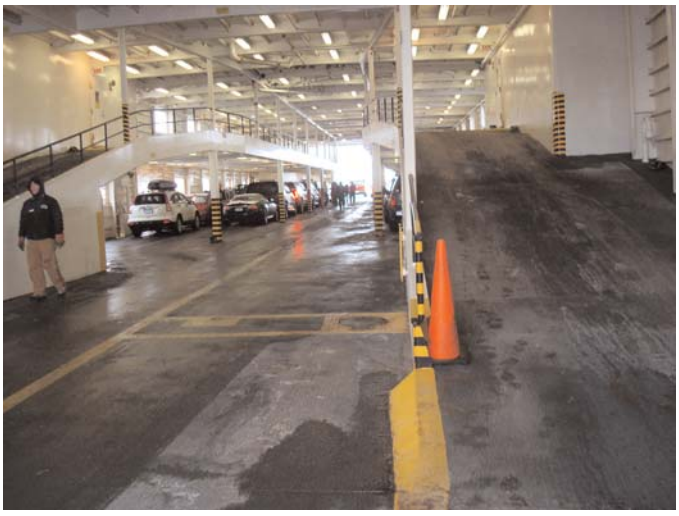

Figure 5-3. Port Jefferson ferry vehicle deck.

arena events. The Bridgeport ferry terminal provides good intermodal connectivity between commuter and intercity rail and local and intercity bus service and good vehicular access from the Connecticut Turnpike. The parking access is limited, and the pedestrian path from the structured parking into the terminal is not attractive. The elevated Interstate highway and railroad structures create a large visual and physical barrier between the ferry terminal (and the waterfront) and the downtown.

Cross Sound Ferry. Cross Sound Ferry operates a ferry route across Long Island Sound from New London, Connecticut, to Orient Point, New York. The New London–Orient Point Ferry operates year-round from the New London train/bus station to the far northern tip of Long Island at Orient Point. The one-way crossing time is 75 to 80 minutes. During the summer, service operates every 90 minutes; on Fridays, Sundays, and holidays, ferries operate as frequently as hourly. In the winter, service is reduced to seven round trips on weekdays. Cross Sound Ferry has a fleet of seven conventional ferries that operate at speeds between 12 and 15 knots and can carry from 22 to 120 automobiles and from 130 to 1,000 passengers.

In addition to the conventional ferries, during the spring and summer, Cross Sound also operates a high-speed (30-knot) ferry on the same route (Sea Jet 1). This ferry seats 400 passengers but carries no vehicles. The Sea Jet1 can sail between Long Island and New London in about 40 minutes and operates up to six round trips daily.

Both the New London Ferry Terminal and the Orient Point Terminal are owned by Cross Sound Ferry. In New London, the ferry terminal is adjacent to downtown and the train station and intercity bus station and also has connections to the local transit system. About 11 Amtrak trains serve the train station in each direction daily. However, the railroad has an at-grade crossing, which creates an awkward pedestrian path connecting downtown, the train, and the ferry. Automobile parking for ferry passengers is available in a municipal garage nearby. Shuttle buses operate to the Foxwoods Casino, and New England colleges often shuttle students to the New London Ferry Terminal when school sessions begin and end.

The New London Ferry Terminal is located on a 30-acre site at the mouth of the Thames River, with queuing areas leading to the conventional automobile ferry and a separate dock for the high-speed catamaran. The terminal uses an Internet-based reservations system that provides the customer with the ability to print a bar-coded boarding pass.

Orient Point is located at the east end of Long Island's North Fork. Access from the west is via NY Highway 25, a two-lane rural road. The terminal has a queuing area for the conventional vehicle ferries and a parking lot with space for about 250 automobiles. The Long Island Railroad (LIRR) terminal in Greenport is about 7 miles to the west. Monday through Saturday bus service is provided hourly during daytime periods and connects Orient Point with Greenport and Riverhead.

During 2003–2004, Long Island Sound communities studied the potential of ferry service between Connecticut and Long Island and between Connecticut and Manhattan. More than 50 possible sites were investigated for possible service and were ranked based on community acceptance, land use compatibility, and technical and market feasibility. The study identified six fast ferry routes (including two routes already operated by conventional craft) as viable, and two new conventional ferry routes in the first screening. However, after further technical review and comments from local governments, the study recommended only one new Connecticut to Long Island service and three Connecticut to Manhattan services. Several water taxi services were also recommended for further study.

Viking Fleet Ferries. During the summer season, Viking Fleet Ferries operates a ferry service from Montauk, New York, to Cross Sound's New London Terminal. This service only operates on

Friday and Sundays and some holidays. The crossing time from Montauk to New London is about one hour. Viking Fleet uses a 225-passenger monohull to provide this service. Viking Fleet is primarily a party fishing operator but also operates daily scheduled ferry service from Montauk to Block Island, Rhode Island.

Facility and Vessel Maintenance

Bridgeport–Port Jefferson Ferry. The Port Jefferson Ferry vessels carry 85 to 120 automobiles and 1,000 passengers. Over the last several years, the ferry company has received federal funding to repower its vessels with more modern and fuel-efficient (and less carbon-intensive) engines. Not only have emissions been reduced by about 13 percent, but power has been increased to 1,000 horsepower, and the engines operate with less vibration and noise.

At Bridgeport, Port Jefferson Ferry pays a rent of about $150,000 annually (including the utilities), which includes dock access, the queuing area, and a modest terminal structure. In addition, the Port Authority charges about $1 per passenger, which is, in effect, a passenger facilities charge. This charge has been litigated between the Port Authority and Bridgeport–Port Jefferson Ferry and is currently in court for final disposition. In response to the Port Authority's passenger tariff, the ferry company has proposed to relocate to another site, away from downtown Bridgeport.

On Long Island, Port Jefferson Ferry owns the ferry terminal and about 280 linear feet of shoreline to perform maintenance work and administrative functions at the Port Jefferson Terminal. The Town of Brookhaven and the Village of Port Jefferson provide several parking lots, totaling about 200 spaces, within walking distance of the Port Jefferson terminal. The LIRR station, which has service to New York City, is about a mile south of the ferry terminal. Local bus service is provided between the ferry terminal and the LIRR station on four routes, with a combined frequency of about every 20 to 30 minutes. Highway access to the ferry dock is via non-grade-separated state highways and local roads. The ferry terminal is about 10 miles from Interstate 495 in Medford on Central Long Island.

Cross Sound Ferry. Over the last several years, Cross Sound Ferry, like the Port Jefferson Ferry, has received federal funding to repower its vessels with more modern and fuel-efficient (and less carbon-intensive) engines. Cross Sound Ferry has achieved a 20-percent reduction in emissions and fuel consumption with this retrofit. The company also maintains its vessels and rebuilds engines at its own shops and provides commercial repair services to other vessel operators. Cross Sound estimates that its largest ferry, the John H., which carries 120 automobiles and 1,000 passengers, burns about 190 gallons of fuel on each one-way trip. The Sea Jet 1, a 30-knot, 400-passenger-only fast ferry, burns about 130 gallons of fuel on each trip (Adam Wronowski, Cross Sound Ferry, personal communication, March 22, 2010).

Staffing Levels

Bridgeport–Port Jefferson Ferry. Port Jefferson Ferry employs about 175 people during the peak season and about 125 in the off-peak periods. Many of the employees have master's licenses, and all maritime employees have licenses. In addition, the company spends about $140,000 annually on security training and monitoring and uses a variety of methods to ensure safe operation. Some of this expense is reimbursed by DHS funding.

Cross Sound Ferry. Cross Sound employs about 300 employees in the peak season and about 150 in the off-peak season. The company hires almost all its employees at an entry level, trains the personnel, and encourages all of its maritime employees to become licensed masters. Cross Sound Ferry, like most ferry operators, takes security concerns seriously and has an active training pro-

Table 5-2. Connecticut–Long Island ferry system route fares.

Route	Operator	Automobile Ferry Fare				
		Adult Walk-on	Child Walk-on	Automobile	Bicycle	Motorcycle
Bridgeport–Port Jefferson	Port Jefferson Ferry	$17.00	Free	$51	Free	$29.75
New London–Orient Point (Automobile Ferry) [a]	Cross Sound Ferry	$14.51	$6.00	$47.67 (includes $2 Port tax)	$4.15	$27.98
New London–Orient Point (Sea Jet 1)[b]		$20.21	$6.22	n/a[c]	n/a	
New London–Montauk	Viking Fleet Ferries	$40.00	$25.00	n/a	$7	n/a

[a]Cross Sound charges a floating "surcharge" against a base fare that reflects changes in fuel prices.
[b]This is a passenger-only ferry.
[c]Not applicable.

gram. Employees are trained to be aware and participate in drills and exercises. In addition, the company used federal funds to purchase lighting and surveillance equipment to provide additional security.

Financial Structure

All ferries providing service between Connecticut and Long Island are privately owned and operated. The only government funding they have received has been for engine upgrades (relating to emissions reductions) and security enhancements. These amounts are minor compared to their passenger and vehicle revenues, which exceed $50 million annually. For Connecticut–Long Island route fares, see Table 5-2.

Fares

Both Port Jefferson Ferry and Cross Sound Ferry use variable pricing in peak periods. The peak periods for these services are generally on weekends and holidays. During these periods, some discounts—such as unlimited automobile passengers and discounts on trailers/buses, and so forth—are not available. In addition, commuter tickets are also available.

Both the Port Jefferson Ferry and the Cross Sound Ferry have vehicle reservation systems. These systems provide the ability to manage vessel capacity and ensure the capacity is well used throughout the day.

Market studies conducted by each company indicate that the majority of ferry passengers live on Long Island. For the Bridgeport–Port Jefferson and Cross Sound Ferry services, about 55 to 60 percent of the passengers originate on Long Island. Most Cross Sound Ferry passengers reside in Suffolk County (the easternmost county). The other 45 percent of passengers are distributed throughout Central and Eastern New England. In addition, Port Jefferson Ferries reports that about 70 percent of its walk-on, return-day-trip passengers originate in Bridgeport (these trips make up about 20 percent of their total passengers).

Funding Sources

As all of the operators in this case study are privately owned, each garners revenues from a variety of sources. Cross Sound Ferry and Port Jefferson Ferry obtain revenues through passenger fares, onboard and terminal concession stands, and restricted federal emission grants. Viking Ferries also has a large charter and private rental business that supplements their passenger ferry service.

Planning Issues

Both Cross Sound Ferry and Port Jefferson Ferry have large, well-established operations. In interviews, their executives expressed comfort with their maritime operations, their ability to maintain and operate vessels, and their ability to provide necessary capital enhancements needed to maintain market share.

Both operators, however, identified government leadership and public policy as important to enhancing the ability of the marine transportation mode to divert automobiles from the highway system and to create more sustainable transportation systems. Both Cross Sound Ferry and Port Jefferson Ferry have experienced challenges in expanding their services due to local concerns and the high financial expense and permitting maze of investing in terminal facilities.

Environmental and Regulatory Issues

From a systems perspective, both Cross Sound Ferry and Port Jefferson Ferry noted that ferries could decrease energy consumption and help achieve other public policy goals. However, there is not a consistent recognition of the importance of and the opportunities provided by a marine highway system. The *Long Island Sound Waterborne Transportation Plan* (2005) estimated that ferries captured about 23 percent of the Long Island–Connecticut travel. Ferries carry about 2.3 million passengers annually, which means that approximately 7.7 million passengers between Connecticut and Long Island use highway modes annually (or about 25,000 trips daily) (Cambridge Systematics, Inc., et al., 2005).

Travel between Connecticut and Long Island can be accomplished via ferry or automobile. The ferry operators think of their catchment areas as an oblong circle where their Long Island terminals are located west of the midpoint. Trips within that oblong are ferry-competitive but trips outside are not. For comparison, Table 5-3 provides data for the trip from Huntington, New York, to Bridgeport, Connecticut, on highway and ferry.

Table 5-4 shows the change in travel time and fuel use with a fast-ferry option.

Table 5-5 provides data for a different trip from Long Island to New London via either highway or ferry.

As ferry speeds increase (or highway travel times decrease), the ferry catchment area increases because the ferry travel times become more competitive than the highway travel times. In all cases, using the ferry results in fuel usage reductions of about 15% to 25%, depending on automobile occupancy (the lower the automobile occupancy, the higher the fuel savings from ferries). In congested corridors, ferry travel times to the ferry terminal are com-

Table 5-3. Huntington (NY) to Bridgeport (CT)—automobile vs. ferry travel.

Mode	Miles	Travel Time	Cost	Per Vehicle Fuel Used
Highway—Clear	75	80 min	$40	4 gal[a]
Highway—Congested	75	120 min	$45	5 gal
Automobile to Ferry—Ferry to Bridgeport	25	130 min	$70	3 gal per auto carried including ferry fuel used

[a]Automobile cost based on 55 cents per mile operating cost. This is the IRS allowance.

Table 5-4. Huntington (NY) to Bridgeport (CT)—automobile vs. fast-ferry travel.

Mode	Miles	Travel Time	Cost	Total Fuel Used[a]
Highway—Clear	75	80 min	$40	1,600 gal
Highway—Congested	75	120 min	$45	2,000 gal
Automobile to Fast Ferry	25	70 min	$30	730 gal[b]

[a] Calculation assumes 400 vehicles traveling from Huntington to Bridgeport. Fast-ferry alternative assumes a 25 mile drive to ferry terminal and then walk-on passengers.
[b] Based on 1.5 passengers per automobile, 22 mpg per automobile, and $20 fast ferry fare per passenger

Table 5-5. Riverhead (NY) to New London (CT)—automobile vs. ferry travel.

Mode	Miles	Travel Time	Cost	Per Vehicle Fuel Used
Highway—Clear	200	220 min	$110	10 gal
Highway—Congested	200	300 min	$120	12 gal
Automobile to Ferry	30	140 min	$70	3 gal per auto carried including ferry fuel used

petitive with automobile travel times. Conventional ferries allow for automobile use at either terminal, but the passenger-only, fast-ferry market is limited by the need to complete trips beyond the immediate ferry terminal area. As a result, while using passenger-only fast ferries could be more fuel efficient than driving (per Table 5-4), the market for these trips may be limited and hence not financially viable.

Land Use Issues

Cross Sound Ferry and Port Jefferson Ferry mentioned that their Long Island host communities are sensitive to increases in service and expansion of terminal facilities. However, both companies recognize that there is latent demand that cannot currently be accommodated and that results in additional highway trips and vehicle miles traveled.

In New London, the town is interested in developing a multimodal center where ferries are one piece of the puzzle. The multimodal center is seen as an economic catalyst for redevelopment in the town center.

Bridgeport is faced with urban design issues that limit the ability to create optimal pedestrian and bicycle environments that encourage movements between the train station and ferry terminal. It is unlikely that changes in the urban infrastructure scheme will change in the near future to allow for redevelopment to occur.

Port Jefferson and Orient Point communities have both restricted land use growth around the ferry terminals.

Emergency Response

After the attacks of September 11, 2001, ferries provided the only transportation from Long Island. While there is no formal emergency response system that the ferry operators work with, a more structured arrangement is being considered by local and state authorities.

New York Harbor Ferries

Quickfacts

Operator	Service Category	# of Routes	# of Vessels	Annual Passengers	Annual Vehicles	Fleet Age (years)
New York Waterway	Transit–Ferry Urban	16	34	9,855,000	n/a[a]	8–25
New York Water Taxi	Transit–Ferry Urban	1?	11	438,000	n/a	3–9
Statue Cruises	Transit–Ferry Urban	1	1	146,000	n/a	17
Seastreak	Transit–Ferry Urban	2	4	1,095,000	n/a	6–9
Staten Island Ferries	Transit–Ferry Urban	1	10	23,725,000	n/a	5–45

[a]Not applicable

History

Birth, Growth, and Decline

The history of scheduled ferry service in New York Harbor extends back more than 200 years. Rowboats connected Manhattan with Brooklyn before the Revolution. Service to Staten Island began in the 1820s. New York City records indicate that by 1860 eight ferries were authorized to operate across the Hudson River to New Jersey. After the Civil War, as both commerce and railway traffic increased, ferry traffic also continued to grow. The railroads built large ferry terminals in New Jersey to serve New York City—Erie Terminal, Central Terminal of New Jersey, Pennsylvania Terminal in Jersey City, the Lackawanna Terminal in Hoboken, and the West Shore Railroad Terminal in Weehawken.

The first fixed link across the Hudson River was developed by the Manhattan & Hudson (now Port Authority Trans-Hudson [PATH]) urban trains and linked Jersey City, Hoboken, and Manhattan. The Hudson Tubes opened in 1908 and immediately diverted passengers from the ferry services, although the Pennsylvania Railroad continued to operate its ferries from Jersey City. The Hudson Tubes carried almost 50 million passengers annually just a few years after opening and now carry about 85 million passengers.

In 1910, the Pennsylvania Railroad opened Pennsylvania Station on 34th Street, a terminus for rail connections to New Jersey, through an extensive network of commuter trains and two underwater tunnels. These tunnels now carry about 45 million passengers annually under the Hudson.

In 1927, the states of New Jersey and New York opened the Holland Tunnel, the first vehicular access into Manhattan from New Jersey. About 34 million vehicles annually now use the Holland Tunnel. In 1931, the George Washington Bridge opened between New Jersey and Manhattan and soon carried more than 5 million vehicles annually. In the late 1930s, the Port Authority opened the first bores of the Lincoln Tunnel into the midtown area of New York City. In 1950, the Port Authority Bus Terminal (PABT) opened near Times Square. The Lincoln Tunnel now carries more than 42 million vehicles annually, and the PABT handles about 200,000 passengers daily. The George Washington Bridge serves more than 106 million vehicles each year.

Ferries also crossed the East River and connected Manhattan to Brooklyn and Queens. These ferries were among the first to cease operations when the city built the Brooklyn and the Williamsburg Bridges. In 1920, the Long Island Railroad was extended into Pennsylvania Station connecting Manhattan to Brooklyn and Queens directly with fast electric trains.

As a result of these new fixed links, ferry service dwindled. Passengers either took direct trains into Manhattan or drove their automobiles into the city. The last scheduled ferries operated from Hoboken to Manhattan in 1967 (Wikipedia, accessed March 4, 2010). Only the New York City-operated Staten Island Ferry continued to operate.

Revival, Growth, and Stabilization

By the early 1980s, the cross-Hudson fixed links were straining to keep up with demand. At the same time, industrial brownfield sites on the New Jersey side of the Hudson River became available as industry moved to new locations and factories became obsolete. The sites were large, which allowed for master planning and dense, efficient development. Additionally, these sites had views of Manhattan and direct access to the Hudson River. What they did not have was easy access from the mainland.

Arthur Imperatore, the President of NY Waterway, credits Regional Plan Association staff with inspiring the New Jersey Waterfront reuse vision, which combined residential and commercial development with access improvements. The two major access improvements were direct ferry connections to Manhattan from multiple New Jersey terminals and a light rail system operating along the waterfront from Bayonne to Weehawken, which created a development spine and linked ferry terminals, PATH stations, and the NJ Transit's Hoboken Terminal (Interview with Arthur Imperatore, New York Waterway, January 10, 2010). This vision has resulted in more than 6,000 housing units being developed on the west side of the Hudson between 1990 and 2000, with additional units developed over the last 10 years, along with millions of square feet of commercial space (U.S. Census Bureau).

Mr. Imperatore's related firms initiated service from Weehawken, where he had purchased 350 acres of old railroad yards in the mid-1980s. Ferries operated from Port Imperial to West 38th Street in New York City. Within a year, approximately 1,500 daily passengers were riding the Weehawken ferry (Regional Plan Association, 2006). Concurrently, the Port Authority was experiencing significant capacity issues in its tunnels, at the PABT, and on PATH. The Port Authority considered extending PATH station platforms to allow longer trains, but this alternative was too costly. Instead, the agency decided to try ferries. In the mid-1980s, the Port Authority issued a Request for Proposals from parties interested in providing ferry service from the NJ Transit's Hoboken Terminal to lower Manhattan (Interview with Port Authority, January 10, 2010).

A 2006 Regional Port Authority white paper summed up the contemporary role of ferries in New York harbor:

> Over the last 100 years or more [ferries have] gone from essential to non-existent (with the exception of the Staten Island Ferry) and then in the last twenty years to a role that might best be described as "niched." These niches include ferry services that are either part of intermodal connections or in other ways complement existing transit modes, services that provide better options than the existing ground modes, and services that can open up new development opportunities. When searching for additional ferry service opportunities, it is these characteristics to be kept in mind. (Regional Plan Association, 2006)

New York Harbor now has 21 ferry routes serving Manhattan operated by six different ferry operators (five private operators and one public agency). Most routes are 3 to 5 miles long and take 10 to 15 minutes. More than 30,000 daily passengers use private ferry services from 13 New Jersey ferry terminals to four Manhattan landings. These trips make up about 4 percent of daily travel into Manhattan from New Jersey (New York Metropolitan Transportation Council, 2008). Additional service is provided from Brooklyn and Queens to Manhattan. The iconic Staten Island Ferry carries about 65,000 passengers daily into Manhattan at Whitehall.

Organizational Structure

New York Harbor ferries are primarily private-sector businesses and are similar to the American aviation system—government provides the infrastructure while the private sector is responsible for the planning, design, financing, and operation of ferry services.

This unique metropolitan arrangement was greatly influenced by two government actions:

- The Mayor's Waterborne Transportation Policy, adopted in 1986, which established the public and private sector roles:
  - The City and other public agencies will encourage ferry services.
  - No operating subsidies will be provided to ferry operators (including subsidies for vessels).
  - The City would consider making City land available for landing sites and would set up a reasonable regulatory framework (i.e., landing permits).
  - The City would not object to premium fares (Interview with Alan Olmstead, New York City Department of Transportation, January 10, 2010).
- The Port Authority's Request for Proposals for privately operated ferry services (service initiated in 1989) between Hoboken and Battery Park City, with the private sector assuming the operating risk and the Port Authority providing the fixed facilities.

In effect, the arrangement was a free market system with the freedom to enter the market and the freedom to fail. As a result, there was significant experimentation with new service to Pier 11 near Wall Street, East 34th Street, West 38th Street (later replaced by Pier 79), and to Battery Park City. Fees charged to ferry operators funded operating and maintenance expenses for the fixed facilities, and the City and Port Authority continued to build terminal capacity as private operators incrementally expanded service. During this period, the public sector invested more than $350 million in trans-Hudson ferry facilities (Interview with Alan Olmsted, New York City Department of Transportation, January 10, 2010).

New York Waterway was selected by the Port Authority to provide the Hoboken–Battery Park City Ferry Service and, by June 2001, was serving more than 10,000 passengers daily. The route now serves about 4,000 passengers daily, with another 2,000 passengers using the Hoboken Ferry Terminal to access other Manhattan destinations.

Ridership incrementally expanded and, by 2001, about 35,000 passengers were using privately operated ferries in addition to the 65,000 passengers using the Staten Island Ferry. After the attacks of September 11, 2001, with the PATH World Trade Center Station destroyed, private ferry ridership surged to more than 65,000 daily.

In 2003, PATH resumed service to lower Manhattan and ferry ridership dropped back to the levels preceding the attacks of September 11, 2001. Fuel costs put financial pressure on ferry providers because fuel costs are a much larger part of overall costs for ferry operators than fuel costs are for operators of other modes. Ferry operators increased fares as a result, and ridership dropped again to about 30,000. Some industry observers note that the New York policy model, as detailed in the Mayor's Waterborne Transportation Policy, is being challenged as operators experience financial stress caused by competition from subsidized operators, increases in costs, and decreases in ridership resulting from higher fares and the recession. There have been calls for ferries to be subsidized, just as other modes of transportation are subsidized.

Operational Structure

System/Service Routes

In New York Harbor, aside from the publicly operated Staten Island Ferry, five private operators provide service to 4 Manhattan terminals, 13 New Jersey locations, and 6 Queens/Brooklyn sites.

New York Waterway. The largest operator is New York Waterway, which operates 16 ferry routes, including eight operated for BillyBey Ferries. Until 2005, all of these routes were under the direct control of New York Waterway, but following financial challenges, the company spun off the routes south of NJ Transit's Hoboken Terminal (including that route and the Port Authority contract) to BillyBey for the assumption of $19 million in debt. BillyBey then contracted with New York Waterway to provide the service on their behalf. New York Waterway routes carry about 17,000 passengers (not including the Belford route in Monmouth County), while the BillyBey routes carry about 10,000 daily passengers.

Most of the access to the New Jersey ferry terminals is by walking or other transit. While a few terminals have large parking lots, ferries were often developed to encourage dense, urban development. (See a photo of New York Waterway's Weehawken Terminal in Figure 5-4).

New York Waterway operates free shuttle buses connecting Pier 78 to Manhattan—serving 57th Street, 49th Street, 42nd Street, and 34th Street, as well as a special Downtown loop. Five peak period routes operate, and, in the midday and at night, a separate set of five routes operates in longer loop routes (one route also connects to the World Financial Center Terminal). On the New Jersey side, a combination of shuttle buses and free transfer arrangements on one NJ Transit route provide local access.

New York Water Taxi. The next largest private ferry operator is New York Water Taxi. Until 2011, the company operated service from Manhattan to Brooklyn and Queens, locations that tend to be distant from subway lines (these services are now operated under public agency contract by New York Waterway). New York Water Taxi currently operates a contract service for the IKEA store in Red Hook (Brooklyn), which provides access to the store from Manhattan (see photos of this service in Figure 5-5). Weekend service was initially required as a condition of IKEA's City approvals. However, eventually IKEA chose to extend and expand the service under a contract with New York Water Taxi; the service now operates daily. On some days, IKEA ridership has reached 5,000 passengers.

Seastreak. Ferry service to Monmouth County, New Jersey, is a distinct niche, catering to residents in a high-income residential area that will pay premium fares for shorter travel times as compared to highway or train. Seastreak uses four high-speed vessels to provide this service

Figure 5-4. New York Waterway Weehawken Terminal.

Figure 5-5. New York Water Taxi to Ikea in Brooklyn.

from Atlantic Highlands and Highlands, New Jersey, while New York Waterway serves Belford, New Jersey, with one high-speed vessel. Both operators terminate in Manhattan at Pier 11. Even though the monthly passenger fare approaches $600, the services are well subscribed. Seastreak carries about 3,000 daily, while New York Waterway carries about 1,600. The niche for ferries in this market is speed—the journey is less than half the distance by water than by highway or train, and the travel time is about 50 minutes compared to at least a 75-minute automobile trip and a 90-minute train trip. In contrast to the other New Jersey ferry terminals, the Monmouth County terminals have large park-and-ride lots to serve a dispersed ridership. Seastreak notes the importance of park-and-ride lots in attracting and maintaining market share (Halcrow Interview with Jim Barker of Seastreak, on behalf of Port Authority, December 8, 2009).

Staten Island Ferry. Finally, the Staten Island Ferry continues to provide service between Manhattan and Staten Island and carries about 65,000 passengers daily, making it the busiest ferry operation in North America. Service is provided by large, 1,200- to 6,000-passenger ferries operating every 15 minutes in the peak period and every 30 minutes at other times. The 5-mile route takes about 25 minutes, and there is no fare. In 1997, the Staten Island Ferry became a free service, in conjunction with the Metropolitan Transportation Authority's switch to free transfers on other New York City transit services (including subway to bus and commuter rail to subway).

In addition, Statue Cruises operates one commuter service between Liberty Landing Marina in New Jersey and Battery Park City in New York City. About 400 people daily use the service.

Tables 5-6 and 5-7 show the various routes, services, and crossing times/locations, by operator in New York Harbor. See Figures 5-6 and 5-7 for route maps.

Facility and Vessel Maintenance

Ferry operators employ a variety of vessels, which has resulted in the development of ferry terminals that can serve vessels that board from the side or the bow. Nonetheless, bow loading is the predominant docking arrangement in New York Harbor because it allows the vessel operator to avoid excessive maneuvering into a dock; instead, the vessel bumps against the dock and a gangway is lowered onto the deck. Approach and boarding are faster because the gangway allows several streams of passengers to board at once. Furthermore, because the dock and vessel have the same freeboard, a separate ramp is not required, and capital costs are reduced. This design also facilitates emergency responses.

Marine Log noted that on September 11, 2001, "Because of their bow-loading design, NY Waterway's [New York Waterway's]ferries were pressed into service as waterborne ambulances. . . . With all of Manhattan's arteries shut down and its subways at a standstill, NY Waterway put 22 of its 24 ferries in 'load and go' service at piers in lower and Midtown Manhattan, taking a total of 158,506 evacuees to points in Jersey City, Hoboken and Weehawken, N.J., as well as Brooklyn and Queens" (Snyder, 2001).

Safety is a high priority, and ferry operators report that their conflicts are primarily with kayaks, jet skis, and swimmers. In addition, the waterways can sometimes be closed for dignitaries, thereby creating schedule concerns.

New York Waterway. New York Waterway operates 34 vessels, mostly small 149-passenger catamarans with three crew members, operating at 15 knots. The company directly operates large terminals at Port Imperial and Hoboken in New Jersey and Pier 79 and the World Financial Center in New York City.

New York Water Taxi. New York Water Taxi operates 10 vessels, including five 149-passenger, 26-knot vessels and five 75-passenger, 21-knot vessels.

Seastreak. Seastreak uses four high-speed vessels to provide service from Atlantic Highlands and Highlands, New Jersey, while New York Waterway serves Belford, New Jersey, with one high-speed vessel.

Staten Island Ferry. Service for the Staten Island route is provided by large, 1,200- to 6,000-passenger ferries.

Staffing Levels

Each ferry operator has a unique culture and different approaches for hiring and retaining vessel crews. Most of the private operators hire locally, at entry level, and then gradually promote employees into higher levels of responsibility. Some operators hire personnel with fishing boat

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Table 5-6. New York Waterway ferry services.

Route	Service Season	Service Schedule	Crossing Time	Crossing Location
Manhattan Midtown/W. 39th–Belford/Harbor Way	Year-round Departures	Once per day	60 to 67 min	Raritan Bay/Lower New York Bay
Manhattan Midtown/W. 39th–Edgewater Ferry Landing	Year-round Departures	Every 30 min	15 to 20 min	Hudson River
Manhattan Midtown/W. 39th–Hoboken 14th Street	Year-round Departures	Every 20 min	10 min	Hudson River
Manhattan Midtown/W. 39th–Lincoln Harbor/Weehawken	Year-round Departures	Every 15 min	7 to 8 min	Hudson River
Manhattan Midtown/W. 39th–Newport	Year-round Departures	Every 30 min	10 to 15 min	Hudson River
Manhattan Midtown/W. 39th–Paulus Hook	Year-round Departures	Every 30 min	15 min	Hudson River
Manhattan Midtown/W. 39th–Port Imperial/Weehawken	Year-round Departures	Every 20 min	8 min	Hudson River
Manhattan Pier 11/Wall Street–Belford/Harbor Way	Year-round Departures	Every 15 min	40 to 55 min	Raritan Bay/Lower New York Bay
Manhattan Pier 11/Wall Street–Hoboken/NJ Transit Terminal	Year-round Departures	Every 10 to 20 min	12 min	Hudson River
Manhattan Pier 11/Wall Street–Liberty Harbor/Marin Blvd	Year-round Departures	Every 15 min	15 min	Hudson River
Manhattan Pier 11/Wall Street–Paulus Hook	Year-round Departures	Every 15 min	8 min	Hudson River
Manhattan Pier 11/Wall Street–Port Imperial/Weehawken	Year-round Departures	Every 10 to 20 min, no service between 10 a.m. and 4 p.m.	18 to 22 min	Hudson River
Manhattan Pier 11/Wall Street–Port Liberte	Year-round Departures	Every 40 min	20 min	Hudson River
Manhattan World Financial Center–Belford/Harbor Way	Year-round Departures	Every 30 min	40 to 55 min	Raritan Bay/Lower New York Bay
Manhattan World Financial Center–Hoboken/14th Street	Year-round Departures	Every 30 min	8 min	Hudson River
Manhattan World Financial Center–Hoboken/NJ Transit Terminal	Year-round Departures	10 to 30 min	8 min	Hudson River
Manhattan World Financial Center–Liberty Harbor/Marin Blvd	Year-round Departures	Every 24 min	12 min	Hudson River
Manhattan World Financial Center–Paulus Hook	Year-round Departures	7 to 8 min	8 min	Hudson River
Manhattan World Financial Center–Port Imperial/Weehawken	Year-round Departures	20 to 40 min	14 to 15 min	Hudson River
Paulus Hook–Belford/Harbor Way	Year-round Departures	20 to 75 min, 5:45 a.m. to 9:30 a.m., 30 to 120 min 2:40 p.m. to 8:55 p.m.	55 to 60 min	Raritan Bay/Lower New York Bay
Haverstraw–Ossining	Year-round Departures	30 min until 8:42 a.m., one departure at 4:12 p.m. Every 30 to 40 min in the p.m. from Haverstraw	15 min	Hudson River
Newburgh–Beacon	Year-round Departures	30 to 40 min in a.m., 10 to 15 min in p.m.	9 min	Hudson River
East River Route	Year-round Departures	2 a.m. departures, 3 p.m. departures	55 to 60 min	East River

Table 5-7. New York Water Taxi, Statue Cruises, Seastreak, and Staten Island Ferry services.

	New York Water Taxi	Statue Cruises	Seastreak	Staten Island Ferry
Route	Ikea Express	Liberty Landing Marina–World Financial Terminal	Connors Highlands–East 35th Street	Staten Island–Manhattan
Service Season	Year-round Departures	Year-round Departures	Year-round Departures	Year-round Departures
Service Schedule	Every 20 min weekdays from 2:40 p.m. to 7:20 p.m.	Every 30 min weekdays from 6:00 a.m. to 8:45 p.m.	a.m. and p.m. peak-hour service only from Connors Highlands, 30 to 75 min from Manhattan	15 to 60 min
Crossing Time	15 min	10 min	60 min	25 min
Crossing Location	East River	Hudson River	Hudson River	New York Harbor

experience or even maritime academy training, but, in general, new employees begin as deckhands. Crew training and coordination with the Coast Guard is continuous for all ferry operators.

New York Waterway. New York Waterway employs about 130 people as crew members and administrative staff.

Figure 5-6. Hudson River and East River crossings to Manhattan.

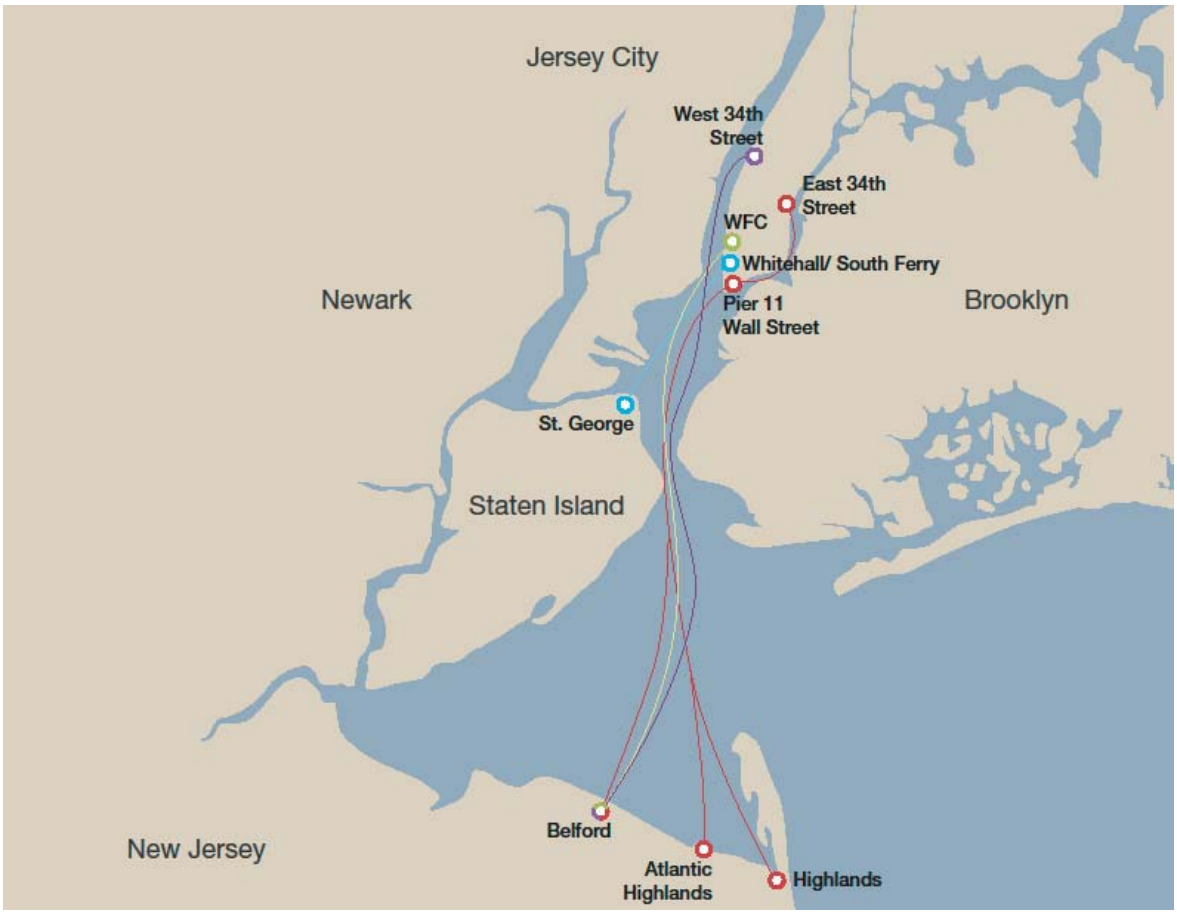

Figure 5-7. Manhattan–New Jersey Shore map.

New York Water Taxi. New York Water Taxi employs 50 to 100 employees depending on the season.

Staten Island Ferry. The Staten Island Ferry employs about 625 staff, two-thirds of which are vessel crew.

Financial Structure

Fares

Fares for New York Waterway, New York Water Taxi, Seastreak, and Staten Island Ferry are shown in Tables 5-8 and 5-9.

Funding Sources

Other than the Staten Island Ferry and a handful of demonstration services, the New York Harbor ferries do not receive operating subsidies. Public agencies have built ferry docks along the waterfront using municipal, regional, state, and federal funds, and, in general, the guidance provided by the Mayor's 1986 Waterborne Transportation Policy continues to be followed.

New York Harbor ferries now routinely carry 30,000 passengers each weekday (not including the Staten Island Ferry), with most of the use occurring on the trans-Hudson corridor. In this

Table 5-8. Fares for New York Waterway.

Route	Fare						
	Adult	Child 6 to 11 years	Senior	Bicycle	10 Trip	Monthly	Student Monthly
Manhattan Midtown/W. 39th–Belford/Harbor Way	$20.00	$9.00	$16.50	$3.00	$190.00	$605.00	$455.00
Manhattan Midtown/W. 39th–Edgewater Ferry Landing	$9.50	$6.00	$8.75	$1.25	$78.00	$272.00	$214.00
Manhattan Midtown/W. 39th–Hoboken 14th Street	$8.50	$5.50	$7.75	$1.25	$70.25	$252.00	$210.00
Manhattan Midtown/W. 39th–Lincoln Harbor/Weehawken	$8.50	$5.50	$7.75	$1.25	$70.25	$252.00	$210.00
Manhattan Midtown/W. 39th–Newport	$7.25	$3.75	$6.25	$1.00	$72.50	$252.00	$180.00
Manhattan Midtown/W. 39th–Paulus Hook	$7.25	$3.75	$6.25	$1.00	$72.50	$252.00	$180.00
Manhattan Midtown/W. 39th–Port Imperial/Weehawken	$8.50	$5.50	$7.75	$1.25	$70.25	$252.00	$210.00
Manhattan Pier 11/Wall Street–Belford/Harbor Way	$20.00	$9.00	$16.50	$3.00	$190.00	$605.00	$455.00
Manhattan Pier 11/Wall Street–Hoboken/NJ Transit Terminal	$6.50	$3.25	$6.00	$1.00	$65.00	$214.00	$155.00
Manhattan Pier 11/Wall Street–Liberty Harbor/Marin Blvd	$6.50	$3.25	$6.00	$1.00	$65.00	$214.00	$155.00
Manhattan Pier 11/Wall Street–Paulus Hook	$6.50	$3.25	$6.00	$1.00	$65.00	$214.00	$155.00
Manhattan Pier 11/Wall Street–Port Imperial/Weehawken	$12.00	$7.00	$11.00	$1.25	$100.00	$332.00	$263.00
Manhattan Pier 11/Wall Street–Port Liberte	$9.25	$4.75	$8.25	$1.00	$92.50	$312.00	$225.00
Manhattan World Financial Center–Belford/Harbor Way	$20.00	$9.00	$16.50	$3.00	$190.00	$605.00	$455.00
Manhattan World Financial Center–Hoboken/14th Street	$10.00	$6.00	$9.00	$1.25	$80.00	$282.00	$220.00
Manhattan World Financial Center–Hoboken/NJ Transit Terminal	$5.50	$2.75	$5.00	$1.00	$55.00	$181.00	$130.00
Manhattan World Financial Center–Liberty Harbor/Marin Blvd	$5.00	$2.50	$4.50	$1.00	$50.00	$166.00	$124.50
Manhattan World Financial Center–Paulus Hook	$5.50	$2.75	$5.00	$1.00	$55.00	$181.00	$130.00
Manhattan World Financial Center–Port Imperial/Weehawken	$12.00	$7.00	$11.00	$1.25	$100.00	$332.00	$263.00
Paulus Hook–Belford/Harbor Way	$20.00	$9.00	$16.50	$3.00	$190.00	$605.00	$455.00
Haverstraw–Ossining	$3.00	$2.75	$2.00	n/a[a]	$27.00	$100.00	n/a
Newburgh–Beacon	$1.00	$0.50	$0.50	n/a	$9.00	n/a	n/a

[a]Not applicable.

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Table 5-9. Fares for New York Water Taxi, Statue Cruises, Seastreak, and Staten Island Ferry.

	Routes	Fares						
		Adult	Child (6 to 11)	Senior	Bicycle	10 Trip	Monthly	Student Monthly
New York Water Taxi	Ikea Express	$5.00	n/a[a]	n/a	n/a	n/a	n/a	n/a
Statue Cruises	Liberty Landing Marina–World Financial Terminal	$7.00	$5.00	$6.00	n/a	$55.00	$220.00	n/a
Seastreak	Connors Highland–East 35th Street	$23.00	$16.00/ $9.00	n/a	$5.00	$192.00	$625.00	n/a
Staten Island Ferry	Staten Island–Manhattan	Free						

[a]Not applicable.

corridor, ferry service has encouraged the development of thousands of New Jersey residential units and has also contributed toward economic development on the west side of the Hudson. Ferries have also helped relieve overcrowding on the region's fixed links, including the Holland Tunnel, the Lincoln Tunnel, and the PATH services.

There is some concern that the 1986 model is fraying. All operators report some level of financial stress related to providing commuter services. The financial challenges result from high fixed costs and highly peaked service patterns that limit the ability of operators to spread costs out over the entire day—about 75 percent of ferry ridership occurs in the 4-hour peak periods (New York Metropolitan Transportation Council, 2008). While public agencies, through their ownership of the terminals, have removed a significant capital expense from the operators, the carrying costs of vessels are still assumed by the ferry companies and are significant. A $3-million ferry would likely require $300,000 annually in financing costs, representing the fares of about 60,000 passengers annually or 230 passengers each day. In addition, diesel fuel costs in the mid-Atlantic area roughly doubled between 2000 and 2009 (compared to inflation which increased about 25 percent over that period) (U.S. Department of Energy, accessed April 14, 2010), changing the financing assumptions that the pre-2001 ferry system was based upon.

Several New York Harbor ferry operators report data to the National Transit Database. In 2009, these ferry operators reported combined operating costs totaling about $43 million, resulting in an average hourly cost of about $575. These costs include vessel capital expenses. It is likely that if the vessel costs were considered a public capital expense and were removed from the operating expenses, operating expenses would be reduced by 15 to 20 percent (National Transit Database, 2010a, 2010b, 2010c).

Planning Issues

In spite of the current financial challenges facing ferry operators, City policy continues to encourage expansion of waterborne transit services. The public benefits of such services are economic development, congestion relief, and improved emergency response. New York City provides a good example of the public benefits of patient, incremental expansion of ferry service under private control.

The emerging paradigm for New York Harbor Ferries is as a transit service

- Available for emergency response.
- For areas that have few or poor transit options.

- That is supplemental to overburdened parallel systems.
- That may require modest public subsidies not exceeding other transit modes.
- That provides a time savings relative to other alternatives.
- That serves land uses and associated development that will help to attract sufficient ridership to support cost of vessel operation (Interview with David Hopkins, New York City Economic Development Corporation, April 12, 2010).

One ferry operator mentioned that "build it and they will come" is not a model that works. However, interviews with a broad range of operators revealed that this model might eventually work, but it may take up to a decade for individual ferry routes to become profitable, and during this period public assistance is necessary.

Land Use Issues

Experience with New York ferries suggests that creating a density of travel, either through land development (or because of it) or by connecting with other transit services is an imperative. New York has the benefit of having very short ferry crossings—most are less than 10 minutes—allowing for one vessel to make three or four trips in an hour. Filling up the vessels requires passengers, and when ferries operate at full capacity they are a very efficient mode of transport. The City is currently identifying prime infill development sites along the East River, and all sites require good transit to succeed. Some of the best sites are at a distance from existing transit, and the best option for good transit could be fast and frequent ferry service.

Emergency Response

While the New York ferry resurgence was initially based on trans-Hudson congestion relief and Hudson River shore economic development, the system also became an important public safety service during the evacuation of Manhattan on September 11, 2001. Since then, emergency response has become an important public benefit of providing and maintaining ferry service. This benefit was reinforced during the power blackout in the Northeast United States in August 2003, during the New York City Transit strike in 2005, and when ferries evacuated US Airways Flight 1549 after its emergency landing in the Hudson River in January 2009 (Interview with Port Authority, January 10, 2010).

As part of this expanded role, ferry operators participate in numerous training programs, Homeland Security initiatives, and practice drills to ensure that the ferry system can perform during an emergency. These are mandated costs to the ferry operators; however, except for some minor equipment grants, these costs are not reimbursed by an agency. In addition, when an emergency does occur, the costs incurred are often reimbursed many months later or may never be paid. These requirements place additional financial stress on the ferry operators.

North Carolina Department of Transportation Ferry Division

Quickfacts

Operator	Service Category	# of Routes	# of Vessels	Annual Passengers	Annual Vehicles	Fleet Age (years)
North Carolina Department of Transportation Ferry Division	Highway–Ferry Essential	7	21	2,100,000	950,000	5–25

History

North Carolina has a long history of using ferries as a form of transportation, especially in areas that are otherwise inaccessible by roads or are lacking easy road access. The current North Carolina Department of Transportation Ferry Division evolved from the state's practice of acquiring private ferry routes that began around 1934.

The first ferry route to eventually become part of the state's ferry network connected Oregon Inlet with Whalebone Junction (North Carolina Department of Transportation, n.d.). Initiated as a private tug and barge conveyance system and later as a wooden trawler ferry, in 1934, the North Carolina State Highway Commission (Commission) began subsidizing the crossing to reduce the toll rates. Over time, the crossing gained in popularity and users and, in 1942, the Commission instituted fixed reimbursement for the ferry operator so as to discontinue tolls completely.

New ferry routes came on line during the 1940s and 1950s, operated both by private entities and by the Commission. Concurrent to the expanding ferry system, the paving of Highway 12 allowed for greater access to the Outer Banks area, leading to increased demand on the ferry system.

During the early 1940s, ferry service across the Croatan Sound was operated by a private entity before being acquired by the state in 1946. The Croatan Sound service continued until 1956, when the Governor Umstead Bridge was completed, thereby ending the Croatan Sound ferry operation. Highway 12 brought new demand for a ferry service between Hatteras and Ocracoke Island. The new ferry service was started by a private operator before being purchased by the state in 1957. The Alligator River crossing, the first ferry service constructed and operated by the state, began in 1947 and operated until 1962, when the Alligator River was bridged (North Carolina Department of Transportation, n.d.).

Between 1940 and 1977, the North Carolina ferry system evolved as new services were added and then retired when new bridges replaced existing ferry service. During that 30-year span, ferry services were started and retired at Croatan Sound, Alligator River, Oregon Inlet, and Bogue Sound.

In 1960, the Commission created a State Ferry Operations office independent of the Highway Division Administration in the town of Manteo. The State Ferry Operations department was charged with maintaining the ferry fleet, as well as managing all personnel. By 1964, the fleet had grown to a point where the state created the Marine Maintenance Facility, separate from ferry operations, to more efficiently manage the two divisions. The Operations office moved to Morehead City to be more centrally located. In 1974, on the recommendation of a specially formed committee, the governor combined the State Ferry Operations and the Marine Maintenance Facility under one department, the Ferry Division, which would exist at the Highway Division level and be responsible for all aspects of the state ferry system (North Carolina Department of Transportation, n.d.).

Organizational Structure

The current incarnation of the Ferry Division in North Carolina lives within the state department of transportation (DOT). The ferry routes and vessels that operate on these routes are considered an extension of the state highway system, although the Ferry Division is on the same administrative level as the Highway Division within the DOT. As a public entity, all funding sources, budgetary decisions, and operational service are approved at the state's highest level through the state DOT and by the governor. Legislative influence extends to yearly budgets and federal and state funding sources. The governor has the ultimate approval through the annual state budget process.

North Carolina operates a statewide ferry system along its coast from the Knotts Island crossing near the Virginia/North Carolina border to the Fort Fisher crossing near the South Carolina/

North Carolina border. While the ferry system is operated by the state, the routes are a mixture of free and tolled crossings. Most of the shorter crossings are free for all users, with longer-distance routes charging one-way fares. The state has discouraged the implementation of tolling across all routes except for the long-distance routes with the understanding that the ferry system is part of the state highway system and thus is provided free to all users. This notion may be challenged as the global economic downturn has begun to affect long-term budget allocations.

In addition to the statewide ferry system, there are a few ferries that provide service to national parks located in the Outer Banks. These ferries are provided free of charge to park visitors. The National Park Service provides ferries to manage the number of people visiting the parks while maintaining the integrity of the park conditions.

In 2009, the ferry system reduced service as a response to budget shortfalls and increased expenses. The Coast Guard mandate requiring additional crew aboard vessels forced North Carolina to remove some vessels from service in order to redistribute staff to the more heavily patronized routes. The governor recently announced that the service cutbacks were temporary, and service would be restored to previous levels in 2010 (Interview with North Carolina Ferry Division, January 14, 2010).

Operational Structure

System/Service Routes

Currently, North Carolina is the second largest state-owned and -operated ferry system in the country, with service operating 365 days a year and offering over 200 daily departures during the summer season and 150 daily departures during the winter season. The system has seven ferry routes that provided service for nearly 1 million vehicle trips and 2.1 million passenger trips during the 2008–2009 fiscal year (North Carolina Department of Transportation, 2009).

The North Carolina routes have developed organically, with implementation guided by demand for service. North Carolina began the ferry service through purchasing existing services from private operators with the aim of preserving or creating low-cost or free service. As demand for ferry service grew over the years, more routes were added, but in most cases bridges were seen as the permanent solution to providing access. The practice of replacing ferry service with bridges continued until most ferry routes that could be reasonably replaced were (as is documented with ferry routes that once existed across Croatan Sound, Alligator River, Oregon Inlet, and Bogue Sound). The ferry routes that remained are a collection of services for areas where bridges were either unwarranted or unwanted, such as Ocracoke Island. Table 5-10 highlights the current routes in the North Carolina ferry system. Figure 5-8 provides a route map.

Facility and Vessel Maintenance

North Carolina owns and operates all of its waterside facilities and vessels (Interview with North Carolina Ferry Division, January 19, 2010). Water landings and vessels were either purchased or built during the state ferry expansion. Some vessels were purchased directly from private operators and were folded into the agency, while others were acquired in conjunction with the United States Department of the Interior, which had established the Cape Hatteras National Seashore Park. Still other vessels were commissioned directly by the state to satisfy increasing ferry service demand. (See Figure 5-9 for a photo of a typical North Carolina ferry vessel.)

North Carolina operates RO-RO ferries on all of their routes. The vessels are a mix of River Class and Sound Class ferries, of which the Sound Class ferries have specially designed hulls and propulsion systems to handle tricky sea conditions; some ferries are double-ended ferries. In total, the system has 21 vessels in its fleet, and there is one vessel on order (Interview with North Carolina Ferry Division, January 14, 2010).

Table 5-10. North Carolina ferry routes.

Route	Service Season	Service Schedule	Crossing Time	Crossing Location
Bayview–Aurora	Year-round Departures	Every 1.5 h	30 min	Pamlico River
Currituck–Knotts Island	Year-round Departures	Every 2 to 3 h	45 min	Currituck Sound
Swan Quarter–Ocracoke	Year-round Departures	Every 3 to 6 h	2.5 h	Pamlico Sound
Cedar Island–Ocracoke	Year-round Departures	Every 2 to 3 h	2.25 h	Pamlico Sound
Hatteras–Ocracoke	Jan 1–May 11, Sept 29–Dec 31	Hourly	40 min	Hatteras Inlet
Cherry Branch–Minnesott Beach	Year-round Departures	Every 30 min	20 min	Neuse River
Southport–Fort Fisher	Year-round Departures	Every 45 min to 2 h	35 min	Cape Fear River

The state also owns and operates a vessel for dredging and piling work, the *Dredge Carolina,* and three tugs that assist it (Interview with North Carolina Ferry Division, January 14, 2010). The *Dredge Carolina* does work during the permitted time period allowed by regulators and is equipped for workers to live on board during the working season.

North Carolina maintains all of its vessels at its central maintenance facility located at Manns Harbor. Maintenance is conducted by in-house engineers and technicians. They complete all required haul-outs, engine repowers, painting, and handle any vessel breakdowns. Maintenance

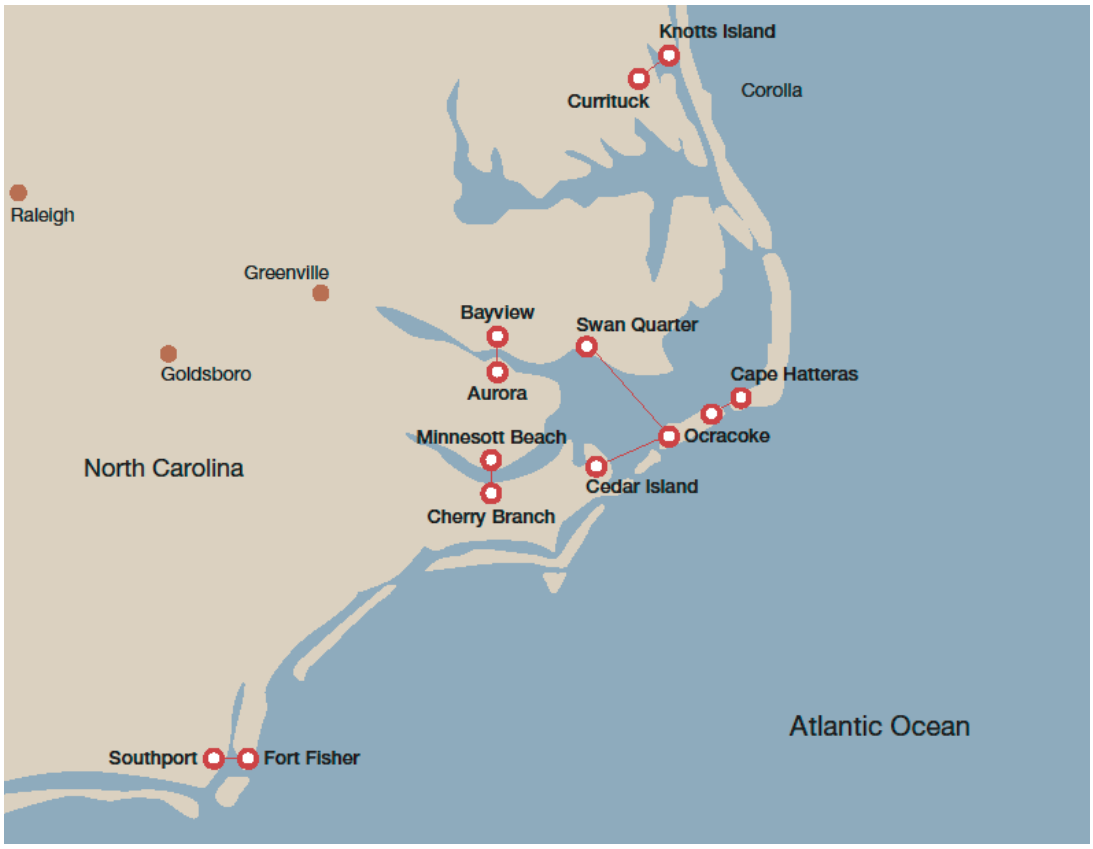

Figure 5-8. North Carolina ferry routes.

Figure 5-9. Typical ferry vessel–North Carolina Department of Transportation Ferry Division.

parts are stored in a facility adjacent to the central maintenance facility, with usually approximately $1.8 million worth of parts kept onsite (Interview with North Carolina Ferry Division, January 14, 2010). Maintenance parts are trucked to the three satellite facilities as needed. The three satellite facilities handle lighter-duty repairs to allow the vessels to return to duty within a short period of time.

In addition to maintaining its own vessels, the state performs its own dredging, piling, and cluster work to maintain clear waterways within the various sounds. The state works closely with the United States Army Corps of Engineers to determine the optimal time for dredging allowance. When the dredging season is over, maintenance crews work to improve pilings and other waterside improvements and maintenance.

North Carolina is one of the very few operators that provide 100 percent of maintenance in house (Interview with North Carolina Ferry Division, January 14, 2010). The state completed a new state-of-the-art maintenance facility at Manns Harbor that can handle the necessary capacity needed for vessels in dry dock. The centralized maintenance facility also enables the Ferry Division to effectively manage maintenance tasks, such as parts inventory, for a fleet that is separated across many miles.

Staffing Levels

The ferry system has approximately 500 to 525 employees during the low season (November to April) and 575 to 600 employees during the high season (May through October) (Interview with North Carolina Ferry Division, January 14, 2010). Administrative staff is split between Manns Harbor, where the main maintenance facility is located, and Morehead City, where the previous State Ferry Operations department was located.

Due to the great distance separating the various routes from the maintenance facility and head administrative office, there are three satellite maintenance facilities. These facilities are located at Cherry Branch, Cedar Island, and Hatteras. Vessel crew also report directly to their route locations. Crews work seven-on/seven-off shifts, with two crews for each vessel. Coast Guard regulations require a minimum number of crew members on board at any one time, which has forced North Carolina to increase its crew staffing.

44 Guidelines for Ferry Transportation Services

As a majority of the ferry routes serve the Outer Banks, a well-known vacation destination, the cost of living for staff members is significantly higher than the cost of living in other parts of the state, especially the interior. The condition of the state's resources and the Ferry Division's budget have prevented salaries from keeping pace with the cost of living in the Outer Banks. This circumstance has made it difficult for the Ferry Division to attract the necessary workforce. In response, the Ferry Division has completed a staff dorm where staff and crew can live during the work week; a second dorm is under construction. Two dorms are already operational at Hatteras. Room and board is provided free of charge. The intent is to reduce the cost for staff traveling from home in the interior part of the state and also to entice prospective workers with a benefit. It has so far proven to be very popular with the staff (Interview with North Carolina Ferry Division, January 14, 2010).

Financial Structure

Fares

As North Carolina considers its ferry system an extension of the state highway system, most of the ferry routes are provided free to passengers, with the exception of its longer routes and the Southport–Fort Fisher route. Table 5-11 shows the fare breakdown by route.

Reservations are offered only on the Cedar Island–Ocracoke and Swan Quarter–Ocracoke routes. All other routes are offered on a first-come/first-served basis. Motorists with reservations must claim their reservation at least 30 minutes prior to departure or it will be canceled.

Funding Sources

North Carolina receives its ferry funding through a combination of state revenues and federal funds or grant monies. The annual ferry budget is set through the state DOT, which portions out the state revenues accordingly. Federal grants and funds are applied for on a year-to-year basis, depending on the type of funding available. Most of the federal funds received are applied to capital projects rather than operating needs.

Table 5-11. Ferry route fares.

Route	Fare
Bayview–Aurora	Free
Currituck–Knotts Island	Free
Swan Quarter–Ocracoke	• Pedestrian–$1.00 • Bicycle Rider–$3.00 • Motorcycle–$10.00 • Vehicle and/or other combination less than 20 ft–$15.00 • Vehicle and/or other combination 20 to 40 ft–$30.00 • Vehicle and/or other combination 40 to 65 ft–$45.00
Cedar Island–Ocracoke	• Pedestrian–$1.00 • Bicycle Rider–$3.00 • Motorcycle–$10.00 • Vehicle and/or other combination less than 20 ft–$15.00 • Vehicle and/or other combination 20 to 40 ft–$30.00 • Vehicle and/or other combination 40 to 65 ft–$45.00
Hatteras–Ocracoke	Free
Cherry Branch–Minnesott Beach	Free
Southport–Fort Fisher	• Pedestrian–$1.00 • Bicycle Rider–$2.00 • Motorcycle–$3.00 • Vehicle and/or other combination less than 20 ft–$5.00 • Vehicle and/or other combination 20 to 40 ft–$10.00 • Vehicle and/or other combination 40 to 65 ft–$15.00

There are only four tolls in the state of North Carolina, three of which are for ferry crossings. The state collects approximately $2 million annually in toll income (Interview with North Carolina Ferry Division, January 19, 2010). The operating budget for fiscal year 2009/2010 was $30 million, which comprises a mix of toll revenue, state transportation improvement funds, and supplemental federal funding grants. A typical federal grant size is $1.8 to $1.9 million, with a needs-matching grant from the state required.

Implementing additional tolls on ferry routes has been politically infeasible in the past, with a high degree of opposition from both citizens and elected officials. The global economic downturn has begun to change perceptions, as the annual ferry budget has continued to decrease—down 3 percent, 5 percent, and 7 percent over the past 3 years, respectively (Interview with North Carolina Ferry Division, January 19, 2010). The budget has decreased from $35 million in 2008/2009, to $30 million for 2009/2010, to a projected $27 million for 2010/2011. In the first 6 months of fiscal year 2009, the Ferry Division spent $17 million, over half of its annual budget, which contributed to service reductions to offset future budget shortfalls. The state indicated that to optimally run the system, an annual budget of approximately $38 to $48 million is necessary to maintain existing services and to continually improve the system (Interview with North Carolina Ferry Division, January 19, 2010).

A study currently being conducted by North Carolina State University is examining how the ferry system can increase efficiency in a variety of ways. One option being looked at in the study is the effect on ridership and revenue of increasing tolls or implementing new tolls. A survey conducted as part of the study found that most people agree with the idea of paying a toll to help offset some of the budget reduction, although a proposed toll was not included as part of the study. Other forms of new tolling being studied include seasonal tolling or increased tolling prices.

In 2008, the United States experienced rapidly rising fuel and gasoline prices during a short period of time. This affected not only the everyday layperson, but all industries with gasoline and fuel as primary operating expenses. Overall, the North Carolina DOT provides and pays for fuel for all of its departments, the Ferry Division included. The state spends $6 million annually on fuel, and the rapid rise in fuel prices in 2008 wiped out its "rainy day" fund for that year. The state indicates that there likely will be no change in operating procedure for purchasing and distributing fuel among the different DOT departments, and individual departments will not be responsible for purchasing or budgeting for their own fuel.

Planning Issues

Environmental and Regulatory Issues

The state of North Carolina complies with all state and federal environmental regulations, including the regulations of the Coast Guard and Homeland Security. Many of North Carolina's air quality regulations follow the California Air Resource Board Title 13 regulations for compliance.

The Ferry Division is moving toward meeting the United States Environmental Protection Agency's requirement for Tier 3 diesel engines after repowers. This is currently the extent to which the state is investigating new technologies and/or vessels. A new ferry is on order and is under construction at a ferry dock in Texas; its delivery is expected in 2011. A separate bid has recently been awarded for a second Sound Class ferry to be completed in 2012.

Outside of regulation compliance, the state DOT and Ferry Division are engaged in environmental stewardship through an environmental policy, as well as programs such as the ferry-based water quality monitoring program. The environmental policy outlines the Ferry Division's

mission statement as well as goals for service and includes (North Carolina Department of Transportation, 2008):

- Continuing [its] commitment to environmental stewardship and improvement, including a commitment to the prevention of pollution and the preservation of natural resources. The North Carolina DOT Ferry Division also strives to meet or exceed relevant environmental legislation, regulations, and other requirements.
- Providing a framework for setting and reviewing objectives and targets via the development of relevant procedures.
- Being cognizant of the ferry system's impacts to land, air, and water resources and inhabitants of these resources.
- Making this environmental policy available to the public, including those who work on behalf of the Ferry Division, on the web site.
- Requiring Ferry Division employees whose work duties may significantly impact the environment to review the Environmental Management System and become familiar with the ways that they can ensure environmental stewardship.

The Ferry Division is also compliant with ISO: 14001, which is the international standard for environmental compliance.

In addition to its environmental policy, the Ferry Division, in partnership with Duke University and the University of North Carolina (UNC)–Chapel Hill, gather water quality data as part of a program called "FerryMon." Ferries on the Neuse River/Pamlico Sound collect water on the ferries through a system located on board the vessels. The data are logged and downloaded by cell phone to computers at Duke and UNC–Chapel Hill. Through the gathering and logging of data, a database is being established that will help in monitoring water quality standards over time, as well as during natural events such as storms or hurricanes (Institute of Marine Sciences at UNC–Chapel Hill et al., n.d.).

Land Use Issues

Each ferry terminal in the North Carolina system consists mainly of a small terminal building, a waiting area for vehicles and passengers, and a loading dock. Most terminals are located in areas where it made sense to establish a water crossing. Historically, there has been little effort to focus landside development immediately around the terminal areas. In some cases, the lack of development is encouraged, as the terminals are gateways or entry points to existing communities such as on Ocracoke Island. Ferries are seen more as a form of transportation than a catalyst for landside development. In the past, ferry routes have given way to bridges, which tend to limit development along the shoreline.

Most passengers using the ferries arrive by vehicle, as the ferries are just one link in an overall transportation trip. There is also little local transit coordination, as ferry routes often cross multiple local jurisdictions and involve trips that are generally not conducive to transit.

North Carolina experiences a dramatic high-season ridership during the summertime. The Outer Banks experiences both vehicular traffic and ferry traffic congestion as vacationers flock to the area. Given the capacity constraints of Highway 12, ferry users often experience one to two boat waits during the high season. While ridership had been falling over the past few years, the summers of 2009 and 2010 experienced a modest ridership increase during the high season. This increase was likely due to more vacationers staying in state or closer to home to save money during the economic downturn.

Emergency Response

The Outer Banks is vulnerable to large storms and hurricanes that can wipe out Highway 12, which is the major entrance and exit to the area. For some places along the Outer Banks, such as

Ocracoke Island, the only access is via ferry. During an emergency, ferries from the Ferry Division are called to aid once the disaster warning has been released. Ocracoke Island has an onsite emergency coordinator and, as part of Hyde County, is part of an overall county emergency plan. During an emergency, the Ferry Division follows the protocols of Hyde County.

U.S. Virgin Island Ferries

Quickfacts

Operator	Service Category	# of Routes[a]	# of Vessels	Annual Passengers	Annual Vehicles	Fleet Age (years)
Transportation Services of St. John, Inc.	Transit–Ferry Intercity	2	3	2,100,000	950,000	15–30
Varlack Ventures	Transit–Ferry Intercity	2	3			

[a]Only franchised routes are considered in this case study.

History

The U.S. Virgin Islands are made up of three islands in the Caribbean Sea: Saint Thomas, Saint John, and Saint Croix. Charlotte Amalie, the territory's capital, is located on Saint Thomas. The population of all three islands, according to a 2009 estimate (CIA Factbook, accessed March 20, 2010), is 109,825. Much of the population is split between Saint Thomas and Saint Croix, with Saint John functioning mostly as a tourist and resort destination. This is reflected in the distribution of government services, which are located mainly in Saint Croix and Saint Thomas.

As a territory, the U.S. Virgin Islands system of government is similar to that of a state, with three branches of government: the Executive Branch, the Legislative Branch, and the Judicial Branch. The U.S. Virgin Islands are governed by the laws of the United States Constitution, as well as the Revised Organic Act of 1954 that further defined the laws and rights for citizens in the U.S. Virgin Islands (United States Virgin Islands, accessed March 21, 2010). Currently, the U.S. Virgin Islands have a proposed constitution that is before the United States Congress for review.

Saint Croix, which is 83 square miles, is the largest of the three islands. Saint Croix is also the furthest distance from Saint Thomas and Saint John—40 miles south of Saint Thomas. Saint Thomas is the next largest island in the territory at 31 square miles. It is the closest island to Puerto Rico, another U.S. territory. Saint Thomas and Saint John are only separated by 4 miles (3.5 nautical miles). Saint John is the smallest of the three islands at 20 square miles. It is also the only island without an airport and is completely reliant on ferries for inter-island travel.

Water travel is a necessity for residents of the islands of Saint Thomas, Saint John, and Saint Croix, and thus the U.S. Virgin Islands require a robust ferry service. Ferry service has traditionally been offered by small, private operators who met demand for travel between the main islands of Saint Thomas and Saint John, where most of the government services are located. In 1972, the government created a franchise agreement with two private ferry operators to maintain passenger-based ferry service between Saint Thomas and Saint John (Interview with Transportation Services, January 29, 2010). The franchise agreement gave the ferry operators the right to operate on approved routes between the two islands and regulated ferry fares through the public services commission. Only the two contracted ferry operators were given the right to provide ferry service between the two islands. The two ferries provide non-competition-based services dictated by the franchise. Other for-profit ferry services exist for vehicle transportation although services are not as frequent as the franchised service (United States Virgin Islands, accessed March 21, 2010).

Organizational Structure

Under U.S. Virgin Islands Code Title 25, Chapter 3, regularly scheduled ferry service between Saint Thomas and Saint John shall be maintained in accordance with regulations by the Governor (Virgin Islands Code, Title 25, Chapter 3). For the purpose of maintaining transportation facilities and services between the Islands of Saint Thomas and Saint John, the Governor shall contract for, purchase, or otherwise acquire all such equipment, labor, services, and facilities as are necessary or appropriate. Title 25 is the precursor to enacting the ferry franchise agreement.

In 1986, the U.S. Virgin Islands enacted a franchise agreement to operate ferry services between Saint Thomas and Saint John, as well as bus services on Saint Thomas. The franchise agreement is part of Act No. 5168 of the 1986 Regular and Special Legislative Sessions. The franchise agreement exclusively gave the right to Transportation Services of St. John, Inc., and Varlack Ventures to operate marine services between the two islands (Virgin Island Session Laws, Act No. 5186, 1986). The franchise agreement requires maintaining existing service levels from 1986 for the length of the 10-year franchise. The two franchises are on a temporary extension and as a result are still operating under their 1986 franchise agreements. As part of the franchise agreement, the two operators are considered as a public utility, to be regulated by the Public Services Commission.

Ferry services between Saint Thomas and Saint John currently continue to operate under the franchise agreement established in 1986 by the same private ferry operators. Both operators provide duplicate routes between the two islands, with demand split evenly between the two operators. Because the franchise agreement eliminates competition between the two operators and fares are regulated by the Public Services Commission, the two operators in essence operate as one unit, although the internal functioning of the two entities remains independent.

U.S. Virgin Islands Code Title 25, Chapter 3 mandated that vessels in service under the franchise agreement be under the auspices of the Governor. Since the franchise agreement was instituted in 1986, the two contracted operators have continued to operate their own private vessels in service. Both operators own and operate similarly sized vessels, one vessel for each route plus one space boat, for a total of three boats for each operator. The two boats in daily service are approximately 300-passenger vessels.

Operational Structure

System/Service Routes

The franchise agreement mandates ferry service between Saint Thomas and Saint John. Pillsbury Sound, which separates Saint Thomas from Saint John, is considered part of the federal highway system; this classification of Pillsbury Sound is the basis of the franchise agreement and the government's sponsorship of the route. By contrast, the crossing between Saint Thomas and Saint Croix is not considered part of the federal highway system, thus there is no franchise mandate.

The two franchise operators provide identical service with identical service schedules and very similar fare structures. Passengers can board either ferry for passage between the two islands. The two terminals on Saint Thomas are located in the most populated areas on the island—the capital, Charlotte Amalie, and Red Hook on the eastern side of the island. Cruz Bay on Saint John is the main entry point to the island. As 75 percent of Saint John is part of the National Park Service, only one terminal is necessary. Table 5-12 outlines the ferry routes. Figure 5-10 shows a route map.

Red Hook has more frequent service compared to ferries departing from Charlotte Amalie. This is due to the shorter travel time between Red Hook and Cruz Bay (approximately half the duration of one-way travel on the Charlotte Amalie–Cruz Bay route) and the fact that most of the local population lives closer to the Red Hook terminal. The Charlotte Amalie terminal pro-

Table 5-12. Ferry routes between Saint Thomas and Saint John.

Route	Service Schedule	Service Frequency	Trip Time
Red Hook, Saint Thomas–Cruz Bay, Saint John	6:30 a.m. to 7:30 a.m., 8 a.m. to 12:00 a.m.	60 min	15 to 20 min
Charlotte Amalie, Saint Thomas–Cruz Bay, Saint John	7:15 a.m., 9:15 a.m., 11:15 a.m., 1:15 p.m., 2:15 p.m., 3:45 p.m. (leaving Cruz Bay), 9:00 a.m., 11:00 a.m., 1:00 p.m., 3:00 p.m., 4:00 p.m., 5:30 p.m. (leaving Charlotte Amalie)	2 h	40 to 45 min

vides easy ferry access to tourists heading to Saint John, especially tourists who have arrived to the island via cruise boats.

Both operators of ferry service between Saint Thomas and Saint John provide identical service with almost identical service headways. While ferry operation is non-competitive due to the franchise agreement, it is important to note the similar service schedules and ridership demand that allow for both entities to provide similar services. Ridership is generally split evenly between the two franchised operators, since fares and schedules are held constant. Together, the two operators transport approximately 2 million passengers a year between Saint Thomas and Saint John (Interview with Transportation Services, January 29, 2010). Ridership experiences some seasonal peaks, notably during Carnival, when daily passenger loads spike to 10,000 to 15,000 passengers.

Figure 5-10. U.S. Virgin Island ferry service routes.

Otherwise, daily ridership is generally constant throughout the year, as local residents depend heavily on the ferry service to travel to work and school and make daily foodstuff purchases. The U.S. Virgin Islands are a year-round tourist destination, so tourist patronage does not make up a large proportion of seasonal ridership. (Interview with Transportation Services, January 29, 2010).

Ferry service between Saint Croix and Saint Thomas is not mandated by the government, and the route between the two islands is not a popular one. Unlike Saint John, Saint Croix is largely self-sustaining, with jobs and housing located on the island. In addition, the journey between Saint Croix and Saint Thomas by water is very uncomfortable because of rough water, and people prefer to travel by air. In this instance, inter-island air travel is more attractive than water travel. Travelers travel by seaplane for inter-island travel.

Facility and Vessel Maintenance

Both franchise operators own and operate their own vessels for the Saint Thomas–Saint John route. Until now, the island government has been unable to secure federal capital financing to purchase government-owned vessels for use on the route. The island government is currently working with the federal government to secure a $5-million capital funding grant that would be used to purchase two new ferry vessels, one for each franchise operator (Interview with Transportation Services, January 29, 2010).

Both operators generally operate three vessels on the two routes. Because the Red Hook to Cruz Bay route has the more frequent service, there are two vessels in operation. There is one vessel on the Charlotte Amalie to Cruz Bay route. Both operators use similarly sized vessels, ranging from boats that can carry 149 passengers to boats that can carry more than 300 passengers. One operator uses a 149-passenger boat for the Charlotte Amalie run to Cruz Bay and two passenger boats that can each carry 280+ passengers for the Red Hook run.

Daily vessel maintenance is conducted by each operator's own maintenance staff. One franchise operator has four mechanics on staff to conduct daily checks on the vessels. The vessels are put in dry dock twice a year—one time for Coast Guard inspection and the second time for removal of barnacles from the bottom of the boat because they can affect vessel operation.

Vessel replacement of boats on the franchise routes has been performed by the operators with their own resources and in accordance with individual requirements. The U.S. Virgin Islands received federal funding for new vessels in 2011 and expects to receive these vessels in the next several years. It is hoped that the new vessels on order with monies from the federal grant will arrive sometime in fall 2010.

Staffing Levels

Staff comprises crew members, mechanics, and administrative personnel. Both operators have a staff of 45 to 50 people. The staff comprises 4 or 5 mechanics and 25 crew members; the remainder is administrative staff. Both ferry operators are family-owned enterprises.

Financial Structure

Fares

Regular adult fares run between $7 and $11 per one-way trip, as shown in Table 5-13. Discounted trips are available for students, seniors, and government workers. The island government purchases tickets in bulk at a reduced price to distribute to its workforce. In contrast to the usual one-month ticket book, government-purchased bulk tickets are good for 90 days.

Tickets can be purchased in advance (mail or online) or at the ferry terminal. A recent upgrade to the ticket collection system discontinued the practice of having an onboard ticket collector;

Table 5-13. Fare structure.

Route	Fare	
	Franchise #1	Franchise #2
Red Hook, Saint Thomas–Cruz Bay, Saint John	$7.00 adult one way, $2.00 child fare, $2.00 senior rate, $3.00 luggage charge	$6.00 one way
Charlotte Amalie, Saint Thomas–Cruz Bay, Saint John	$11.00 one way, $3.00 luggage charge	$12.00 one way

now an outside ticket company distributes tickets and collects fares for both operators jointly. The U.S. Virgin Islands Port Authority is currently testing a turnstile pilot program where passengers can use swipe cards for entry. This program will hopefully be spread to all the terminals once the testing phase is complete.

Fares are set and approved by the Public Services Commission, which oversees all utilities on the islands. The franchise agreement creating the government-sponsored ferry routes deliberately states that fare increases or decreases must be approved by the Public Services Commission because ferry service is considered as a utility on the islands (Virgin Island Session Laws, Act No. 5186, 1986).

Funding Sources

Because the ferry is an integral part of residents' daily travel, any increase in fares is met with intense public resistance. The private operators have been unable in the past few years to work out an agreement with the Public Services Commission to raise fares. This dispute has caused the operators to threaten to go to the court, as they allege that they are continually losing money (Interview with Transportation Services, January 29, 2010).

Another source of discontent between the franchise operators and the government is the current use of private vessels when the government is mandated to use publicly purchased vessels on the Saint Thomas–Saint John ferry routes. Federal funding is the main source of capital projects, and federal funding of over $5 million is scheduled to be granted for new ferry boats (Interview with Transportation Services, January 29, 2010).

Planning Issues

Environmental and Regulatory Issues

The U.S. Virgin Islands follow current federal standards and regulations. The territory does not have its own set of environmental compliance regulations.

The increase in the cost of fuel that began in 2008 has forced the ferry operators to begin to investigate new technologies to reduce fuel consumption. At least one operator has started to welcome overtures from companies selling new technologies, such as fuel additive, that are purported to reduce the amount of fuel burned by the engines. Fuel can be purchased from only a few purveyors on the island and because the operators lack space to store large amounts of fuel, they pay for fuel at prices listed on the day that the vessels fill up (Interview with Transportation Services, January 29, 2010).

Land Use Issues

On Saint Thomas and Saint John, ferry terminals are located in well-established areas. Charlotte Amalie is the island's government seat, while Red Hook and Cruz Bay are points of local development and commerce. The majority of the ferry service between the two islands is passenger day travel, with residents using ferries as a commute mode.

Emergency Response

The U.S. Virgin Islands experience the threat of hurricanes every season. Emergency evacuation plans are in place for each island should a natural disaster occur. In an emergency, there is the possibility that vessels from Saint Thomas would have to assist in evacuating Saint Croix and in doing so navigate the rough waters between the two islands. For this reason, the ferry operators in the U.S. Virgin Islands use monohull vessels.

Washington Island Ferry Line (Wisconsin)

Quickfacts

Operator	Service Category	# of Routes	# of Vessels	Annual Passengers	Annual Vehicles	Fleet Age (years)
Washington Island Ferry Line	Highway–Ferry Essential	1	5	200,000	n/a	7–40

History

Washington Island is an island located 6 miles (5.2 nautical miles) from the tip of Door County, Wisconsin. It is a popular vacation destination as well as a year-round residence for approximately 700 people. Ferry service is an integral part of island life—many of the island's daily goods arrive by boat. Supplies such as foodstuffs and heating products ensure that residents can live on the island year-round.

Washington Island Ferry Line (WIFL) began service in 1940, when Arni and Carl Richter purchased two wooden ferries from an existing service that was run by Captain William Jepson and that had been in operation for 6 years. Upon acquiring United States Postal Service (USPS) contracts to deliver freight mail, what was once seasonal service transitioned to daily service to the island. Today, WIFL continues as a private ferry operation (Purinton, accessed April 1, 2010).

As a family-owned and -operated business, the ferry service continues to provide a public service for both residents and visitors to the island. In addition, ferries shuttle commerce and goods between the mainland and the island. Although the ferry service is a wholly owned private entity, there are some aspects of operation that fall under government regulation and oversight. This regulation and oversight is provided mainly by the United States Coast Guard, as well as several state offices that oversee marine-based functions.

Organizational Structure

As a private operation, WIFL has the flexibility to modify and adjust to changing conditions, both environmental and social. The company owns all of its vessels, as well as the ramps, piers, and terminal facilities.

Operational Structure

System/Service Routes

WIFL operates only one route between the mainland and Washington Island (see Figure 5-11 for route map). Approximately 200,000 people ride the ferry every year. The service operates 26 or 27 round trips a day during the summer, with service reduced to twice a day during the winter season due to severe weather and ice conditions. The summer months provide 75 to

Figure 5-11. Washington Island ferry route.

80 percent of the year's business. Summer travelers are mainly tourists, in-state visitors, and day-trippers (Interview with Washington Island Ferry Line, February 4, 2010). Few commuters use the service daily, since the dock is located far from the nearest town on the mainland and schedules are not set to accommodate a typical commuter schedule. Friday and weekend trips tend to have more passengers than a typical weekday because of seasonal property owners and vacationers heading to the island for the weekend. WIFL runs special trips on Friday, Saturday, and Sunday nights to satisfy the demand from weekend travelers (See Table 5-14 for service schedule).

Travel time on the ferry route varies by the season. During the non-winter months, the crossing takes approximately 30 minutes. During the winter months, the crossing time can extend to 40 to 45 minutes. Severe weather such as icy conditions can extend a one-way trip to 4 hours. In this situation, an icebreaker is required to clear a path through the ice, either with the operation's ferries that can break ice or with the assistance of the Coast Guard (Interview with Washington Island Ferry Line, February 4, 2010).

Table 5-14. Washington Island Ferry Line service frequency by season.

Season	Frequency–To Island	Frequency–From Island
Spring		
April 1, 2010–May 7, 2010	Hourly	Hourly
May 8, 2010–July 1, 2010	Hourly	Hourly
Summer		
July 2, 2010–August 15, 2010	30 to 45 min	30 to 45 min
Fall		
August 16, 2010–October 24, 2010	Hourly	Hourly
Early Winter/Winter		
October 25, 2010–December 5, 2010	Hourly	Hourly
December 6, 2010–January 2, 2011	4 sailings per day	4 sailings per day
January 3, 2011–March 31, 2011	Two times weekly (do not sail on Wednesdays)	Two times weekly (do not sail on Wednesdays)
Night Trips		
Friday Night Trips	30 to 60 min	30 to 60 min
Saturday/Sunday Trips	Once nightly	Once nightly

Facility and Vessel Maintenance

WIFL operates a fleet of four RO-RO vessels. At full capacity, the vessels can carry 149 passengers, 18 to 21 vehicles, or 2 fully loaded semi trucks. In age, the vessels range from 7 to 40 years old. Two boats were recently sold due to age (Interview with Washington Island Ferry Line, February 4, 2010).

Vessels are replaced based on a number of factors, including capacity demand, usefulness in the fleet, cost of modification, and payback period. As a private operator, WIFL undergoes a rigorous cost-benefit exercise to determine the short- and long-term implications of new vessel purchases, including changing technologies and new potential governmental regulation requirements.

The spike in fuel costs in 2008 forced WIFL to find ways to limit the financial impact of the cost increases. WIFL began implementing new fueling strategies, purchased new fueling equipment, changed fueling vendors, and created a reserve fund. In addition, WIFL sought to lock in fuel prices by buying a bulk of 2009's fuel in advance instead of at market rates. WIFL crew were also required to undergo spill containment training in the event of fuel leaks and reduced the amount of time spent idling.

WIFL owns two docking facilities and leases two others. Wisconsin State Department of Transportation (WDOT) grants assisted in the construction of a mainland breakwall. WIFL conducts all of its daily maintenance needs in an onsite maintenance facility, although it does not have dry dock capability. Dry docking occurs at a facility 40 miles away.

Staffing Levels

WIFL is run with a staff of 12 to 14 people in the off season, with staff size expanding to 30 to 32 during the summer months. WIFL has not had difficulty recruiting crews and staff; it has more often been the case that more people are looking for marine-based work in the area than there is capacity to hire. In addition, 100 percent of the operation is island based—meaning that workers start and end their day on the island.

Financial Structure

Fares

The fares charged by WIFL are shown in Table 5-15. Tickets can be purchased at the office and ticket booth. Tickets cannot be purchased in advance on WIFL's web site. Discounted ticket

Table 5-15. Fare structure (round trip).

Passenger Type	Fare
Adult	$11.50
Child (6–11 years)	$5.50
Automobile (passengers not included)	$25.00
Motorcycle	$15.00
Bicycle	$4.00
Island resident children	Free

books are available for regular riders, who often have a "house" account. Island school children also ride the ferry for free. Tickets are collected during boarding by crew members.

Despite the financial difficulties of recent times, WIFL did not raise its rates for the season of April 2010 to April 2011. They expect to be able to maintain rates at the same level during the year.

Funding Sources

As a private operator, WIFL receives no public funding for day-to-day operating costs. Door County applied for grant funding from WDOT for the construction of docks and breakwalls.

Planning Issues

Planning, whether short- or long-term, is critically important to the continued operations of WIFL. As a private operation, WIFL must strive continually to maintain a balance of costs and expenditures. Some short-term goals identified to maintain the balance of costs and expenditures include the following (Interview with Washington Island Ferry Line, February 4, 2010):

- Acquire new fueling equipment/fuel truck to avoid a fuel surcharge.
- Change fuel supply vendors.
- Undergo spill containment training.
- Create a reserve fund in case of emergencies or unexpected expenditures.
- Look closely at engine manufacturers to understand optimum fuel burn rate.
- Reduce idling time.
- Make decisions on future engine purchases based on the ability to reduce consumption but keep horsepower.
- Undergo engine repowers and resell old engines.
- Purchase new engines before new EPA emission requirements take effect.

Long-term goals include the following:

- Improve "value added" experience for passengers.
- Include more deck space for passengers to move around on new boats.
- Provide more education for crew and staff, especially for information sharing.
- Provide more service at a lower cost.
- Balance capital costs against the benefits of operating savings and environmental compliance.
- Provide shore transportation alternatives.

Environmental and Regulatory Issues

Keeping abreast of current environmental issues and regulations pertinent to the WIFL operation is a constant effort for the staff. Certain aspects of environmental regulations, such as safety and security for vessels, which are mandated by the Coast Guard, are well known because of their relevance to day-to-day operations. Other regulations and possible future regulations related to environmental contaminants, such as air pollution, require more nuanced response because of the complex nature of environmental pollution.

The state of Wisconsin does not have an independent environmental regulatory system separate from the federal government, so WIFL maintains standards that meet federal requirements.

WIFL is a member of the Passenger Vessel Association (PVA), a national association representing the interests of owners and operators of passenger vessels, which provides a variety of services to assist in making daily operations possible. The PVA provides operators with information on environmentally related transportation issues such as emissions and energy and updates on issues expected to be important in the near future. In addition, operators have experts at their disposal through the PVA if there are any questions regarding new requirements and regulations that have been passed or implemented. This was identified as very helpful by WIFL as they do not have the capability in house to keep abreast of and understand all of the new rules and mandates that come down from the government, often from different departments.

Over the past few years, the water level in Lake Michigan has fallen drastically, enough so that WIFL needed to build a new ramp at the mainland dock as well as make modifications to the terminal on Washington Island. This is a concern since the drop in water level is a recent occurrence; Lake Michigan's water level had been stable for the previous 20 to 25 years. It is not known if Lake Michigan will return to its previous water level. WIFL spent $400,000 to make improvements to the docks, which are owned or leased exclusively by WIFL. Unforseen expenses have a significant impact on financial stability and overall business health.

Land Use Issues

Due to the relatively rural location of WIFL's mainland dock, it is not expected that there will be any landside development around the ferry terminal. As the island's population is relatively stable at around 700 year-round residents, it is not expected that the island will experience a dramatic increase in traffic.

Regulatory Issues

Despite being a private operation, WIFL falls under the oversight of several different state departments. The fares WIFL charges, while not needing approval by the state, must be submitted each year to the Wisconsin State Office of the Commissioner of Railroads, which oversees all tariffs in the state. WIFL falls under the Railroads Commission because of its role as a carrier of intrastate commerce. In addition to the tariff oversight, the Wisconsin Department of Natural Resources (WDNR) regulates all permits for dock construction and dredging. WIFL docks are required to have WDNR permits under the same rules as marinas. WIFL docks are recognized as commercial maritime facilities with a strong public interest. WDNR has repeatedly placed conditions on WIFL permits that would require unlimited public access and use. In the past, WIFL has gone to court to contest regulations required by the state as part of a permit application for dock maintenance construction; WIFL settled one case out of court and won one case.

The Coast Guard plays a large role in the continued operation of WIFL. The Coast Guard must certify each ferry as well as oversee all aspects of safety while the boat is in operation. WIFL's working relationship with the Coast Guard has evolved over the last 10 years, developing into a respectful partnership. It was noted that the Coast Guard has become more customer service-oriented and more open to feedback from the operators, which has allowed the partnership to occur.

A pending issue for WIFL is the upcoming Tier 2 engine standards soon to take effect. WIFL has come up with some strategies to ensure that all boats will be in compliance by the time the rule takes effect. Two of these strategies are (1) streamlining the emission systems and boat lifecycles (moving toward greater energy efficiency by reducing heat, lights, generators, and standby power) and (2) planning to repower two ferries before the new tier takes effect (Interview with Washington Island Ferry Line, February 4, 2010).

Emergency Response

WIFL is part of Washington Island's emergency evacuation plan. In addition to emergency evacuations, WIFL also provides service for everyday emergencies, such as transporting ambulances or necessary supplies. WIFL is on call 24 hours a day for this service and charges after-hour rates to those users.

Seattle Metropolitan Area Ferry System

Quickfacts

Operator	Service Category	# of Routes	# of Vessels	Annual Passengers	Annual Vehicles	Fleet Age (years)
Washington State Ferries	Highway–Ferry Essential	10	23	22,500,000	10.1	1–64
Port of Kingston	Transit–Ferry Urban	1	2	n/a	n/a	5–30
Kitsap Transit	Transit–Ferry Urban	2[a]	3	500,000	n/a	Historic Mosquito Fleet–Newly Acquired
King County Water Taxi	Transit–Ferry Urban	2[b]	2	300,000	n/a	20–25

[a]Kitsap Transit is currently undergoing planning for a new ferry route
[b]Forecast since King County has been in operation less than 1 year

History

Before roads and railroads were prevalent, ferry boats were the main mode of transportation for people traveling along Puget Sound. From the 1850s to the 1930s, so many steamboats traversed Puget Sound waterways that locals nicknamed the Sound's fleet of ferries "the Mosquito Fleet," because the steamboats often resembled a "swarm of mosquitoes" (The Free Online Encyclopedia of Washington State History, accessed April 22, 2010).

The Mosquito Fleet was not a unified fleet under one or a few owners—the ferries were often independently owned. At one time, over 2,500 individual steamboats were part of the Mosquito Fleet (The Free Online Encyclopedia of Washington State History, accessed April 22, 2010). Seattle's central location within Puget Sound transformed the area into a major maritime transportation hub, and the Mosquito Fleet moved both human and animal cargo, mail, machinery, and all goods necessary to supply and build the settlements that lined the coast from Olympia to Alaska (including Seattle).

The emerging dominance of private automobiles that could not be accommodated on the steamboats signified the end of the Mosquito Fleet era. The completion of the San Francisco Golden Gate Bridge released a fleet of diesel-electric automobile ferries from San Francisco Bay ferry service that would soon arrive in Puget Sound and replace the Mosquito Fleet. The last scheduled run occurred in 1939 (The Free Online Encyclopedia of Washington State History, accessed April 22, 2010).

Through World War II, ferries servicing Puget Sound remained a private enterprise. Ferry service had been consolidated under one main operator, Black Ball Line, although the Washington State Utilities and Transportation Commission regulated fare prices and increases. Rising tensions between Black Ball Line, the state, and the public over continued fare increases, shutdowns,

and strikes led to the state developing a ferry system under the Washington State Toll Authority in 1948 (The Free Online Encyclopedia of Washington State History, accessed April 20, 2010).

In 1949, after a protracted public and private battle between the state and Black Ball Line, an agreement was reached allowing the state to purchase a majority of the equipment and operations of Puget Sound Navigation Company, the parent company of Black Ball Lines. On June 1, 1951, Washington state entered the ferry business with reflagged Black Ball ferries (The Free Online Encyclopedia of Washington State History, accessed April 20, 2010).

Today Washington State Ferries (WSF) is the largest ferry system in the United States, serving eight counties within Washington State and the Province of British Columbia in Canada. WSF owns 22 vessels, stops at 20 different ports of call, and carries approximately 23 million people and 10 million vehicles annually. New state legislation has moved WSF away from passenger-only ferry service, which has led a number of local jurisdictions to take over or start new passenger-only ferry routes in Puget Sound. Ferry service is continually evolving to best serve the people in Puget Sound.

Organizational Structure

For this case study, four ferry operators were interviewed. While this does not cover all of the ferry operators in the area, the sampling of operators interviewed represents a broad swath of services and populations served by ferries. The four operators—Washington State Ferries, King County, Kitsap Transit, and Port of Kingston—are discussed below.

Washington State Ferries

WSF is a part of the Washington State Department of Transportation, reports to the Governor's Office, and is funded by the Washington State Legislature. Considered an extension of the Washington state highways, WSF operates with the goal of moving people and automobiles across the state's waterways. It is the second largest public ferry operation in North America, transporting over 22.5 million passengers and 10 million vehicles a year (Interview with Washington State Ferries, November 2, 2009). WSF recently ceased operating all passenger-only ferry services following state legislative direction that WSF provide statewide transportation services as opposed to passenger-only services, which are viewed by the state as local transit services.

King County

In 2007, the King County Council created the King County Ferry District (KCFD) to operate two passenger-only ferry routes out of downtown Seattle. The KCFD funds and oversees the operations of two existing water taxi services. The KCFD contracts with the King County Marine Division for operations.

Kitsap Transit

Kitsap Transit is Kitsap County's transit agency, providing routes, bus services, vanpools, and paratransit services in addition to passenger-only ferry service. The ferry service is contracted out to a private operator that operates and maintains the ferry boats. Kitsap Transit retains management of the service and oversees all financial and funding concerns.

Port of Kingston

The Port of Kingston was established by the state legislature in 1919 as one of the original Mosquito Fleet landing sites. The Port of Kingston is a municipal corporation governed by three directly elected commissioners. Currently, the Port of Kingston provides marina and dock services to Kingston.

Operational Structure

System/Service Routes

See Figure 5-12 for a map of ferry routes discussed in this case study.

Washington State Ferries. WSF operates nine ferry routes across Puget Sound and an international route to Sidney, British Columbia, in Canada. Ferry routes provide highway connections in the place of bridges or, in some cases, provide ferry service to locations such as the San Juan Islands and Vashon Island that don't have roadway access. Routes vary in nature from 15-minute, low-volume crossings such as Point Defiance–Tahlequah to the 3-hour Anacortes–Sidney, British

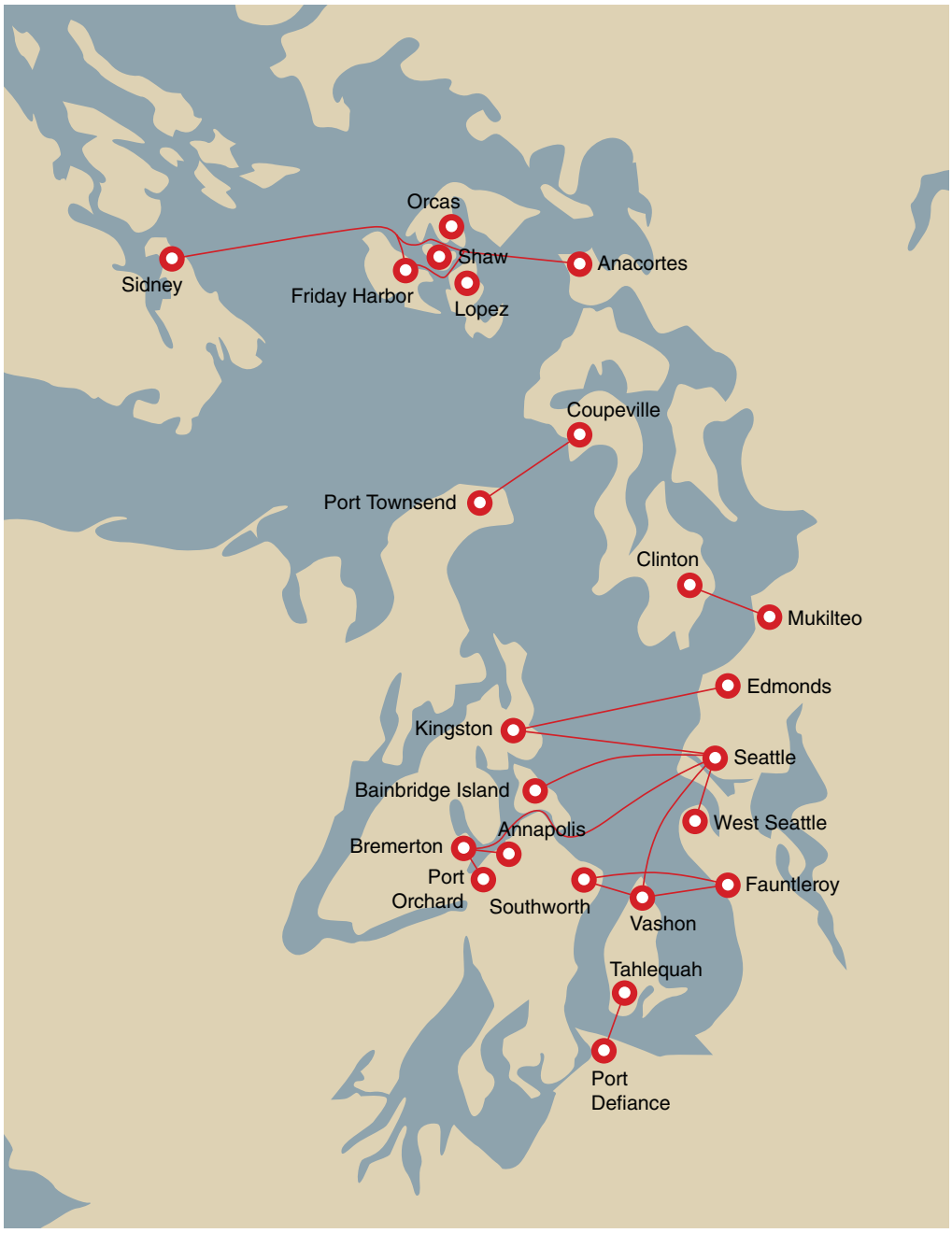

Figure 5-12. Puget Sound ferry routes.

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Columbia, route. The heaviest commuter routes are in the Central Puget Sound area: Seattle–Bainbridge Island, Edmonds–Kingston, and Mukilteo–Clinton. These routes comprise about 60 percent of WSF's ridership.

Table 5-16 shows WSF ferry route information.

King County. King County runs two ferry routes under the water taxi branding. The two routes provide year-round commuter service from downtown Seattle to Vashon Island and West Seattle. In the summer, additional service is provided on the West Seattle route. The Vashon route, which was transitioned to King County in September 2009, is a commuter route operating Monday through Friday with three runs in the morning and three in the evening. The West Seattle route, which transitioned to King County in-house operations in April 2010, runs 7 days a week during the summer, with service hours between 11 and 16 hours a day.

Table 5-16. Washington State ferry routes.

Route	Service Season	Service Schedule	Crossing Time	Crossing Location
Seattle–Bremerton	Year-round	*Seattle:* 6 a.m. to 12:50 a.m. *Bremerton:* 4:50 a.m. to 11:40 p.m.	60 min	Puget Sound
Seattle–Bainbridge Island[a]	Year-round	*Seattle:* 5:30 a.m. to 1:35 a.m. *Bainbridge:* 4:45 a.m. to 12:55 a.m.	35 min	Puget Sound
Edmonds–Kingston	Year-round	*Edmonds:* 5:45 a.m. to 1:00 a.m. *Kingston:* 5:05 a.m. to 12:20 a.m.	30 min	Puget Sound
Mukliteo/Clinton–South Whidbey Island	Year-round	*Mukliteo:* 5:05 a.m. to 2:00 a.m. *Clinton:* 4:40 a.m. to 1:30 a.m.	20 min	Puget Sound
Pt. Townsend–Coupeville	Year-round	*Pt. Townsend:* 6:30 a.m. to 8:30 p.m. *Keystone:* 7:15 a.m. to 9:15 p.m.	30 min	Puget Sound
Fauntleroy–Southworth/Vashon[a]	Year-round	*Fauntleroy:* 4:25 a.m. to 2:10 a.m. *Southworth:* 4:30 a.m. to 1:30 a.m. *Vashon:* 4:05 a.m. to 1:20 a.m.	Fauntleroy–Southworth: 40 min (30 min for direct route) Fauntleroy–Vashon: 20 min (45 min via Southworth)	Puget Sound
Southworth–Vashon[a]	Year-round	*Southworth:* 4:30 a.m. to 1:20 a.m. *Vashon:* 4:00–5:00 a.m. to 2:40 a.m.	10 min (50 min via Fauntleroy)	Puget Sound
Pt. Defiance–Tahlequah	Year-round	*Pt. Defiance:* 5:05 a.m. to 10:30 p.m. *Tahlequah:* 5:30 a.m. to 10:55 p.m.	15 min	Puget Sound
Anacortes–San Juan Islands–Sidney, BC	Year-round	*Anacortes:* 4:25 a.m. to 12:35 a.m.; one daily trip between Sidney/Anacortes *Friday Harbor:* 5:55 a.m. to 11:35 p.m.; one daily trip between Sidney/Anacortes	San Juan Islands	San Juan Islands

[a]Route has a different weekday and weekend schedule. Only the weekday schedule is shown

Figure 5-13. Washington State Ferry–downtown Seattle terminal.

The Vashon route has been operating at approximately 13,000 to 14,000 passengers a month. The West Seattle route monthly passenger totals vary dramatically between peak and non-peak seasons, with ridership during the summer of nearly 40,000 and considerably lower ridership during the commute-only winter season. The winter of 2010/2011 is the first winter that the West Seattle service provided service on weekdays and during commute periods only.

King County does not own any park-and-ride locations. There is no parking at the downtown Seattle site, which is leased from, and adjacent to, WSF (see photo of ferries at downtown Seattle terminal in Figure 5-13). In Vashon, the ferry terminal is collocated next to the WSF terminal, where scheduled Metro buses meet ferry arrivals. In West Seattle, there is limited street parking adjacent to the ferry terminal. The terminal is supported by a shuttle service, which offers a reduced transfer for ferry passengers. Table 5-17 provides information on the King County ferry routes.

Kitsap Transit. Kitsap Transit contracts out for service the two ferry routes from Bremerton. The two routes are relatively short—the Annapolis–Bremerton route takes between 5 and 7 minutes, and the Port Orchard–Bremerton route takes 12 minutes. Overall, the system carries 500,000 annually, although ridership has seen a decline during the recent economic downturn

Table 5-17. King County ferry routes.

Route	Service Season	Service Schedule	Crossing Time	Crossing Location
Vashon–Downtown Seattle	Year-round	Weekday: 6:10 a.m. to 6:30 p.m.	22 min	Puget Sound
West Seattle–Downtown Seattle	Seasonal: April to October	M–Th: 6:50 a.m. to 7:10 p.m.[a] F: 6:50 a.m. to 11:00 p.m. Sa: 8:30 a.m. to 11:00 p.m. Su: 8:30 a.m. to 7:00 p.m.	15 min	Puget Sound/Elliot Bay

[a]The Friday extended schedule is operated on weekday home game nights for the Mariners or Sounders.

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Table 5-18. Kitsap Transit ferry routes.

Route	Service Season	Service Schedule	Crossing Time	Crossing Location
Port Orchard–Bremerton	Year-round	*Port Orchard:* 4:30 a.m. to 8:30 p.m. *Bremerton:* 4:45 a.m. to 8:45 p.m.	12 min	Sinclair Inlet
Annapolis–Bremerton	Year-round	*Annapolis:* 6:00 a.m. to 5:47 p.m. *Bremerton:* 6:07 a.m. to 6:00 p.m.	5 min	Sinclair Inlet
Bremerton–Downtown Seattle[a]	Year-round	To be determined	30 min	Puget Sound

[a]Route under development

(Interview with Kitsap Transit, April 21, 2010). Kitsap Transit is also undergoing planning efforts for a Bremerton–Downtown Seattle route that is discussed in more depth later in this case study.

Kitsap Transit has over 3,000 park-and-ride spaces sprinkled throughout its service territory that service the ferry terminals. Most park-and-ride lots are not near the ferry terminal, with the closest being approximately 1 to 2 miles away. Scheduled bus services feed passengers from the park-and-ride lots to the ferry terminals. The park-and-ride lots are a mix of free and paid lots, with some shared parking in downtown Bremerton and other lots located within easy access of major arterials. Most of the park-and-ride lots are free, although there are plans for some lots to become pay lots, especially those located closer to the ferry terminals. Table 5-18 summarizes information about the Kitsap Transit ferry routes.

Port of Kingston. Similar to the Kitsap Transit route connecting Bremerton and downtown Seattle, the route from the Kingston to downtown Seattle by the Port of Kingston is a restart of a failed ferry route that previously had been operated by a private company. That route closed after 9 months due to a spike in fuel prices, inappropriately-sized boats for the ridership, and a lack of revenue to recoup operating losses (Interview with Port of Kingston, April 15, 2010).

New service between Kingston and downtown Seattle began in late 2010 and is sponsored by the Port of Kingston. The service operates during the commute period, Monday through Friday, commuter service, with one trip in each peak direction.

The Port of Kingston expected a starting ridership of 80 passengers a day, with ridership increasing to 120 to 130 passengers a day after a year in service (Interview with Port of Kingston, April 15, 2010). The new route to downtown Seattle offers a more direct commute and time savings for commuters. Many commuters currently drive or take the bus to Bainbridge Island and then transfer to the WSF ferry to downtown Seattle. This commuting route can often take longer than 60 minutes. The new ferry route offers a 45-minute crossing time without the transfer penalty.

The Port of Kingston does have dedicated parking for its marina services, which are managed separately from passengers parking for the ferry terminal. The operating plan relies on most passengers using Kitsap Transit buses or kiss-and-ride drop-offs for access to the ferry terminal. The Port of Kingston expects most passengers to arrive for the ferry service via Kitsap Transit bus or drop-offs (Interview with Port of Kingston, April 15, 2010). Table 5-19 shows Port Kingston ferry route information.

Facility and Vessel Maintenance

Washington State Ferries. WSF has 23 ferries in its fleet: 21 automobile-passenger ferries and two passenger-only ferries. Due to WSF's financial situation in the past decade, vessel replacement

Table 5-19. Port Kingston ferry routes.

Route	Service Season	Service Schedule	Crossing Time	Crossing Location
Kingston–Downtown Seattle	Year-round	To be determined	45 min	Puget Sound

and new vessel procurement has been delayed in favor of maintaining existing boats in order to maintain level of service. Even with the retirement of four 80-year-old vessels in 2007, WSF has four vessels over 50 years old, with an additional five vessels that are 44 years old. Only three vessels are less than 25 years old. Currently, WSF has three, new, small, 64-automobile boats on order that can carry loads of 750 passengers. While these boats will supplement the fleet, it costs $55 to $115 million per boat to replace aging vessels with 64- to 144-car ferries (Interview with Washington State Ferries, November 2, 2009).

Not all boats are interchangeable within the system, as some routes are fairly short while the international route to Sidney, British Columbia, requires a boat designed for open water with safety-of-life-at-sea features. Other issues make interchangeability difficult, such as the uneven distribution of ridership on routes throughout the system and route distance and crossing times. WSF acknowledges the need for a few specialty vessels of small or large size but is seeking to increase the number of intermediate-sized 144-car vessels in order to improve interchangeability and vessel assignment flexibility.

King County. King County is currently leasing two boats for its two water taxi routes. The leases are for two 77-foot catamarans that carry 150 passengers. King County does not have a designated maintenance facility for its leased vessels, and all daily maintenance is conducted at Pier 50, the passenger-only dock leased from WSF. Boats are also tied up overnight at Pier 50. King County is working to build a maintenance and moorage barge that can moor away from the passenger dock for overnight tie-downs and provide dedicated maintenance facilities (Interview with King County Metro, April 14, 2010).

Kitsap Transit. Kitsap Transit owns one boat, which is a historic boat that is the last remaining passenger vessel from the famed Mosquito Fleet. The historic boat operates on the Port Orchard run, with a carrying capacity of 149 passengers. Kitsap Harbor Tours provides another boat for the Annapolis run, which is being stretched to increase passenger capacity from 85 to 115. The new boat purchased for the run from Bremerton to downtown Seattle will have a capacity of 120 passengers (Interview with Kitsap Transit, April 21, 2010).

The new boat, currently undergoing test runs, is a low-wake, partial hydrofoil that sits 18 inches above water and has a carbon fiber wing. The 120-passenger vessel cost $5.2 million and is designed to get through the narrow Rich Passage at 37 knots, to meet the designated 30-minute crossing time without causing shore damage or erosion (Interview with Kitsap Transit, April 21, 2010). The boat is constructed of composite and aluminum, reducing the boat's weight, which results in minimum wake and wash and thus little impact on the shoreline.

As part of its contract with Kitsap Transit, Kitsap Harbor Tours does all daily maintenance and cleaning on the boats for both ferry routes. Kitsap Transit pays for the twice-yearly haul-outs and Coast Guard inspections. Kitsap Transit anticipates continuing this practice for the new route as well. Fuel is purchased 3 days a week in bulk, although part of Kitsap Transit's long-term plan is to build three fueling stations to provide for their own vehicles. Kitsap Transit would own the fueling stations and the distribution system, using small trucks to bring fuel to the terminal. Kitsap Transit is currently finishing an environmental impact statement (EIS) on storage tanks that can hold 12,000 gallons of fuel. By building a storage tank, Kitsap Transit can reduce its fuel

costs by 30 cents a gallon. The storage tanks would be built using American Recovery Investment Act funds (Interview with Kitsap Transit, April 21, 2010).

Port of Kingston. The Port of Kingston recently purchased two new vessels, the *Spirit of Kingston* and the *Victoria Express.* The *Spirit* is a 5-year-old, 65-foot catamaran with a 150-passenger load capacity. The *Victoria* is a 30-year-old boat that functions as the reserve for when the *Spirit* is out of commission. The *Spirit* cruises at about 25 knots to make the 45-minute crossing, burning approximately 80 to 85 gallons of fuel an hour. When the *Victoria* is in service, she burns 50 gallons of fuel an hour but at a slower speed (Interview with Port of Kingston, April 15, 2010).

The Port of Kingston anticipates conducting all daily maintenance and haul-outs within its marina facilities (Interview with Port of Kingston, April 15, 2010). Included with the purchase of the new vessels are extended warranties on boat engines with the manufacturer. Haul-outs for repair and maintenance will likely occur at Port Townsend, and the Port expects to solicit bids for contract with a yard to complete the required haul-out work.

System Infrastructure

Washington State Ferries. WSF has 20 ports of call in its system. The sizes and types of terminals vary depending on the route and ridership. The downtown Seattle Colman Dock, Bremerton, Bainbridge, and Anacortes terminals have indoor passenger waiting facilities while other terminals have smaller or no covered waiting areas. Overhead passenger loading is used at six terminals; at all other terminals, foot passengers walk onto the vehicle deck, which increases the time it takes to load and offload the vessel. Other terminals, such as the Sidney, British Columbia, terminal, require special facilities for handling immigration and waiting areas.

For a system that carries millions of vehicles every year, WSF's terminal capacity is a major issue, especially during peak times. WSF has worked on updating and expanding its vehicle reservation system to reduce the waiting time for passengers with cars and eliminate waiting queues that extend beyond the holding areas at the terminals. WSF is looking into incentives and programs that will encourage passengers to ride during off-peak periods.

King County. King County is currently leasing the three terminals that service its two routes. The downtown Seattle terminal, Pier 50, is leased from WSF, as well as the Vashon terminal. King County recently built a new dock at the West Seattle terminal in Seacrest Park, which is owned by the City of Seattle. King County has a long-term use agreement with the City of Seattle to use the dock there (Interview with King County Metro, April 14, 2010).

Kitsap Transit. Kitsap Transit owns the floats in Bremerton and Port Orchard and recently spent $4.5 million in improvements at Bremerton to install a new ramp and improve the American with Disabilities Act (ADA) accessibility at the passenger terminal. A new terminal in Port Orchard cost approximately $3 million with upgraded ADA ramps. Kitsap Transit has applied for federal funding to improve the ADA ramps at the terminal in Annapolis (Interview with Kitsap Transit, April 21, 2010).

The proposed ferry from Bremerton to downtown Seattle would dock at Pier 50, which is owned by WSF. There is currently a two-sided float for passenger ferries; one side is being used by King County Water Taxi. Kitsap Transit is considering a longer-term arrangement at Pier 57, which is adjacent to the Seattle Aquarium and owned by the park district. The agreement to lease Pier 57 would be funded through parking improvements made at the pier (Interview with Kitsap Transit, April 21, 2010).

Port of Kingston. The Kingston terminal is located at the Port of Kingston. The passenger terminal is a semi-temporary space of several shipping containers welded together. There are windows installed for some natural lighting. The long-term plan for the Kingston termi-

nal is to add in post and beams for a new waiting area with doors (Interview with Port of Kingston, April 15, 2010). The ferry would dock at Coleman Dock in downtown Seattle, sharing space with King County Water Taxi and Kitsap Transit's proposed ferry from Bremerton to downtown Seattle.

Staffing Levels

Washington State Ferries. WSF employs more than 1,800 people in its agency, including crew members, maintenance staff, and administrative staff. A typical boat is crewed by a captain who is assisted by a chief mate, a quartermaster, and a bridge officer (Interview with Washington State Ferries, November 2, 2009).

King County. King County is currently operating at minimum crew levels; each boat has one captain and two deckhands. There is a small engineering staff of two engineers and two oilers. There are five administrative staff positions. As the operation has just launched, use is made of other King County Department of Transportation staff's administrative time and expertise, but those staff members are paid for from the ferry budget (Interview with King County Metro, April 14, 2010).

Kitsap Transit. Kitsap Transit does not have a staff dedicated to the ferry service, although some staff members have dedicated workloads that affect ferry service. At Kitsap Transit, there is one staff member dedicated to watching budgets and overhead spending and that person is responsible for the One Regional Card for All (ORCA) program. The operations and daily maintenance are handled through the contract with Kitsap Harbor Tours (Interview with Kitsap Transit, April 21, 2010).

Port of Kingston. The Port of Kingston will have a full-time crew of three to four people and a part-time crew of three to four people to handle fill-in needs and private chartering events. An engineer and deckhand will handle all daily maintenance on the boat. The Port of Kingston also anticipates hiring three to four people as administrative support staff, although these positions have yet to be filled (Interview with Port of Kingston, April 15, 2010).

Financial Structure

Released on a limited basis in April 2009, the ORCA card is a contactless stored-value smart card used for payment of public transit fares in the Puget Sound region. Now fully launched within the region, the smart card system is the result of an agreement between seven public transit agencies—Sound Transit, King County Metro, Community Transit, Everett Transit, Pierce Transit, Kitsap Transit, and WSF. ORCA has eliminated intersystem paper fare transfer, although each individual agency still maintains a paper ticket system. While many public transit users are ORCA card users or are familiar with the system, implementing ORCA can be a major financial investment for smaller transit agencies joining the system (ORCA website, accessed April 26, 2010).

Fares

Washington State Ferries. WSF fares are divided into numerous categories, which are summarized in Table 5-20. There are differences in price for automobiles less than 20 feet long and less than 7.5 feet in height and automobiles less than 20 feet long and over 7.5 feet in height. Fares also increase per each additional 10 feet in automobile length. A peak season surcharge is applied to cover the costs of additional service and staff during the summer months, which is defined as May through October.

WSF is planning the future rollout of an online registration system to manage demand, especially demand by passengers with vehicles during the peak season. The reservation system is seen as a mechanism to shift passenger demand and travel times to off-peak or slightly off-peak time periods

66 Guidelines for Ferry Transportation Services

Table 5-20. WSF ferry route fares.

Route	Walk-on		Automobile				Bicycle	
	Fare	Peak Season Fare[a]	Fare		Peak Season Fare[a]		Fare	Peak Season Fare[a]
			Under 20 ft	20 ft to 80 ft	Under 20 ft	20 ft to 80 ft		
Seattle–Bremerton	$3.45 to $6.90	$3.45 to $6.90	$10.10 to $11.85	$17.80 to $94.80	$13.10 to $14.85	$22.30 to $118.80	$1.00	$1.00
Seattle–Bainbridge Island[a]	$3.45 to $6.90	$3.45 to $6.90	$10.10 to $11.85	$17.80 to $94.80	$13.10 to $14.85	$22.30 to $118.80	$1.00	$1.00
Edmonds–Kingston	$3.45 to $6.90	$3.45 to $6.90	$10.10 to $11.85	$17.80 to $94.80	$13.10 to $14.85	$22.30 to $118.80	$1.00	$1.00
Mukliteo/Clinton–South Whidbey Island	$2.05 to $4.10	$2.05 to $4.10	$5.95 to $7.00	$10.50 to $56.00	$7.70 to $8.75	$13.15 to $70.00	$1.00	$1.00
Pt. Townsend–Keystone	$1.30 to $2.65	$1.30 to $2.65	$7.80 to $9.15	$13.75 to $73.20	n/a	n/a	$0.50	$0.50
Fauntleroy–Southworth/Vashon[a]	$3.20 to $4.45	$3.20 to $4.45	$12.95 to $15.20	$22.80 to $121.60	$16.75 to $19.00	$28.50 to $152.00	$1.00	$1.00
Southworth–Vashon[a]	$3.20 to $4.45	$3.20 to $4.45	$12.95 to $15.20	$22.80 to $121.60	$16.75 to $19.00	$28.50 to $152.00	$1.00	$1.00
Pt. Defiance–Tahlequah	$3.20 to $4.45	$3.20 to $4.45	$12.95 to $15.20	$22.80 to $121.60	$16.75 to $19.00	$28.50 to $152.00	$1.00	$1.00
Anacortes–San Juan Islands–Sidney, BC	Fares vary from $6.70 to $17.50 for walk-on passengers and from $12.50 to $41.90 for standard automobiles, depending on trip length and destination.							

[a]Peak Season runs from May 1 through October 31.

since passengers know instantly if they can reserve a space on the boat. Instant information has also reduced somewhat the long queues that used to extend far beyond terminal waiting areas at some terminals.

King County. The King County Water Taxi accepts cash (exact change) or the ORCA card for payment of fares. The King County Ferry District implemented the ORCA card system on its ferries. While the implementation cost is borne by the ferry district's budget, it can use technical assistance through King County Metro. Approximately 80 percent of the riders on the Vashon route use the ORCA card (Interview with King County Metro, April 14, 2010). By comparison, the West Seattle route handles many cash fares, with cash or tickets representing between 60 percent and 70 percent of the fares during the summer season. Fares are collected at the gangway, using a cash box for exact fare (no change is made) and portable ORCA card readers. Route fares are shown in Table 5-21.

Kitsap Transit. Kitsap Transit is one of the original agencies to implement the ORCA card. The system has been installed in approximately 95 percent of the Kitsap Transit vehicles, including the ferries (Interview with Kitsap Transit, April 21, 2010). While most of the ORCA infrastructure is in place, Kitsap Transit estimates that it will take approximately 20 years to earn back the

Table 5-21. King County ferry route fares.

Route	Cash Fare	Transit Pass	Senior Fare	Youth Fare
Vashon–Downtown Seattle	$4.50	$3.75	$2.00	$2.75
West Seattle–Downtown Seattle	$3.50	$3.00	$1.50	$2.25

Table 5-22. Kitsap Transit ferry route fares.

Route	Fare
Port Orchard–Bremerton	$2.00 regular/$1.00 reduced
Annapolis–Bremerton	

capital cost of installing the system (Interview with Kitsap Transit, April 21, 2010). Despite the huge capital costs, Kitsap Transit believes that ORCA offers regional customer convenience and that Kitsap Transit's integration into the regional transit system is a benefit to both customers and the agency. Route fares are shown in Table 5-22.

Port of Kingston. The Port of Kingston is working to implement the ORCA system on its new ferry boats. Kitsap Transit is providing technical assistance to the Port of Kingston with installation of the ORCA system and advice regarding the purchase of infrastructure to implement the system. Port of Kingston fares are shown in Table 5-23.

Funding Sources

Washington State Ferries. Funding for WSF comes through the state legislature. Historically, WSF had dedicated tax funding through two sources: (1) the Motor Vehicle Excise Tax (MVET), which was the primary source of revenue, providing 20 percent of WSF's operating funds and 75 percent of its capital funds, and (2) a portion of gas tax money (Interview with Washington State Ferries, November 2, 2009). In 2000, the MVET was eliminated by the Washington State Legislature subsequent to a voter initiative in 1999. At this point, WSF lost its main source of dedicated tax revenue.

In 2002, voters rejected Referendum 51, which would have provided $720 million for new ferries, terminals, and maintenance and service preservation. The state later approved two transportation packages that included $300 million for ferry vessel and terminal construction and $200 million over 16 years for ferry projects; however, the funding in these packages did not match the funding levels that Referendum 51 would have provided nor did it make up for the loss of the MVET. Washington state is provided with a dedicated $5 million annually from the Ferry Boat discretionary fund and also competes for other federal funds; however, the need is much greater (Washington State Transportation Commission, 2009).

Since then, WSF has continued service through a combination of service reductions and fare hikes and deferred maintenance and vessel replacement. WSF's capital program has been backfilled on a biennium basis from transfers from the highway side of WSDOT, which has to defer road projects that otherwise would have been built. The aging fleet and stepped-up hull inspections resulted in deferred maintenance, leading to several unanticipated service interruptions. Rising fuel prices have raised the cost of operations and simultaneously depressed ridership and fare revenue. Although fuel costs have moderated in recent months, they remain a major point of uncertainty (Washington State Transportation Commission, 2009).

A combination of rising fares, increased service disruptions, increased telecommuting, long-term elasticity of higher fares, and eliminated routes has led to decreasing ridership throughout

Table 5-23. Port of Kingston ferry route fares.

Route	Fare
Port of Kingston–Downtown Seattle	To be determined (estimates of $1.00–$15.00) Bicycles (estimate $3.00)

the WSF system. Between 1987 and 1999, WSF saw a 50-percent increase in ridership, from 18 million passengers to 27 million passengers annually (Washington State Transportation Commission, 2009). Ridership began dropping after 1999, first because of service cuts and then because of major fare increases—20 percent in 2001, 12.5 percent in 2002, and then an average of 5 to 6 percent from 2003–2006. Ridership had dropped about 10 percent by 2006, stabilized, and then dropped again in 2007 and 2008 due to service disruptions, high gasoline prices, and the economic downturn. By 2009, ridership had fallen from 27 million to around 22.5 million passengers annually (Interview with Washington State Ferries, November 2, 2009).

Due to the severity of the funding crisis faced by WSF, the state legislature commissioned *Long-Term Ferry Funding Study: Ferry Funding Recommendations Final Report* (Washington State Transportation Commission, 2009) to evaluate strategies for meeting WSF's long-term funding needs, as described in its Long-Range Plan, and to evaluate "state, regional, or local" funding options. The study's findings and recommendations were released in September 2010. They include the following:

- **Finding:** Long-term capital funding is the most critical need.
- **Finding:** Ferry fares are not a viable source of capital funding.
  - **Recommendation:** Increase ferry fares and other operating revenues to close operating funding gap.
- **Finding:** Challenges to local funding districts are substantial.
  - **Recommendation:** Use fare increases in lieu of local tax funding while leaving the option open for the future.
- **Finding:** A statewide source is the most feasible means of meeting long-term capital needs of the WSF system.
  - **Recommendation:** Fund long-term capital needs with vehicle excise or similar tax.
  - **Recommendation:** Set state tax rate to allow elimination of administrative transfers.

King County. In 2008, the King County Ferry District Board of Directors enacted a new property tax levy of five and a half cents on every $1,000 of assessed property value. The levy was intended to cover the operating and capital costs of the two existing ferry routes plus the addition of demonstration routes outlined in the business plan created by the ferry district. As the effects of the recession hit during 2009, the Ferry District, whose board of directors is the nine members of the King County Council, reduced the levy to a level approximating one-third of one cent for every $1,000 in property tax and redirected the difference toward shoring up King County Metro's budget (Interview with King County Metro, April 14, 2010). The reduction in the levy amount drastically changed the Ferry District's outlook for implementing its business plan as originally developed, with the 2010 work plan limiting operations to only two routes.

Currently, the Ferry District has three sources of revenue: the property tax levy, farebox recovery, and federal grants. The ferries do not currently have any concessions onboard, mainly due to short trip times that are not conducive to food and drink sales. The Ferry District is, however, looking into opportunities for concessions at the terminals or on the vessels.

Kitsap Transit. Kitsap Transit provides a range of transit services throughout Kitsap County in addition to its passenger-only ferry service. The two existing routes between Port Orchard and Bremerton and Annapolis and Bremerton are operated and maintained by a privately contracted company, Kitsap Harbor Tours, LLC. Kitsap Transit owns one boat, and the private operator provides one boat for service. Due to the relatively short route distances for each of the ferry routes, operating costs are absorbed through the overall Kitsap Transit budget.

Kitsap Harbor Tours runs the boats and provides daily maintenance for the boats and the terminals. Crew member wages are set within the contract, and all major maintenance haul-outs

are conducted by Kitsap Transit. The contract has a 5-year term, with the option to add an additional 5 years when Kitsap Harbor Tours sells Kitsap Transit its boat (Interview with Kitsap Transit, April 21, 2010).

Kitsap Transit is currently undergoing planning and environmental studies for a new ferry route between Bremerton and downtown Seattle. The new route was previously operated by WSF, but due to environmental concerns and civil litigation, the route was discontinued in 2003. Kitsap Transit will be restarting the route under their oversight and has secured $5.2 million in federal grants to build a new low-wake boat. While the federal grants cover the capital costs for vessel procurement, there is no guaranteed operating funding stream yet available. Kitsap Transit is awaiting the opportunity to bring a bond measure before voters that will likely be a large transportation package that includes Kitsap Transit's funding needs. Kitsap Transit estimates that the new route will require an additional $5 to $6 million to operate. The agency does not anticipate a bond being put forth before the voters before 2012 (Interview with Kitsap Transit, April 21, 2010).

Port of Kingston. The Port of Kingston is newly entering the ferry transit business, having never before operated a ferry route service. The Port of Kingston received a $3.5 million FTA grant that stipulated use toward purchasing vessels for future ferry service. In a 2010 interview, The Port of Kingston reported that it was developing its operating budget prior to service commencing in October 2010. Prior to starting service in October 2010, the Port planned to charter out its two vessels for the summer of 2010, by which the Port expected to generate a revenue stream of $400,000 to $500,000 to help fund the 2010–2011 operating budget (Interview with Port of Kingston, April 15, 2010).

The Port anticipated that most of its operating revenue would be generated through a number of different sources including private boat chartering, route revenue, and advertising revenue. From the federal grant, the Port of Kingston purchased the *Spirit of Kingston* for $2.5 million and the *Victoria Express* for $650,000 (Interview with Port of Kingston, April 15, 2010). The monies left over from the purchase of the two ferry vessels, as well as the revenue generated from private boat charters prior to scheduled ferry service, are being applied to future operating budgets.

Planning Issues

Environmental and Regulatory Issues

Washington State Ferries. WSF has been investigating various ways of reducing energy and fuel consumption. It has experimented with biofuels as an alternative fuel source as well as a means to reduce air emissions. WSF has also installed energy-efficient engines and fuel injectors to reduce fuel consumption. Operationally, slowing vessels down and operating vessels on fewer engines where possible is another tactic for conserving fuel.

King County. King County performed a high-level environmental assessment when it restarted the water taxi service from Vashon Island to downtown Seattle. The vessels that King County has leased for this service generally create a smaller wake and consume less fuel than the vessels previously used on the route (Interview with King County Metro, April 14, 2010). Some environmental analysis was required at the terminals, but since this service was already in place, the Ferry District does not have to contend with any new water-based issues.

King County is currently exploring the use of biodiesel, but is unsure what the cost or operating implications are. King County will continue to investigate the best way to incorporate biodiesel into its fueling program.

King County has secured several federal grants for new vessel design and construction for the two routes being served. The new vessel will be able to take advantage of new technologies to

reduce fuel consumption and emissions, thereby reducing the carbon footprint associated with this service.

Kitsap Transit. Kitsap Transit used the opportunity for restarting the route from Bremerton to downtown Seattle to research what was the most appropriate vessel for the route. The research considered fueling options such as biodiesel, natural gas, hydrogen fuel cells, and ultra-low-sulfur fuel. Natural gas and hydrogen fuel cells were eliminated as options because the boat needed to go faster than these fuels would allow. The research also considered hovercraft, but these boats burn 120 gallons of fuel an hour, which was too costly for Kitsap Transit (Interview with Kitsap Transit, April 21, 2010). Ultimately, the research pointed to hydrofoils, which are more lightweight and have good fuel economy.

During its research efforts, Kitsap Transit found that there were a number of institutional drawbacks for advancing new technologies. Because some technologies are not yet mature, they cannot be tested by operators, and sometimes regulators are uncomfortable with new technologies (Interview with Kitsap Transit, April 21, 2010).

Land Use Issues

Land use development around the various ferry terminals in the Puget Sound area is inconsistent and is dependent on the individual nature of each community. Ferry terminals are located in both very urban locations, such as downtown Seattle, and rural areas where dense development is unlikely to occur. In West Seattle, the area is fairly built-out, so there is less capacity for centralized dense development. Vashon has remained a semi-rural area despite having an established ferry service for years. In downtown Bremerton, Kitsap Transit has invested approximately $50 million, with $40 million spent on a new ferry terminal and $10 million spent on a new administrative building. Condominiums and activity centers have also been developed. The recent economic downturn has slowed down development, although interest remains high in the area.

Emergency Response

All of the operators are part of the larger regional emergency response plan. Some of the individual agencies, such as Kitsap Transit, play a large role in the county's emergency plan. The spare boat and a spare barge would be used to evacuate residents from Bainbridge Island and also to provide emergency connections. In the event of a collapsed bridge, Kitsap Transit would also provide emergency connections between East Bremerton and West Bremerton.

Each of the agencies reports a good working regional coordination relationship, which fosters open communication and information sharing among the different transit operators, both land- and water-based operators. This working relationship is evident in other regional collaborations, such as the ORCA card and in efforts to increase transit coordination between modes, especially ferries and buses.

Most operators, aside from WSF, operate vessels with a capacity for 150 passengers or less. This is a deliberate decision by operators to avoid Department of Homeland Security regulations for operating vessels with a capacity for 150 or more passengers. For terminals, Coleman Dock is mandated to have a security plan in place, which also applies to King County and the Port of Kingston since they lease docking space there.

In addition to security planning, WSF must comply with immigration regulations due to the international route to Sidney, British Columbia. All passengers who disembark in Sidney must carry appropriate documentation to go through customs. The ferry is mandated to wait until all passengers have cleared customs before returning to Anacortes. If a passenger fails to clear customs, WSF must take the passenger back. The terminal in Sidney must also accommodate an

additional waiting area for customs, making its passenger waiting space larger than passenger waiting areas in other WSF terminals.

Hawaii Superferry Project

Quickfacts

Operator	Service Category	# of Routes	# of Vessels	Annual Passengers	Annual Vehicles	Fleet Age (years)
Hawaii Superferry	Highway–Ferry Essential	1	1	Not operating	Not operating	n/a

History

Inter-island ferry service in Hawaii was not a new idea when the Hawaii Superferry was conceived in 2001. A study prepared in 1973, before introduction of the three SeaFlite hydrofoils in 1975, listed 22 studies completed between 1956 and 1970 that addressed the economics of and demand for an inter-island ferry (Department of Planning and Economic Development, State of Hawaii, 1973). The SeaFlite hydrofoils operated from 1975 to 1978, but eventually they were sold due to their unreliability and uncomfortable service during rough weather (Cataluna, December 23, 2005).

The 1973 study identified secondary effects associated with inter-island service, including parking and roadway congestion in the vicinity of terminals, impacts to the inter-island cargo market, and social impacts from increased travel and tourism. The study concluded that a comprehensive approach to ferry planning was needed, as were contingencies to address issues resulting from changes to interstate travel, impacts to recreational facilities, and redistribution of population and economic activity (Department of Planning and Economic Development, State of Hawaii, 1973). An issue that arose during SeaFlite operations, but was not cited in the 1973 study, was concern that the ferries could harm whales.

No inter-island ferry service was operating in 2001 when the Hawaii Superferry concept was developed. High-speed ferry service from an Oahu hub with planned connections to the islands of Maui, Kauai, and the Big Island of Hawaii (the Big Island) was seen as a competitive alternative to flying that would also allow vehicular movement between the islands.

Organizational Structure

Hawaii Superferry, Inc., registered as a corporation with the Hawaii Department of Commerce and Consumer Affairs in September 2002. Discussion with U.S. DOT's Maritime Administration (MARAD) regarding loan guarantees for vessel financing also started in 2002.

Publicity describing the proposed service first appeared in mid 2003. The business model for operations required capture of 7 percent of the inter-island market (1,500 passengers daily) in order to be profitable, with a target of 10 percent of the inter-island market (Natarajan, June 13, 2003).

Operational Structure

Hawaii Superferry, Inc., registered as a private Hawaiian corporation in 2002. In May 2009, Hawaii Superferry, Inc., declared bankruptcy. Its main assets, the two vessels, were taken into receivership by MARAD.

Figure 5-14. Hawaii Superferry routes.

System/Service Routes

Hawaii Superferry, Inc., planned service from an Oahu hub to the islands of Maui, Kauai, and the Big Island. Actual service included one trip to Kauai and a total of 11 months of operations to Maui (see Figure 5-14). A second vessel intended for service to the Big Island was launched in September 2008. However, delivery of the second vessel, targeted for March 2009, was postponed in 2008 due to the uncertain business climate (*Pacific Business News,* October 28, 2008). Service ended in March 2009, before the second vessel was delivered.

The Hawaii Superferry system was designed to compete with, and provide an alternative to, the airline systems as a means of public transport among the Hawaiian Islands. The ferry system was also meant to provide a means for vehicular traffic among the islands and an alternative method for moving high-value freight. In addition, according to the draft environmental impact statement developed for the project by the Hawaii DOT (Department of Transportation, State of Hawaii, 2008), the system was expected to be beneficial to public health and safety by providing superior marine transportation to help with disaster planning and emergencies.

Facility and Vessel Maintenance

The first ferry, the *Alakai,* was designed without an onboard vehicle loading ramp, a decision that triggered the need for loading barges for the Oahu, Maui, and Big Island harbors and a ramp on Kauai. It is unclear why the *Alakai* was built without a vehicle loading ramp, given that a stern loading ramp was included in the design of the second vessel, the *Huakai,* which was intended for ser-

vice to the Big Island and despite the fact that similar ferries, including the *Spirit of Ontario,* which visited Hawaii in March 2004, had onboard vehicle loading ramps (Leidemann, March 6, 2004).

The Hawaii DOT's original position, as expressed by a spokesman in 2003 and outlined in a May 21, 2004, letter to Hawaii Superferry, Inc., was that the Hawaii DOT was not responsible for providing loading ramps and operational equipment for a private ferry service (Department of Transportation, State of Hawaii, 2008). The Hawaii DOT was concerned that providing loading equipment, which it had not provided for any other harbor users, would set a precedent, opening demands for similar equipment.

After initial resistance, the Hawaii DOT agreed to build temporary, barge-supported loading ramps, at a cost of $38.5 million to the state. Hawaii Superferry, Inc., told the Hawaii DOT that MARAD, as a term of the loan guarantee, had imposed a June 30, 2005, deadline to settle all environmental issues (Auditor, State of Hawaii, December 2008). There is no evidence that MARAD had in fact set such a deadline. However, in order to meet the perceived deadline, the Hawaii DOT adopted the $38.5 million system of temporary loading structures in the belief that such a temporary system would be exempt from environmental review. The Hawaii DOT preferred permanent structures, but under state law, permanent structures automatically require environmental review, a process that would not meet the June 30, 2005, deadline. The Hawaii DOT's December 2005 finding that the temporary barges were exempt from environmental review would later be overturned by the Hawaii Supreme Court.

The Hawaii Senate, in regular session in April 2005, rejected a bill to provide the Hawaii DOT with $40 million in funding for Superferry-specific harbor improvements. Instead, the monies were appropriated through general obligation bonds of $20 million for each of the fiscal years 2006 and 2007. The Harbor Division of the Hawaii DOT then awarded a $38.5 million contract for construction of barges and ramps in China, which meant that, under the Jones Act provisions, if the barges and ramps were not needed, they could not be reused for shipping purposes in the United States.

It is significant that the change in design for the second ferry to include a vehicle loading ramp rendered obsolete the $10 million (of $38.5 million) that the Hawaii DOT spent on infrastructure for the Big Island's Kawaihae Harbor. If both vessels had been built with onboard vehicle loading ramps, the cost of harbor improvements at the four harbors would have been much smaller, and the issue of environmental review triggered by use of state money for a private project would not have arisen.

The vessels were constructed in Mobile, Alabama, at a cost of $95 million. Both the *Alakai,* used on the Maui service, and the *Huakai,* intended for Big Island service, have the capacity to carry 866 passengers and 282 compact cars (or 28 trucks and buses plus 65 cars) at 37 knots. The *Alakai*—353 feet long by 78 foot beam (107.7 meters by 23.8 meters) with 12 foot (3.65 meter) draft—has no onboard loading ramp. The *Huakai,* at 369 feet long (113 meters), is 20 feet longer due to a stern quarter bi-fold vehicle loading ramp designed for a 42-metric-ton truck. (Austal, 2008)

Staffing Levels

Hawaii Superferry, Inc., had a staff of 308 (Segal, 2007). Founding President and CEO, John Garibaldi, was replaced by Thomas Fargo, who became president and CEO in April 2008.

Financial Structure

Fares

A variable fare schedule with higher rates for summer season and weekend service was used. Promotional $39 one-way fares were also offered in spring 2008 in an attempt to increase ridership. Representative fares are provided in Table 5-24.

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Table 5-24. Hawaii Superferry passenger fares.

	September to June		July to August	
	One-way Passenger	One-way Car/SUV	One-way Passenger	One-way Car/SUV
Oahu to Maui	$42.00 (T–Th) $52.00 (F–M)	$55.00 (T–Th) $65.00 (F–M)	$52.00 (T–Th) $62.00 (F–M)	$59.00 (T–Th) $69.00 (F–M)

Funding Sources

Major funding sources for Hawaii Superferry, Inc., included a federally guaranteed loan of $140 million from ABN-AMRO Bank and $71 million in equity financing from J. F. Lehman & Co. (Associated Press, October 29, 2005). Norwest Equity Partners also provided private equity, so that, combined with the equity from J. F. Lehman, $237 million in debt and equity financing was available to Hawaii Superferry, Inc. (Reilly, December 2, 2005).

Numerous Hawaii companies invested smaller amounts, including $1 million from Maui Land and Pineapple Company, Inc., and $0.5 million from Grove Farm Kauai (Segal, 2004). A list of Hawaii Superferry's 30 largest creditors and equity security holders appeared in the May 30, 2009, bankruptcy filing.

For the ferry service to break even, each vessel had to operate at 50-percent capacity (i.e., on average, carry 433 passengers and 142 cars). However, the service usually operated at well below 50-percent capacity. Ridership in spring 2008 was approximately 25 percent of capacity. Promotional fares were offered in the spring and fall of 2008. In July 2008, even though ridership had increased 40 percent over June's ridership to average 390 passengers and 99 vehicles per day, it was still below the break-even point (*Pacific Business News,* August 4, 2004). The service reportedly carried a total of 250,000 passengers during its 11 months of operation.

Planning Issues

Environmental and Regulatory Issues

The allocation of federal funds for private, project-specific activities such as vessel construction and allocation of state funds for private, project-specific activities such as harbor improvements typically would trigger environmental review of the project. The Hawaii DOT's opinion that use of federal and state funds for the Superferry service, a private project, did not require environmental review opened the door to legal challenges.

In January 2005, Hawaii Superferry, Inc., signed a loan guarantee from MARAD for $139.7 million to support securing funds for Austal USA to construct two vessels. Condition X of the MARAD agreement contained preconditions requiring confirmation from Hawaii Superferry, Inc., that no environmental assessment (EA) of harbor improvements would be required before the agreement could be finalized 1 year later (Auditor, State of Hawaii, April 2008). MARAD was concerned that environmental issues could jeopardize port access.

MARAD, as a federal agency, could have requested to be the federal lead for an environmental review under the National Environmental Policy Act (NEPA). However, Condition X of the loan guarantee indicated that MARAD was prepared, in effect, to delegate its federal review authority to the state and accept that state environmental findings on harbor improvements alone were sufficient for the project. However, the state was taking the position that state funding for harbor improvements was exempt from environmental review. Given MARAD's delegation of its federal review authority to the state, the state's position implied that MARAD accepted that review of the impacts of federal funding for the vessels, outside of harbor improvements, was unnecessary.

A Sierra Club editorial in the *Honolulu Advertiser* in March 2005 summarized the issues facing the Hawaii Superferry (Keith, 2005):

- An Environmental Impact Statement (EIS) is required based on at least four criteria:
  - Use of federal funds ($140 million MARAD loan guarantee).
  - Use of state funds ($38.5 million for project specific harbor improvements).
  - Use of state lands.
  - Use of shoreline area.
- Impacts to Kahului Harbor in Maui and traffic impacts near the harbor.
- Transport of invasive species between islands by vehicles.

These issues were the basis of a lawsuit filed in Maui in March 2005 by three private groups asserting that an EIS was required. The suit was rejected in August by the Maui Circuit Court, as was a second suit filed in September 2005. However, a third suit, focusing specifically on potential impacts to Kahului Harbor in Maui, filed by the three groups in Maui District Court in January 2006, was found to have merit. This case was heard by the Hawaii Supreme Court, which ruled in August 2007 that the state DOT was incorrect in not requiring an environmental impact assessment for Kahului Harbor improvements, as the DOT did not consider secondary impacts.

The response of Hawaii Superferry, Inc., was to begin ferry operations from Oahu to Kauai and Maui with the *Alakai* a few days earlier than planned, before the courts could act, and offer a special $5 fare (approximately one-tenth of the planned $52 one-way passenger, $59 one-way vehicle fares). This tactic was not received well in Kauai, where protesters physically delayed the first ferry trip to Kauai and turned back the second trip the next day. Based on a decision by the United States Coast Guard that it would be unable to ensure passenger safety, service to Kauai did not resume. There were no equivalent protests in Maui.

In response to the August 23, 2007, Hawaii Supreme Court ruling, the Maui Circuit Court issued an injunction that stopped the Hawaii Superferry service to Maui on September 14, 2007, and ordered preparation of an EIS, which the DOT then started.

A government audit of the Hawaii Act 2 legislation and environmental review process for Hawaii Superferry was performed by the Hawaii State Auditor in 2008 (Leidemann, March 6, 2004; Auditor, State of Hawaii, April 2008). Key findings of the Phase I, April 2008 report were the following:

- Faced with too little time and opposition from Hawaii Superferry, Inc., the state DOT abandoned efforts to prepare an environmental review of harbor improvements needed to accommodate the ferry service.
- Flawed Hawaiian EIS laws and rules allowed the Hawaii DOT to invoke its own exemption list and ignore requests for environmental review.

Key findings of the Phase II, December 2008 report were the following:

- For Hawaii Superferry, Inc., the Hawaii DOT reversed long-standing policy of not providing pier-side equipment for harbor users.
- Flawed or unclear Hawaiian EIS laws and rules allowed the Hawaii DOT to pay little attention to secondary or cumulative effects.
- Based on a deadline imposed by Hawaii Superferry, Inc., Hawaii DOT implemented temporary harbor improvements consisting of barges and ramps that were not DOT's preferred solution.
- The state-funded $38.5 million of harbor improvements have been problematic, with the Maui barge and pier incurring more than $3 million in damages.
- Fitting the second vessel with a loading ramp eliminated the need for a $10 million barge-and-ramp system built for the Big Island harbor and a $2.5 million ramp for the Kauai harbor.

- If Hawaii Superferry retrofitted the *Alakai* with a loading ramp, the entire $38.5 million spent on harbor improvements for Hawaii Superferry would have been unnecessary.
- Legislation on behalf of Hawaii Superferry, Inc., compromised the state's environmental laws and put the interests of a single business before the state's environmental, fiduciary, and public safety responsibilities.

A range of potentially significant environmental issues associated with operations of the Hawaii Superferry were raised by various interested parties. Some of the issues were reflected in the DOT EIS (*Pacific Business News,* October 28, 2008); however, that document specifically focused on the state harbor improvements rather than on the entire service. The broader range of potential issues included the following:

- Impacts to harbor cargo-handling capacity, particularly due to displacement of existing operations by the loading barge-ramps.
- Incremental (cumulative) impacts by ferry operations in addition to proposed cruise ship service.
- Traffic impacts at the harbors during ferry loading and unloading and cumulative impacts if docking occurred during peak hours or at noon.
- Impacts to existing recreational activities in harbors.
- Collision-related impacts to protected species, including whales, dolphins, and sea turtles.
- Vessel acoustics that could affect whales.
- Transport of invasive species between islands, either on the wheels of recreational vehicles or through inter-island movement of produce.
- Air quality impacts from vessel emissions.
- Impacts to cultural traditions (sites and practices) in the harbor areas including the Pu'ukohola Heiau National Historic Park.

The level of political support provided for the Superferry project was strong. In late October 2007, the Governor called a special 5-day legislative session specifically to address the Supreme Court's decision requiring an EA of the Hawaii Superferry operations. During the session, the state senate and state house passed a bill to allow "large-capacity ferry vessels" to operate between ports in Hawaii while an EA (or EIS) was being prepared. On November 5, 2007, the Governor signed the bill into law under the name of Act 2, Second Special Session. Based on the new law, on November 14, 2007, the Maui Second Circuit Court lifted the injunction, allowing ferry operations to restart.

On December 13, 2007, Hawaii Superferry, Inc., resumed service to Maui after approximately 1 month of delays to make repairs to the loading barge in Kahului Harbor, Maui. A tug was brought in to assist in holding the loading barge in place during rough weather. However, maintenance issues continued to impact service—cracks were found in the aluminum rudder and hull on the *Alakai.* The ferry went in for maintenance in February 2008 and remained out of service for almost 2 months. Service resumed in April.

Questions regarding the scale of the service reemerged after service resumed. During the first week of service, the ferry carried 150 to 300 passengers and 40 to 100 vehicles each way (Segal, 2007). Ridership in the spring was approximately 25 percent of vessel capacity, well below the break-even point. Promotional $39 one-way passenger and $55 one-way vehicle fares were offered through June 2008. In July 2008, even though ridership increased 40 percent over June's ridership to an average of 390 passengers and 99 vehicles per day, it was still below the 50-percent break-even point (*Pacific Business News,* August 4, 2004). In August, discounts to farmers and shippers were offered, and during September and October, promotional $49 one-way passenger fares were again offered (*Pacific Business News,* August 28, 2008; *Pacific Business News,* September 5, 2008).

Meanwhile, in response to Act 2, project opponents in Maui had announced that a new legal challenge would be mounted. This challenge came in February 2008 when the three Maui groups (Sierra Club, Maui Tomorrow, and Kahului Harbor Coalition) presented a case to the Hawaii Supreme Court asserting that the special Act 2 legislation was created for a single private entity, Hawaii Superferry, Inc., and was therefore illegal. In December 2008, the Hawaii Supreme Court heard the legal challenge that the Act 2 law, which was allowing Hawaii Superferry, Inc., to operate while DOT prepared an EIS, was unconstitutional. The lawsuit asserted that the legislature could only act through general laws (in order to avoid sweetheart deals for single entities) and that the state could not make an irrevocable grant of special privileges (Supreme Court of Hawaii, 2009; DePledge, 2008). The court did not indicate a schedule for a ruling.

In January 2009, the draft EIS prepared by the DOT addressing direct, secondary, and cumulative impacts of harbor improvements was released (Department of Transportation, State of Hawaii, 2008). The report, validating the concerns of project opponents, found that the service would adversely impact cultural resources at the harbors, would result in significant impacts to road traffic in the vicinity of harbors and to natural resources, and would impact recreational activities in the harbors.

On March 16, 2009, the Hawaii Supreme Court ruled that the special Act 2 legislation (passed in October 2007 to allow preparation of an EIS while ferry service continued) was unconstitutional, as asserted by the plaintiffs. Hawaii Superferry, Inc., stopped operations and made a final trip on March 19, 2009. With no cash flow, Hawaii Superferry, Inc., declared bankruptcy in May, and bankruptcy was granted in June 2009. As part of the bankruptcy settlement, MARAD took possession of both high-speed ferries.

It is obvious from this case study that a high level of organized legal opposition to a transportation project, including lawsuits during the planning process, cannot be considered a harbinger of future success. It is not unusual for suits to be filed that challenge the process or findings of a federal or state environmental assessment after it has been prepared. In such cases, if documentation is available showing that environmental law and processes have been followed, there is a reasonable chance of a challenge being rejected. Unfortunately, in the case of the Hawaii Superferry, not following required environmental review procedures opened the plan to legal challenges that ultimately were upheld.

Land Use Issues

The system planning for the ferry service did not include public explanation of ridership demand or optimization of vessel size based on predicted demand. A decision was made not to go public with the plans until the feasibility was clear (Lynch, 2003). Continuing reticence to share planning decisions or to initiate environmental review, combined with announcements of federal funding for other harbor improvements, led to a public perception that the ferry service was a private deal developed behind closed doors to support expansion of military activity on the islands (*Pacific Business News,* January 13, 2004).

Public concerns regarding environmental issues emerged quickly, particularly regarding traffic impacts at harbors and the potential for the large, high-speed ferries with a 12-foot draft to hit and kill whales. Hawaii Superferry's decision to use large vessels (107.7 meters long) was reportedly based on the failure of jetfoils in the mid 1970s because they were perceived to be too small to provide comfortable service during rough weather (DePledge, 2008). Hawaii Superferry, Inc., described a strategy to avoid whales in October 2003 (Pendleton, 2003). Skeptics questioned both the practicality of the proposed avoidance procedures and use of unproven whale-detection technology.

The concern over whale strikes dominated public dialogue; environmental benefits that the ferry might have generated did not become part of the public debate, mainly because the normal

Table 5-25. Per passenger fuel consumption comparison.

Vehicle	Fuel Consumption (gal/hr)	Passenger Capacity	Half Capacity	Travel Time (hr)	Fuel Consumption per Passenger Full (gal/passenger)	Fuel Consumption per Passenger half (gal/passenger)
Austral 107	1,750	866	433	3.5	7.1	14.2
Austral 72	1,150	620	310	3.5	6.5	13.0
Boeing 737 (200-800)	1,500	150	75	1	10	20

process for introducing environmental issues into the public dialogue—environmental documentation—was sidestepped. As a result, fuel use per passenger, which can lead to large carbon savings over conventional air travel, did not enter the public discussion. Table 5-25 compares the per-passenger fuel consumption of the Austral 107 (the vessel used in the Hawaii Superferry service) to that of a Boeing 737 (the predominant interisland vehicle) and a somewhat smaller Austral 72 ferry. Both ferries used about 30 percent less fuel per passenger than the Boeing 737, assuming similar occupancy factors.

The decision of Hawaii Superferry, Inc., to start construction of vessels before full financing was in place created pressure to truncate the system planning and environmental review process in order to get the Superferry into service quickly so that it could generate income to meet scheduled vessel payments. The financial situation of Hawaii Superferry, Inc., set the stage for later confrontation over environmental and transparency issues. The construction order removed the flexibility to accommodate planning delays resulting from public questions or reservations about the system. Very few transportation projects avoid some form of schedule delay.

A clear lesson learned from this case study is that early commitment to private debt or equity financing for vessels (or facilities) before environmental documentation and permits are in place should be avoided. NEPA regulations specifically require an environmental review be concluded before "irreversible and irretrievable commitment of resources" to avoid this exact situation. Ideally, the environmental process can be used to bolster the business case—to develop realistic ridership estimates as well as operating and capital costs—leading to the project sponsors not just identifying impacts, but also providing financial backers with a unified, complete analysis of risks and rewards. Financial commitments place constraints on a project's schedule and make delay an obvious tactic if there are opponents, independent of the merit of opposing concerns.

British Columbia Ferry System

Quickfacts

Operator	Service Category	# of Routes	# of Vessels	Annual Passengers	Annual Vehicles	Fleet Age (years)
British Columbia Ferry Services, Inc	Highway–Ferry Essential	25	37	21.8 million	8.5 million	2–50

History

British Columbia ferry services have operated for more than 150 years. Ferry service between Vancouver Island and the Vancouver area started in the mid 1800s and was initially operated by the Hudson's Bay Company. By 1901, Canadian Pacific Railway had taken over ferry service

across the Strait of Georgia and continued transporting passengers and vehicles on the 5-hour journey between downtown Vancouver and downtown Victoria until the 1960s. In the 1950s, Black Ball Line, which also operated ferries in Puget Sound, began service between West Vancouver and Nanaimo, as well as routes to the Sunshine Coast and Jervis Inlet south of Powell River ("Before BC Ferries," accessed July 1, 2010).

In the late 1950s, the provincial government assumed management and operation of the ferry system, and, in June 1960, the new British Columbia Toll Authority Ferry System (BC Ferries) began operations with two vessels operating on the route between Swartz Bay (Victoria) and Tsawwassen (Vancouver). At Tsawwassen, a 2-mile-long causeway, artificial island, and ferry terminal were built.

In the first year of operation, service was profitable and reliable. As a result, the ferry system expanded and started service to other small coastal communities. To keep up with demand, BC Ferries built more vessels, many of them in its first 5 years of operation.

Initially, private competition continued in parallel to BC Ferries service, with Black Ball providing service from Horseshoe Bay to Nanaimo and Horseshoe Bay to Langdale. The province bought out Black Ball in 1961, acquiring five of its vessels, and also acquired five small vessels of the Gulf Islands Ferry Company. Canadian Pacific continued to operate ferry service, but in 1962 reduced its services on the Vancouver–Nanaimo route, eventually downsizing to freight-only services.

As passenger numbers continued to increase, BC Ferries increased capacity through the "stretch and lift" program. In 1970, four vessels were cut down the middle so that an 84-foot midsection could be "spliced" in. Five years later, vessels were hauled back into dry dock and sliced horizontally. The two halves were separated from each other, and a new upper car deck was slid into place.

In 1985, BC Ferries assumed operations of the saltwater branch of British Columbia's Ministry of Transportation and Highways, which ran ferry services to very small coastal communities. BC Ferries' fleet and its geographical service area increased.

In the mid 1990s, the provincial government decided to use BC Ferries to advance its goal of supporting British Columbia's shipbuilding industry by building a "PacifiCat class" fleet of custom-designed, high-speed catamaran ferries for BC Ferries, with the eventual goal of exporting additional vessels on the international market. The three vessels were built by local shipyards from 1995 to 2000 under the supervision of a new provincial Crown corporation. They had a service speed of 37 knots (68 km/h).

The PacifiCats were commissioned between 1998 and 2000. They were intended to improve BC Ferries service between Horseshoe Bay (on the mainland) and the Departure Bay (in Nanaimo). However, the program was afflicted with construction cost overruns, late delivery, and operational and capacity shortcomings. The ships were operated briefly and then sold in 2003 to a private buyer, the Washington Marine Group (BC Ferries website, accessed July 1, 2010).

The PacifiCat experience resulted in a write-down of a $400 million (CAD) investment in the PacifiCat ferries, and is often referred to as the "Fast Ferry Scandal." The PacifiCat experience led to institutional changes at BC Ferries.

Organizational Structure

In April 2003, BC Ferries was transformed from a Crown (government) corporation into an independent, commercial organization subject to the British Columbia Business Corporations

Act and is now officially British Columbia Ferry Services, Inc. (BC Ferries). The sole shareholder of BC Ferries is the B.C. Ferry Authority, which in turn is a no-share capital corporation created under the British Columbia Coastal Ferry Act.

BC Ferries' routes and service levels are defined in the Coastal Ferry Services Contract between the Province of British Columbia and BC Ferries. The contract, originally signed in 2003, is a binding 60-year agreement that is reviewed and updated at regular intervals (performance terms).

The first renewal of the Coastal Ferry Services Contract was completed on June 30, 2007, for performance term two (April 1, 2008 to March 31, 2012).

The intent of the change for Crown corporation to independent commercial organization was summarized by the Chair of the outgoing Crown corporation in its final annual report:

> As a Crown corporation, BC Ferries was very much dependent upon government for everything from rate-setting to vessel construction and spending priorities. Capital investments were approved within the short-term rotation of government fiscal priorities rather than adhering to a long-term business model that is required for a service of this magnitude. In addition, each decision was directly influenced by the politics of the day.
>
> This problem . . . seriously inhibited the Corporation's ability to operate in a businesslike manner. With a major capital replacement program needed to upgrade or replace older vessels in the fleet and improve terminal infrastructure, a new model was required to access outside financing to make these necessary investments. . . .
>
> Every option was seriously considered: from retaining status quo for the taxpayer-supported Crown corporation model to outright privatization of the service. The option that was selected is the optimal solution. It is best described as a commercial model governed by an independent authority that meets the objective of creating a modern, safe and reliable ferry system that will provide improved service and greater customer choice while protecting British Columbia taxpayers from further financial risk and debt burden (Interview with Len Rouche, formerly of BC Ferries, April 2010).

The BC Ferry Commission, an independent agency established under the Coastal Ferry Act, regulates BC Ferries fares and service levels. The Coastal Ferry Act directs the Commission to follow six principles in protecting the public interest. These principles serve to define what is meant by the public interest in the provision of coastal ferry services:

- Priority is to be placed on the financial sustainability of the ferry operators;
- Ferry operators are to be encouraged to adopt a commercial approach to ferry service delivery;
- Ferry operators are to be encouraged to seek additional or alternative service providers on designated ferry routes through fair and open competitive processes;
- Ferry operators are to be encouraged to minimize expenses without adversely affecting their safe compliance with core ferry services;
- Cross subsidization from major routes to other designated ferry routes is (i) to be eliminated within the first performance term of the first Coastal Ferry Services Contract to be entered into under this Act, and (ii) before its elimination, to be minimized;
- Designated ferry routes are to move towards a greater reliance on a user pay system so as to reduce, over time, the service fee contributions by the government.

Operational Structure

System/Service Routes

BC Ferries has the largest ferry fleet in North America (37 vessels) and carries slightly fewer passengers than Washington State Ferries (BC Ferries carries about 21.8 million passengers annually). Service operates daily, with more than 500 departures each day (see Figure 5-15 for a map of BC Ferries routes).

Figure 5-15. BC Ferries route network.

The three most heavily patronized routes are Tsawwassen–Swartz Bay, Tsawwassen–Duke Point, and Horseshoe Bay–Departure Bay. These routes operate with no subsidy, including the cost of their capital. Service is daily.

BC Ferries also operates three northern routes: Port Hardy–Prince Rupert, Port Hardy–Bella Bella/Shearwater/Bella Coola/Klemtu/Ocean Falls, and Prince Rupert–Skidegate (Queen Charlotte Islands). Service on the Inland Passage operates every other day. Service to the Queen Charlotte Islands operates 6 days per week, and service from Port Hardy to Bella Bella and Shearwater operates 3 days per week in the summer. These services are subsidized by the Province.

The balance of BC Ferries' routes is categorized as "other" with three subcategories: Northern Gulf Islands, Mainland/Vancouver Island/Sunshine Coast, and Southern Gulf Islands. The Northern Gulf Routes are

- Buckley Bay–Denman Island
- Denman Island–Hornby Island
- Campbell River–Quadra Island
- Quadra Island–Cortes Island

- Port McNeill–Alert Bay–Sointula
- Powell River–Comox
- Powell River–Texada Island

The Mainland/Vancouver Island/Sunshine Coast routes are

- West Vancouver–Sunshine Coast (Horseshoe Bay–Langdale)
- Sechelt Peninsula–Powell River (Earls Cove–Saltery Bay)
- Bowen Island–Vancouver (Snug Cove–Horsehoe Bay)
- Langdale–Gambier Island–Keats Island
- Saanich Inlet Route
- Brentwood Bay–Mill Bay

The Southern Gulf Islands routes are

- Bowen Island–Horseshoe Bay
- Nanaimo Harbour–Gabriola Island
- Chemainus–Thetis Island–Kuper Island
- Salt Spring/Vesuvius–Crofton
- Salt Spring/Fulford–Victoria
- Mayne–Galiano Island (Sturdies Bay)
- Mayne–Pender Island (Otter Bay)
- Mayne–Saturna Island (Lyall Harbour)
- Mayne–Tsawwassen
- Mayne–Swartz Bay

Note that some routes are double-counted as the vessels make several stops. Service on the other routes category generally operates daily throughout the year.

Facility and Vessel Maintenance

BC Ferries operates 37 vessels on 25 routes serving 47 terminals. All of the vessels are owned by BC Ferries, and the terminals are operated by the company under a long-term lease with the British Columbia Transportation Financing Authority. Nine of the smaller routes are operated under contract with alternative service providers.

All ferries are RO-RO vessels. The vessels are a mix of large ferries (including three "Coastal" class, 160-meter vessels that carry 1,650 passengers and 370 vehicles and are the world's largest double-end ferries) and small, 16-vehicle ferries operating on coastal inlets. The fleet ranges in age from small vessels that are more than 50 years old to the 2-year-old Coastal class vessels. In addition, the BC Ferries capital program includes regular upgrades and midlife rebuilds for the existing fleet. Over the last 5 years, BC Ferries has added seven new vessels and plans to purchase two, new, smaller vessels over the next 3 years. All vessels are designed for a 45-year life with major upgrades and overhauls at quarter, half, and three-quarter life periods. (See Figures 5-16 and 5-17 for photos of BC Ferries vessels.)

The recently completed Coastal class project can be considered a best practice and stands in contrast to the PacifiCat experience of the mid 1990s. BC Ferries commissioned the PacifiCat project, which involved building three large fast catamarans to operate between Vancouver and Vancouver Island. BC Ferries intended for the new vessels to operate at higher speeds and thus provide the same number of trips with fewer vessels. The program was also intended to provide new jobs within British Columbia's maritime industry.

The PacifiCat project ran over budget and behind schedule, and the actual vessel speed increase was not great enough to reduce fleet requirements. The province eventually terminated the project and sold the three vessels at a large loss (Interview with BC Ferries, June 2010).

Figure 5-16. BC Ferries with open automobile deck.

Despite cancelling the PacifiCat project, BC Ferries still needed new vessels for the Vancouver–Vancouver Island service. The new management of BC Ferries opted for an inclusive stakeholder consultation process combined with a private-sector, design-build model, with impressive results. The vessels built as a result of this process are part of the Coastal class boats now in operation.

In the stakeholder process, management was able to include a large number of industry user and operator ideas on ship design. BC operators were also consulted, and the project managers learned what worked well for the people who work on the ship. One commenter noted that "the cooks designed the galleys," and as a result the new vessels have a high employee acceptance (Interview with BC Ferries, June 2010).

Early in the process, management at BC Ferries decided to use the design-build approach, where broad specifications were given to bidders, but the designer and builder had the final

Figure 5-17. BC Ferry operating in the Strait of Georgia.

responsibility to deliver the product as agreed. This approach resulted in a high degree of certainty on product, price, and schedule. As a result, BC Ferries was solicited by world-class ship designers and builders and was able to access the global market for the best product and most efficient shipbuilder. Even with a 25-percent Canadian duty on foreign ships, the German-built Coastal class vessels still cost less than a comparable home-built vessel, and BC Ferries was able to use the savings to purchase an additional vessel (BC Ferries Fare Index, accessed June 2010).

BC Ferries staff believes that accessing the most commercially viable options allows the company to save money and pass on the savings to its passengers.

Staffing Levels

The ferry system has more than 2,800 full-time maritime workers, plus 1,700 casual (on-call) employees. All unionized employees are members of the BC Ferry & Marine Workers' Union (BC Ferries website, accessed July 1, 2010). The company also has another 350 administrative employees.

Many of BC Ferries' ships are licensed by Transport Canada to operate at different crewing levels, depending on the number of passengers on board. Transport Canada sets the number of crew members required for a certain number of passengers mainly according to their estimate of how many crew members would be required for a prompt and efficient evacuation of the ship in case of an emergency. As an example, the vessel on the Comox–Powell River route can carry a maximum of 659 passengers, provided there are 25 crew members ("A" License). The maximum load is reduced to 324 if there are only 18 crew members ("B" License) (BC Ferries website, accessed July 1, 2010).

BC Ferries provides career and management development programs. Safety and security are major initiatives, and the company works to train crews for emergency situations from passenger security training to evacuation drills.

Financial Structure

Fares

BC Ferries' 25 routes have multiple fare tariffs (all dollar amounts given in the "Financial Structure" section are CAD). The three routes from Vancouver to Vancouver Island have the following tariff structure (BC Ferries Fare Index, accessed June 2010):

- **Pedestrian**—$14 ($7 for children and passengers with disabilities)
- **Vehicle Tariffs (always in addition to the pedestrian fare)**
  - Bicycle—$2
  - Motorcycle—$23.40
  - Vehicle and/or other combination less than 20 feet—$46.75
  - Vehicle and/or other combination longer than 20 feet—$5.25 per foot additional
  - Buses—$3.75 per foot

Other routes have similar tariff structures. Note the following range of fares:

- **Pedestrian—**from $5.20 for Gulf Island service to $170 for service to Port Hardy
- **Vehicle Tariffs (always in addition to the pedestrian fare)**
  - Bicycle—from $2 to $5
  - Motorcycle—from $5.70 to $23.40
  - Vehicle and/or other combination less than 20 feet—from $11 to $400
  - Vehicle and/or other combination longer than 20 feet—from $33 per foot additional
  - Buses—from $1.55 to $23 per foot

Discount rates are available to groups of 16 or more fare-paying passengers travelling together on foot or in a vehicle licensed to carry 16 or more passengers (e.g., a bus) on the following routes:

- Tsawwassen–Swartz Bay
- Tsawwassen–Duke Point
- Horseshoe Bay–Departure Bay
- Tsawwassen–Gulf Islands
- Prince Rupert–Port Hardy
- Port Hardy–Mid Coast
- Prince Rupert–Skidegate

Fare Discounts. BC Ferries provides several fare discount programs. These include prepaid fares via the BC Ferries Experience Card, available on several routes for loading a minimum amount of money to the card (the Vancouver to Vancouver Island service does not receive a discount). In addition, four routes use prepaid paper ticket books.

BC Ferries also uses peak/off-peak tariffs, and these rate changes cover mid-week discounts as well as less expensive off-season rates.

British Columbia senior residents can travel free (pedestrian only) Monday through Thursday, excluding five peak or holiday days.

Operating Expenses. BC Ferries has expenses of about $570 million annually. These expenses include about $335 million in operations, about $89 million in maintenance, about $50 million in administration, about $30 million for the cost of goods sold on ships, and about $66 million in amortization. Interest expenses result in expense of another $34 million. In 2008, BC Ferries had total revenues including government payments and subsidies, of about $640 million. Retained earnings (the company is not-for-profit) were about $37 million (British Columbia Ferry Services, Inc./BC Ferries Authority, 2008).

Funding Sources

BC Ferries' unique operating structure contributes to an equally unique financing arrangement. Every route charges a fare and in total, about two-thirds of the operating and capital cost of the service is derived from fares. Ancillary services (such as food and beverage) contribute 9 percent to service operations, with the balance obtained from provincial and federal subsidies.

Under the Coastal Ferry Act, the province enters into contracts for the operation of ferries on specified ferry routes. So far, BC Ferries is the only ferry operator that has such a contract with the province. The primary feature of the contract is a commitment by BC Ferries to provide a defined number of "core" sailings on each of 25 "designated" routes. The province's key commitment is to pay BC Ferries a "service fee" (currently on 22 of the 25 routes) for each sailing.

During the contract term, BC Ferries must meet or exceed specified core service levels in relation to designated ferry routes. The Coastal Ferry Services Contract specifies routes and core service levels per route (hours of operation, minimum capacity, and frequency and number of trips), subject to an allowance for short-term, temporary service disruptions. In return, the province pays BC Ferries for the provision of services.

About one-third of BC Ferries' annual budget comes from government payments. The payments will approach about $125 million in Fiscal Year 2011/12. There are three categories of government payments:

- **Ferry Transportation Fees.** These fees subsidize 22 unprofitable routes in smaller markets and to avoid cross subsidization from the three major (profitable) routes (which receive no ferry transportation fee).

- **Social Program Reimbursement.** This approximately $12-million payment provides a reimbursement to BC Ferries for toll discounts established by the province and given to students, seniors, people with disabilities and those who qualify for the medical travel assistance program.
- **Unregulated Route Fee.** This fee provides about $2 million in annual funding for unregulated routes through a flow-through for private operators.

Each route's expenses include both operating and capital costs. The BC Ferry Commission reviews BC Ferries' rates to ensure that BC Ferries is reimbursed for operating expenses, administrative expenses, and the amortized cost of capital facilities and vessels.

The Vancouver–Vancouver Island services represent about 60 percent of BC Ferries' total revenue and operate with no government subsidy. In 2007–2008, more than 11 million passengers used these services, and the services carried almost 4 million vehicles. Users generated about $104 million in passenger fares, $182 million in vehicle tariffs, and $64 million in onboard services (food, beverage, etc.). Parking, reservation, and other fees generated another $20 million in revenues.

The northern routes have a farebox recovery of about 34 percent (and represent about 8 percent of total cost). In 2007–2008, these routes carried about 100,000 passengers and almost 34,000 vehicles. The northern routes generated about $17 million (CAD) in passenger/vehicle revenues and received a subsidy of about $33 million.

The other routes represent about one-third of BC Ferries' service and cover about half of their costs through the fares and tariffs. In 2007–2008, this route group carried about 10.4 million passengers and 4.6 million vehicles and generated about $31 million in passenger fares and more than $51 million in vehicle tariffs. These routes also generated about $12 million in other ancillary revenues (British Columbia Ferry Services, Inc./BC Ferries Authority, 2008).

Planning Issues

Environmental and Regulatory Issues

At BC Ferries, environmental and cost containment issues intersect at fuel efficiency. The company has a commitment to reducing greenhouse gas emissions and saving money. For the last 7 years, BC Ferries has reduced its annual fuel consumption with two-thirds of the fleet being repowered. As a result, BC Ferries has seen a 35- to 40-percent reduction in fuel consumption. The organization is also cleaning hulls and has added new propellers and rudders to reduce drag and the power required to maintain scheduled speed.

The largest vessels have not been repowered, but the engines have been rebuilt. As a result, lube oil consumption was reduced by two-thirds and emissions were also reduced.

BC Ferries is also using operational procedures to reduce fuel consumption. On-time departures mean less engine idling and lower fuel consumption in addition to contributing to better safety and on-time arrivals. There is now a 5-minute "cut-off" for passengers to board and a 10-minute "cut-off" for vehicles.

BC Ferries is also using technology to reduce fuel and other operational costs. GPS-enabled piloting identifies the routes with the best environmental conditions and results in optimized power for sailing. These advanced piloting techniques and technologies result in a 5- to 6-percent fuel savings.

Currently, 5 percent of BC Ferries' fuel supply is biodiesel. This percentage will likely increase to 10 percent as the biodiesel portion of the fuel supply increases. Only ultra-low sulfur fuel is used. BC Ferries is also considering natural gas vessels for its smaller routes and could even convert one of its routes to a cable ferry. These additional measures could result in a further 20- to 30-percent reduction in fuel consumption (Interview with BC Ferries, June 2010).

Other environmental initiatives include replacing ground transportation vehicles with fuel-efficient and lower emission vehicles as well as using propane and electrically powered baggage vans and service vehicles. The company has also replaced chemical cleaning and maintenance with "greener" products, including a de-icing product that is less corrosive than road salt.

Recycling is also an important priority. Each week BC Ferries composts almost one ton of compostable material and recycles everything from cardboard to used cooking oil.

Land Use Issues

As with other highway-oriented and rural ferry systems, BC Ferries provides critical access for isolated communities and is the "highway" for many communities.

The main land use impact of the BC Ferries system is to provide access to communities in much the same way a highway provides access. On the most intensely travelled routes between Vancouver and Vancouver Island, terminals tend to be large, with staging areas and adjacent parking. Reflecting the historical growth of the ferry service, terminals are located in areas where water crossings made the most sense. The Tsawwassen, Horseshoe Bay, Swartz Bay, Duke Point, and Departure Bay terminals all are located some distance from primary land uses (Swartz Bay is about 25 miles from Victoria, and Duke Point and Departure Bay flank Nanamio). Some of the smaller ferry services do terminate in the traditional town centers.

The operating and funding scenario for BC Ferries limits access to smaller communities. Since the provincial ferry transportation fee is fixed, any additional increase in service or change in vessel capacity needs to be reflected in higher fares. While the financing system was designed to bring accountability and transparency to BC Ferries' financing and service allocation, some of the smaller, ferry-dependent communities consider themselves "abandoned" (Interview with BC Ferries, June 2010). The service levels don't increase, vessels tend not to be replaced, and vessel sizes aren't increased because that would end up reflected in higher fares. As a result, one of the traditional aspects of transportation—creating land value by being a loss leader—is limited to the existing provincial financial support levels.

Emergency Response

Safety and response is a high priority at BC Ferries. The company developed a security plan in 2007, and, as a result of the 2010 Olympics, new measures concerning physical security as well as new procedures and baggage handling were implemented. The company is fully compliant with the International Ship and Port Facility Security (ISPS) Code.

Crew training is conducted regularly. Training includes about 14,000 annual training days and about 1,300 training days for marine evacuation systems. In addition, all ships have Voyage Data Recorders (black boxes).

PART 2

Practitioner and Policymaker Guidance

SECTION 6

Summary of Guidance

The results of both the literature search and the case studies suggest that there are specific markets that respond well to ferry services and, as a result, these ferry services provide economic and social benefits to society.

During the course of this study, it was found that most ferry operators, or ferry sponsors, approach the decision to initiate or expand ferry service in a systematic manner, in order to develop useful and economical services. The common themes of these approaches include the following:

- Identification of goals and desired outcomes.
- Understanding of the market.
- Development of service criteria.
- Development of an operating plan (including labor and equipment availability).
- Development of a financing strategy.
- Incorporation of a business plan.

These steps lead to an overall suggested process of analyzing, considering, and then implementing ferry service (if justified), by working through a strategic planning process and then a specific business plan for the proposed service. This process is illustrated in Figure 6-1.

Sections 7 through 9 focus on specific areas of this development process. Section 7 focuses on the strategic plan issues of developing goals and objectives and establishing and assessing criteria. Section 8 provides an introduction to ferry service operation and management issues, notably logistics (personnel, deploying equipment, and other more technical and day-to-day issues) that will ultimately have to be addressed in the business plan. Section 9 presents and discusses the components of a ferry service strategic plan and business plan and provides examples.

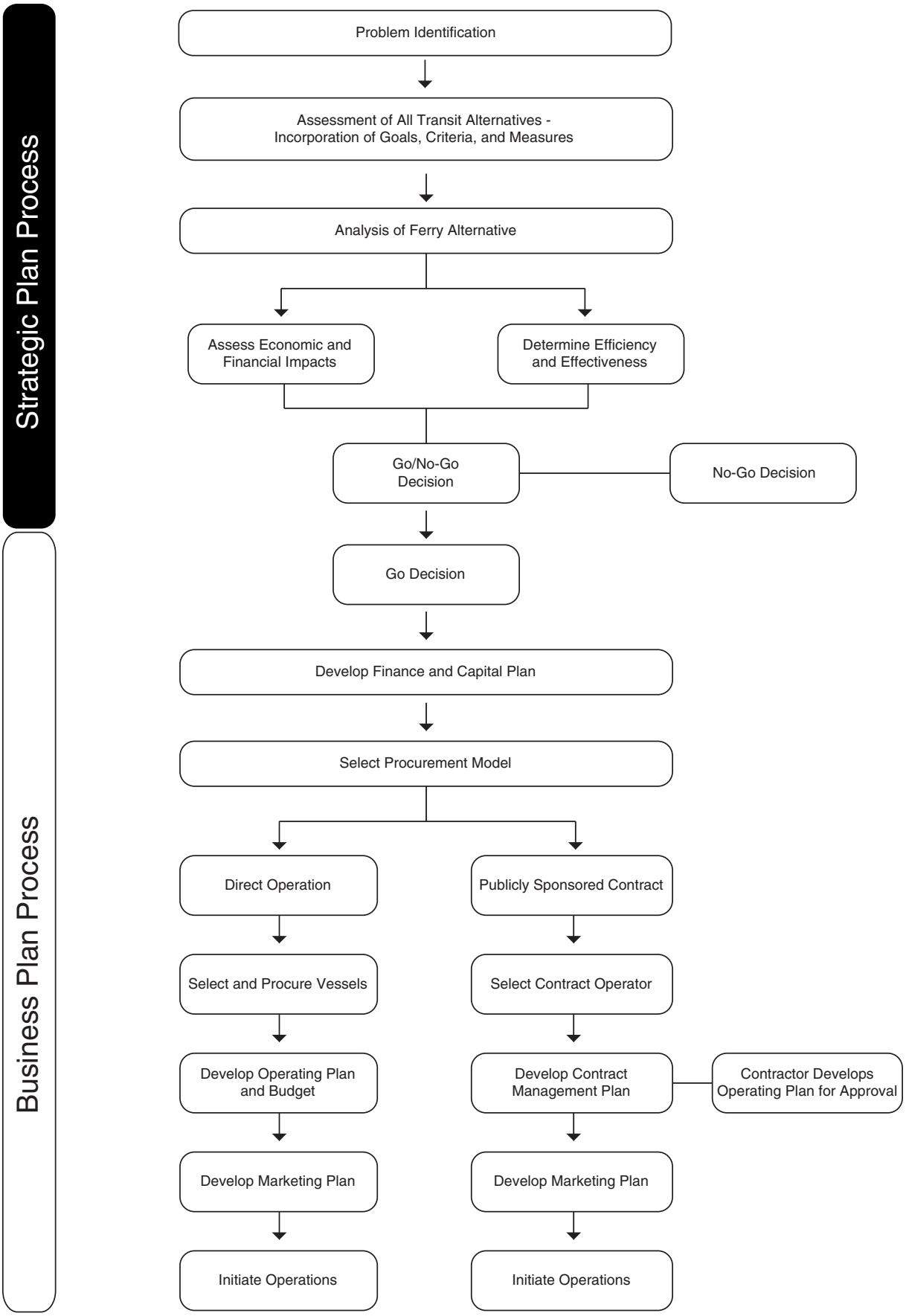

Figure 6-1. Transportation/ferry service development process.

SECTION 7

Strategic Planning in Ferry Service Development

The major subheadings of this section follow the steps outlined in the top part of the flow chart depicted in Figure 6-1:

- Problem identification
- Assessment of all transit alternatives—incorporation of goals, criteria, and measures
- Analysis of the ferry alternative
  - Assess economic and financial impacts
  - Determine efficiency and effectiveness
- The Go/No-Go decision

Each step is discussed in depth below.

Problem Identification

Ferry service is provided as a means of public transportation to serve a number of different constituents. In service areas where ferry routes compete against other transit modes or automobiles, ferry ridership is sensitive to outside influences that may increase or decrease ridership on a monthly basis. Gas prices, unemployment levels, and traffic congestion are just a few factors that influence ridership in both the short and long term. Ferry operators operating in this type of environment are aware of these factors as they impact competitiveness and marketability.

Operators who provide ferry services where there is no other transportation alternative are less prone to fluctuations in ridership, although these operators face their own set of factors that influence financial viability. Tourist season, weather conditions, and service headways influence the financial break-even point and the level of profits earned during the year, but ensuring that ridership returns every year can be a source of concern during down economic cycles.

Analysis of new or modified ferry routes should take into account a number of different factors. Unlike landside transit routes, ferry routes typically are point-to-point routes, with no stops along the way. If a route is modified, the new landing point should be demonstratively better than the previous one for both passengers and the operator. If a new route is introduced, it should be demonstrated that the service catchment area has the characteristics and demographics of a productive route. This section outlines these characteristics.

Private Operators

Private operators operate closer to the economic margin than public operators, who generally have several sources of revenue besides ticket receipts. Private operators also consider their ability to make large capital expenditures as well as any increase in operating or maintenance costs.

Because they are usually smaller entities with a few routes, private operators must be able to forecast as accurately as possible the rate of return on their investment in any new route. Private operators do have greater flexibility in modifying or cancelling routes than public operators, who are beholden to their public constituents. Conversely, private operators are often long-established companies in remote areas, and while they do strive to create a profit, they can also have a culture that values the community they operate in and their responsibility to the public (which is often their friends and neighbors).

Public Operators

Public operators consider starting new ferry routes for a variety of reasons and to do so often accept financial deficits. Public operators begin new service to reach new or growing communities, satisfy mission statements, or because of the local political climate. Obtaining capital grant monies is a common way to offset the cost of new vessels, and new operations and maintenance costs are covered through farebox recovery and subsidization.

Assessment of All Transit Alternatives—Incorporation of Goals, Criteria, and Measures

Ferry planning is often undertaken in the context of land-based versus water transportation decisions. Ferry projects are not as prominent as land-based transportation decisions, whether it is bridges, tunnels, and highways for automobiles or buses and rail for public transit. Given that the ferry industry in the United States varies widely, and that public benefits are perceived differently in different locations, factors affecting public goals should be considered during ferry planning and development. These factors include the following (Norris, 1994)

- **Transportation demand.** A main factor for any new, proposed, or expanded route is transportation demand. Consideration of this factor should take into account existing traffic congestion, landside public transit demand, RO-RO demand, interstate/state transportation systems, and legislative policy.
- **Economic development.** Ferry service demand is a function of land use and economic development. Ferries can be used to respond to economic growth within a region or can be used as a catalyst to encourage new and more intense land uses. In this context, ferry terminals take on the role of community gateways, similar to rail or other multimodal transit stations.
- **Safety and regulatory compliance.** Public policy places a high value on safety and security—in fact, these goals are the highest priority of the ferry operator and government regulators.
- **Cost-effectiveness.** Cost factors must be considered during ferry planning, especially for public projects involving public funding. Cost analyses must look at capital and operating costs, public versus private operation, and technological advances when assessing a preferred mode or route.
- **Environmental issues.** The environmental impact of new or expanded ferry service must be considered under NEPA and under any relevant state environmental disclosure laws. These pieces of legislation ensure that critical environmental issues, such as coastal zone issues, energy efficiency, air quality, water quality, wildlife habitats, and community impacts/concerns, are adequately addressed and mitigated.
- **Geographical conditions.** Separate from environmental concerns, geography plays a major role in water-related decisionmaking, and influences waterborne transportation differently than landside transportation. Decisions are affected by weather patterns, shore conditions, type of water body and conditions, tide/flood conditions, and year-round versus seasonal operation requirements.

Linkages between these six factors should also be considered during ferry planning and development. Some of the linkages that should be considered are discussed below.

Transportation Demand and Economic Development

Transportation demand and economic development are linked. The case studies undertaken for TCRP Project H-40 indicate that urban ferry travel is directly related to land development. Future ridership on a new or modified ferry route is projected in a way similar to many other transit projects, by taking into account future land uses, future transportation demand, service frequencies, and travel time compared to competing travel modes. Projected ridership levels are taken into account in decisions about appropriate vessel size and carrying capacity. Operators need to ensure that they will carry the minimum number of passengers per trip necessary to break even on their cost per trip (for a private operator) or meet criteria for farebox recovery (for a subsidized public operator). Operating a vessel that is too large for a particular route can adversely affect an operation's economic bottom line when the costs of fuel and staff are included. Operating a vessel that is too small on a popular line can cause passenger frustration, leading to ridership loss as passengers turn to other transportation modes and lose confidence in their ability to make certain scheduled crossings.

Ferry routes and terminals have recently begun to be part of larger land use and transportation planning conversations that seek to link together transportation services with developing or redeveloping land uses or specific communities. Advocates of transit-oriented developments, smart growth, and other related planning ideals highlight ferry terminals as potential attractors that can assist in bringing activity to underused areas. Ferry terminals are seen as downtown anchors, helping to revitalize former main streets as well as supplementing supporting businesses who serve ferry passengers. Tradeoffs for the development include allocating the necessary land and water area for the ferry facility, as well as designing the terminal to be functional while minimizing its impact.

Ferry service sponsors must consider the economic catalyst effect against existing demand. Each route and terminal must be carefully analyzed to determine whether there is enough demand for them to be financially and operationally viable. The type of ferry service offered is also a critical factor in stimulating economic activity. Passenger-only ferries are more likely to draw passengers to supporting businesses than vehicle ferries, where passengers never exit their car at the terminal. Further discussion of analysis factors when considering economic development as part of new ferry service is provided later in this report.

When deciding whether ferries should be used to provide access to a new development site, prior to entering into elaborate and expensive ridership projections, decisionmakers should determine whether ferries can provide the access to the destinations that is desired, at a level of service that can be sustained. The following factors should be taken into consideration:

- The size of the site (larger sites can result in financially sustainable ferry services).
- The type of land uses (more intense uses generate more traffic, but niche uses—such as a park—can be successful for ferries).
- The trip market (for instance, whether the anticipated trips are concentrated in one area, such as to a central business district).
- Other modes (whether other modes are inconvenient, over capacity, or non-existent).
- Water conditions (whether there is adequate water depth, the ability to provide terminal facilities, harbor traffic, and so forth).

In Ferry Intercity or Ferry Essential operations, where ferry service links metropolitan areas to other metropolitan areas (and where other modes do not exist) or where small communities are

linked to a metropolitan area, the primary policy considerations are economic development of the non-urban area and statewide policy provisions that seek to increase and support access to isolated areas. These policy considerations are subjective and based on a perception or an understanding of how a ferry operation might affect local economies. For example, if the state chose to encourage tourism and recreational activities, then ferry service may be increased or supported. On the other hand, if resource conservation was an important goal, then ferry access could be limited.

In areas like the Seattle, Washington, metropolitan area, ferries are part of state highway systems and can move millions of passengers a year. The geographical nature of a region and its economy can require a robust ferry system that is able to move millions of people on a daily basis. In other instances, such as islands off of the mainland, ferries provide the only transportation. In both of these examples, ferries compete well or have little competition with vehicular or transit travel, taking advantage of built-in ridership demand. Ferry operators in these situations must still ensure that fare levels and service frequencies are constantly adjusted to market demand as tourists often make up a large part of the yearly revenue intake and swings in fares could dissuade local and visitor ridership.

Safety and Regulatory Compliance

Regulatory compliance is an important aspect of ferry service. While economic regulation has diminished in the last 20 years (i.e., regulation of tariffs and schedules), environmental, workplace, safety, and security regulations have all increased. Ferry systems of all sizes must take into consideration the risk of accidents, such as collisions, groundings, allisions, fires, and explosions (Harrald et al., 1999). The Coast Guard certifies the vessel and conducts annual vessel inspections. The Coast Guard also enforces laws and regulations pertaining to minimum crewing levels, licensing for vessel crews, security threats, and the origin of passenger vessels.

Cost-Effectiveness and Environmental Issues

Cost-effectiveness and environmental issues are also closely related. The ability to reduce marine emissions is an increasingly critical component in determining the viability of new vessels and routes. In the last decade, on-road vehicles have become extremely clean, with emission reduction levels (relative to direct engine exhaust) of 98 percent or more. Studies have concluded that ferries will have to reduce emissions by 85 to 98 percent to make the impacts of ferry commutes less than the impacts of on-land commutes (CALSTART, 2002).

Since 2007, all new vessels have had to meet Tier 2 engine requirements, part of a broader effort to use technologies that reduce emissions. The case studies conducted for TCRP Project H-40 found that several ferry operators have participated in a government grant program to repower their vessels with newer engine technology. The operators were uniformly pleased with the results of the program because the public benefited through reduced emissions and the operators benefited through reduced fuel consumption.

Additional emission reduction can result from the use of alternative fuel sources, such as biodiesel. Biodiesel may be used in almost all diesel engines (the predominant propulsion mode in vessels) at concentrations of up to 5 percent. New engines can use up to 20 percent biodiesel and remain within warranty requirements.

A 2002 EPA study found that use of 20-percent biodiesel (B20) results in a minor increase in oxides of nitrogen (NO_x), but provides double-digit percentage decreases in particulate matter (PM), hydrocarbons (HC), and carbon monoxide (CO) (see Table 7-1). (The EPA report documented these trends continuing as the biodiesel percentage increases. At 100-percent biodiesel, NO_x increases by about 10 percent, but PM and CO both decrease by about 50 percent and HC

Table 7-1. Emission impacts of 20-percent biodiesel.

	Emission impacts of 20 vol% biodiesel for soybean-based biodiesel added to an average		
			Percent change in emissions
Pollutant	NOx		2.0%
	PM		-10.1%
	HC		-21.1%
	CO		-11.0%

Source: Assessments and Standards Division, Office of Transportation and Air Quality, 2002.

decreases almost 70 percent. Carbon dioxide emissions would also decrease significantly when considering the entire production process). Virgin Trains, a UK passenger railroad operator, expects that a 20-percent biodiesel blend in its fuel mix will result in a carbon dioxide emission reduction of about 14 percent. (Assessments and Standards Division, Office of Transportation and Air Quality, 2002; *BBC News,* 2007)

The cost of biodiesel has been estimated to be comparable with petroleum when oil costs $70 per barrel (in 2011, oil traded from $80 to $130 per barrel). As the biodiesel industry expands and develops new technologies and as worldwide petroleum demand increases, it is likely that biodiesel will represent a lower cost option for ferry operators.

New engines are certified by manufacturers to operate on B20. These new engines are also cleaner burning, and the case studies conducted for TCRP Project H-40 indicate that operators replacing engines experience about a 20-percent overall reduction in fuel use. Since new engines are both more efficient and allow use of alternative fuels, these engines provide ferry operators with the ability to reduce emissions and costs in multiple ways. Using biodiesel in a new engine could reduce overall costs by about 20 percent and reduce emissions of PM, CO, and HC by 20 to 35 percent.

Balancing Constraints and Limited Resources with Market Opportunities

The ferry industry serves a wide range of users. Ferries that serve areas with multiple transportation offerings are in a complicated position—trying to compete for a discrete number of riders who have many choices for transportation to their destination. In these situations, ferry passengers can often be categorized as "choice riders," those who make a conscious decision to ride ferries when they may be more expensive or less convenient than landside transit or driving for reaching the passengers' destination. Ferries must maintain a delicate balance between fare prices and operational and maintenance costs to meet budget requirements.

The ferry operator should consider the importance of the following to marketing ferry services:

- **Attractive terminals.** A ferry terminal is a gateway to the community and is also a storefront for prospective customers. Terminals provide a welcoming experience for disembarking passengers, as well as providing connections to other travel modes. The terminal itself can be seen as a multimodal center comparable to other transit facilities. The terminal provides passengers with information on routes and schedules, the ability to pay for tickets, protection from

the elements, and a secure waiting area. The design of the terminal can also reflect its immediate surroundings and home community and can serve as a catalyst for future development, some of which could benefit the ferry authority or the ferry operator. These locations are often infill, brownfield sites, creating good opportunities for many stakeholders to benefit.

- **Intermodal transit connections.** Intermodal transit connections at or near ferry terminals are critical components of the overall ferry transit trip. For riders on passenger-only vessels, the connections at the other end of the ferry trip to their final destinations are important if the ferry terminals are not located near employment centers. Ferry operators can also enter into agreements with other transit operators that allow passengers to receive a discounted transfer ticket on either bus or rail to get them to their final destinations.
- **Quality service.** Since 1994, Washington State Ferries has used "Level-of-Service" (LOS) standards to ensure that they are providing an adequate level of service to the public. LOS for WSF is measured in "boat waits" (Washington State Ferries, 2007). A one-boat wait means that 85% or more of general vehicle traffic would not have to wait more than one sailing after arriving at the dock before boarding a boat. While LOS is currently limited to boat wait, the *Transit Capacity and Quality of Service Manual* (Kettleson & Associates, Inc., et al., 2003) uses the LOS concept to apply to transit passenger waits, speed of service, and many other factors.
- **Universal fare media.** It is not uncommon for public transit within one region or jurisdiction to issue more than one form of fare media. Regions with multiple ferry operators also have different fare-collection methods. Unifying fare media and fare collection into one form that can be used both landside and for ferries greatly increases accessibility for commuters who transfer between modes. Both public and private operators can gain from having a common fare media, especially electronic media that allow for fare discounts and transfer credits between operators.

Analysis of the Ferry Alternative

Assess Economic and Financial Impacts

Project selection varies for a public or a private venture depending on project financing. The "big picture" issues that need to be considered are similar, but have some distinctions.

Private-Sector Economic and Financing Considerations

In selecting new ferry service or modifying an existing one, private operators must account for a number of factors within their business plan. Private operators often need to publicly discuss their environmental impacts, but their financial projections are usually private. As a result, their internal business plan documents the financial feasibility of the operation. This business plan, discussed further in Section 9 includes issues such as the following:

- **Capital funding.** What is the source of the capital funds needed for new vessels and new or upgraded dock or terminal facilities?
- **Operations cost.** How do costs for labor, insurance, leases, professional services, regulations, permits, and insurance add up? What is the total cost to operate the service, and are there economies of scale? Do unit costs decrease as service increases?
- **Labor availability.** Are qualified maritime personnel and masters available?
- **Operational funding.** What is the source for operating and maintaining the service? How will incidental costs such as marketing be covered?
- **Vessel acquisition.** What vessel or vessels are appropriate for the new or modified route? Where will vessels be stored?
- **Ridership forecasts.** What is the ridership forecast for the route (by day, month, and year)? Does seasonality play a role in ridership levels?
- **Maintenance.** Where will the new vessel be maintained? Will it require a specialized service not already under contract?

- **Fares.** What are appropriate fares for the service given its length and/or in comparison with other routes in service?
- **Emergency contingency.** What does the operator need to consider in the event of a natural or manmade disaster or unforeseen changes in the cost of labor or fuel?

Private operators who do not receive public monies may still be subject to environmental analysis for new services especially if landside improvements are required. New routes are generally not regulated, but in some cases states regulate levels of service, which can either hinder or delay business-related changes. In addition, new terminals, docks, or any waterside infrastructure may require permitting from relevant state or federal agencies. It is important for operators to be aware of state and federal regulations that may pertain to their operations.

San Francisco Bay Area Emergency Response

California law requires the Bay Area Water Emergency Transportation Authority (WETA) to plan and operate new water transportation services on San Francisco Bay and coordinate maritime emergency response using public transportation ferries.

WETA coordinates the Bay Area maritime emergency response for the transportation of people by passenger ferry boats during an emergency; provides representation to state emergency authorities; and activates its Emergency Operations Center, which communicates with the Regional Emergency Operations Center (REOC) and the Metropolitan Transportation Commission (MTC), the region's transportation planning and funding agency. WETA anticipates that its emergency operations capabilities will evolve and increase over time as staff, facilities, vessels, and funding become available (it should be noted that WETA is assuming management control of most ferry services in San Francisco Bay).

The WETA Emergency Water Transportation System Management Plan provides for several phases of activity (San Francisco Bay Area Water Emergency Transportation Authority, 2009):

- **Pre-emergency planning.** This planning includes identification of public transportation ferry assets, size, ownership, location, and capacity; cataloging of existing ferry terminals; development of a primary WETA Emergency Operations Center; and discussions and drafting of contracts and Memoranda of Understanding (MOU) with local, public, and private ferry service operators to enable execution of the WETA emergency response.
- **Response phase.** In response phase activities, WETA focuses on working to effectively communicate and coordinate with other agencies. WETA's first priority is to protect life, property, and the environment. The second priority is to provide emergency water transportation services during the response phase and the third is to restore basic water transportation services generally during the recovery phase of the emergency. In the response phase, WETA's primary task is working within the regional emergency transportation response and mutual aid coordination process.
- **Recovery phase.** Recovery phase activities could occur within 3 days of the emergency. As soon as possible, WETA will begin to restore basic water transportation services. During this time, WETA will work towards restoration of the normal, pre-emergency WETA services, but may also provide additional or expanded service in the event that bridges, highways, and other facilities are inoperable.
- **Non-emergency operations.** These operations involve continuing response training and exercises for emergency response personnel to become fully familiar with the procedures, facilities, and systems used during an actual emergency. The exercises, drills, and training also provide feedback to maintain a continuously improving plan.

Public-Sector Economic and Financial Considerations

Ferries are just one "tool" in a region's transportation "toolbox" that public agencies use to deliver access. As examples across the country indicate, the appropriateness of ferry service is dependent on the viability of existing transportation modes.

All public actions require allocation of resources through a deliberative process. Transportation projects compete for public resources with schools and public safety, health, and other infrastructure programs. Within transportation budgets, ferries compete for funding with other modes. Decisionmakers try to use the limited funding available to benefit the greatest number of people.

When thoughtfully planned and implemented, ferry service can benefit a large number of people. Compared to other investments, ferry service may cost less. A ferry route may open a new development site that is geographically close to important destinations that have previously been difficult to access. Agencies will consider the total life-cycle cost of the ferry investment versus other investments and also consider the economic impact of the ferry route. A private-sector operation must make a profit and must take this into consideration when deciding whether to offer ferry service; the public-sector decision is more subjective and includes consideration of impacts other than economic ones.

Determine Efficiency and Effectiveness Criteria

In determining efficiency and effectiveness criteria for evaluating potential ferry services, it is important to be aware of (1) the different market segments that ferries can serve and (2) whether the ferry service under consideration will be a public or private entity.

In this research, ferry services are understood to fit into two broad market segment categories:

- Transit (no vehicle access), which includes both urban services (the vast majority) and also passenger-only, intercity services. Urban ferry services do not carry automobiles, and they complement a travel market with many choices. Urban ferry services are more like transit operations than traditional maritime operations. Ferries that operate outside the metropolitan area or between metropolitan areas and do not carry vehicles are also ferries—transit/intercity.
- Highway-oriented essential ferries, which allow vehicle access as well as walk-on passengers, and primarily substitute for a bridge or other fixed crossing in a rural, island, or low-density corridor where travel distances are lengthy or typically interurban or intercity. These ferry services are usually the only choice in the market.

In addition to being categorized by the market segments they serve, ferry services can be categorized by whether they are publicly sponsored or private-sector initiatives. Publicly sponsored ferries are designed to meet a public purpose, while private-sector services focus on financial risk and reward.

Public sponsorship usually results from a desire or expectation that ferry services will result in a publicly desired end. For example, better access to a location can increase property values, result in faster travel times, and create economic activity. These are benefits that can accrue when using ferry services as a means to achieving a public objective. If the public sector is already engaged in providing metropolitan or urban access and mobility, ferry services can be considered as another tool to increase the economic competitiveness of the region.

Private sponsorship is always based on return on investment (or profit). Ferries are capital-intensive enterprises, and investors need to understand the potential risks and rewards with investment in ferry services and a particular ferry route. Since investment capital can be placed almost anywhere, opportunity cost is an important concept for the ferry entrepreneur. In this research, it was found that private sponsors defined "return on investment" broadly. Examples

include corporate entities where ferry services share common fixed expenses with other corporate businesses (such as marine yards or other maritime operations), as well as real estate examples, where ferry services provided access to give value to the land development.

In all cases, the basic operating principles (and the criteria that accompany them) are the same whether the boat is carrying cars across an isolated river or carrying people into a crowded city center.

Figure 7-1 illustrates the sequence in which various criteria should be considered when making a decision about the establishment of new ferry services. A common requirement for all ferry operators, whether public or private, is to consider permitting criteria. Following the consideration of permitting criteria, decisions must be made on the basis of criteria that vary with the type of sponsor (public or private), but include some crossover on publicly regulated services. As the decisionmaking process proceeds, the market (transit—urban/intercity or highway-oriented/essential) determines the appropriate criteria, and, in the final step of the decisionmaking process, operational criteria are considered, and these are the same for all kinds of ferries.

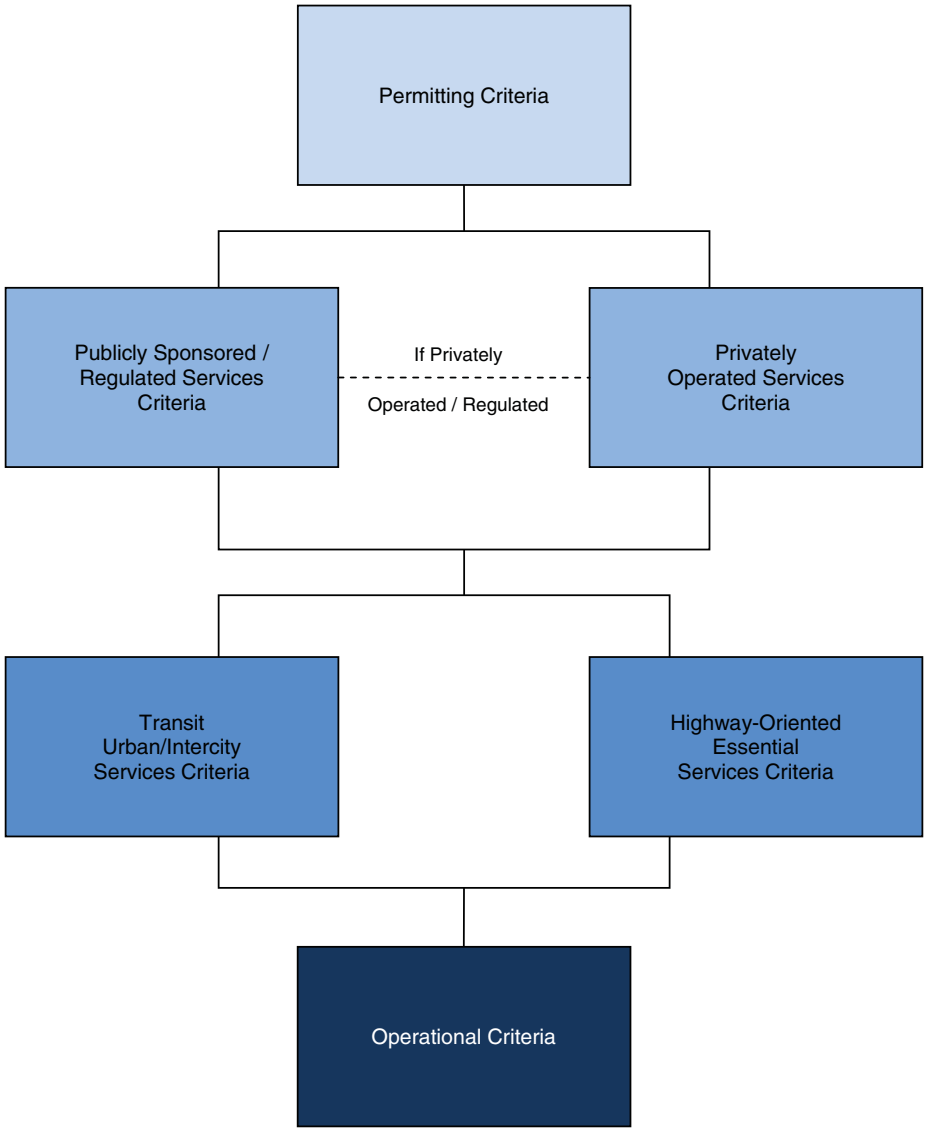

Figure 7-1. Criteria flow chart.

Permitting Criteria

The establishment of any transportation service, including ferry service, will eventually require that a governmental authority issue a permit either for operations (in a regulatory system), or for a land use action (finding that the transportation use is consistent with land use regulations and allowing construction of terminals), or for the use of public lands (such as tidelands, shore and port facilities, or sovereign lands of the state). To issue the permits required for ferry service, the responsible government agency will need to consider the impacts and the benefits of the proposed service. The case studies presented herein suggest that an agency should consider the following criteria when reviewing a terminal proposal:

- Economic criteria
  - The proposed terminal and the range of ferry services proposed are consistent with the community's vision for the area, as articulated in adopted land use plans.
  - The terminal and the service are consistent with a local, regional, or statewide transportation plan and will assist in delivering the goals of that plan.
  - The terminal and the service are not consistent with the current land use plans or conflict with existing transportation policy, but will deliver a major economic benefit to the area that will create an overriding consideration of support.
- Impact criteria
  - The terminal and service have greater net environmental benefits (i.e., fewer people driving, lower emissions, fewer greenhouse gases, and/or better development patterns) than the no-build alternative.
  - The terminal is convenient to connecting transportation services (transit, rail, and highway), ensuring seamless connections and reducing impacts on local roads and local transit services.
  - The terminal's location actively increases the ferry service's positive impacts (e.g., sustained ridership, easy access via transit or vehicles, non-environmentally sensitive area, and/or prime potential to include in joint development opportunities).

Publicly Sponsored/Regulated Services Criteria

A few jurisdictions regulate ferry services economically (the U.S. Virgin Islands and BC Ferries are two examples). However, in those areas that do regulate ferry services, the criteria are often the same as those governing expenditure of public funds. These criteria generally involve avoiding unnecessary and wasteful competition, maximizing use of the existing transportation infrastructure, and providing efficient and affordable services to the public. The following criteria should be considered in decisions concerning the establishment of publicly sponsored/regulated ferry service:

- Economic criteria
  - The proposed service will create additional and necessary capacity and access and will promote economic development and assist in delivering adopted land use plans.
  - The proposed service will not result in diversion of users from parallel facilities or services that already exist and have adequate capacity.
  - The proposed service will provide additional emergency and disaster response capability.
- Financial criteria (publicly sponsored services)
  - The combined capital and operating cost (life cycle) of ferry services does not exceed the cost of fixed facilities (i.e., bridges and rail links) and their public transit systems.
  - The proposed service can demonstrate sustained projected ridership levels that will not be impeded by other forms of transportation or transit services.
- Equity criteria
  - Essential, lifeline ferry services are provided in remote and isolated communities to ensure access, provide economic stability, and sustain ridership.

Privately Operated Services Criteria

A private enterprise has one overriding consideration: to make a profit. There are several financial criteria that correspond to this requirement:

- The ferry service makes a reasonable profit and return on investment that is competitive with other potential uses of investment funds.
- The ferry service has a reasonable balance between the risks assumed in investing in and operating the service and the net revenues received from the service.
- The ferry service sets fares that guarantee a reasonable rate of return based upon seasonal ridership demands.

Transit Urban/Intercity Services Criteria

Urban/intercity ferry services, as illustrated in the case studies presented herein, are almost always subsidized, although the range of subsidies varies. In New York, for example, ferry facilities are paid for with public monies, but operating costs are not. In other areas, such as Seattle, operating costs are subsidized. The involvement of public funds in urban/intercity ferry services means that these services typically have to meet criteria regarding efficiency, effectiveness, and the environment such as the following:

- Efficiency criteria
  - Ferry services reduce the need for additional fixed facilities.
- Effectiveness criteria
  - The ferry services will be well used to the extent they represent significant additional capacity. A reasonable threshold would be 50 percent of the capacity of a freeway traffic lane (about 1,000 people per hour).
  - Ferry service is targeted to areas that have few or poor transit options.
  - Ferry service provides a time savings relative to other alternatives (it is faster due to congestion or faster due to a more direct travel route).
  - Ferry service will enable land uses that can create enough demand to use the vessel capacity efficiently.
  - Ferry vessel size and capacity is balanced with demand to achieve a high ratio of seat occupancy to seat capacity, avoiding fuel and labor waste.
  - Wherever possible, ferry terminals are simple structures that provide necessary amenities for riders.
- Environmental criteria
  - The ferry system represents the best practices in vessel design and engine emissions and the per-passenger emissions are equal to or less than comparable transit systems.
  - The ferry system, on a life-cycle basis, including the capital elements, results in lower carbon emissions per passenger for a comparable trip on other modes.

Highway-Oriented Essential Services Criteria

Essential ferry services typically involve creating links in the highway network that permit vehicles to continue travel in the most direct manner to a community separated from others by a large body of water. Sponsors of highway-oriented ferry services should consider measuring existing and potential services against efficiency and effectiveness criteria such as the following:

- Efficiency criteria
  - The ferry service will be sized correctly to the market; vessels will be large enough to meet the anticipated demand, but the average vehicle deck occupancy will not be less than 50 percent (aggregated).
  - Ferry services are less expensive to operate and capitalize on a per-vehicle basis than the construction of a bridge or other fixed link.
  - Services are adjusted to reflect seasonal ridership peaks and troughs in demand.

- Effectiveness criteria
  - The ferry services will use best practices to manage peak demand and increase off-peak use to ensure productive use of system investment.

Operational Criteria

The ferry case studies presented herein suggest several operational criteria for all types of ferry services:

- Safety and security criteria
  - The ferry operator meets all regulatory requirements for safety, operations, and maintenance.
  - The ferry operator creates a "culture of safety" in the workplace.
  - The ferry operator adequately and comprehensively trains staff and licensed operators.
  - The ferry operator complies with all security provisions outlined by the Department of Homeland Security.
  - The ferry operator complies and participates in emergency disaster relief plans and drills wherever appropriate.
- Reliability criteria
  - The ferry operator employs best practices to ensure reliable operations (e.g., preventative maintenance and adequate staffing).
  - The ferry operator employs practices to reduce delay caused by passengers or other external factors (e.g., adequate cut-off times, adequate scheduling of connecting transit services, timely delivery of provisions, and so forth).
  - The ferry operator develops contingency plans that consider the impacts of weather, impacts resulting from unavailable vessels, or impacts from high peaked passenger loads.
- Efficiency criteria
  - The ferry operator uses best practices in crew scheduling to ensure productive and efficient work schedules.
  - The ferry operator uses competitive processes to procure fuel, equipment, and other provisions.
  - The ferry operator sets performance metrics to measure efficiency (e.g., operating cost per seat, change in operating cost, and so forth).
- Effectiveness criteria
  - The ferry operator considers the most efficient use of vessels including operating vessels across different routes to achieve efficiencies.
  - Ferry terminals are selected to minimize the water passage but still ensure the most direct travel route for passengers.
  - The ferry operator (passenger ferry) uses terminal designs and operating practices that allow vessels to arrive, alight passengers, board new passengers, and depart within 5 minutes.
  - The ferry operator maximizes the number of passengers on each vessel trip by creating seamless transit and other intermodal connections.
  - The ferry operator (vehicle ferry) operates a reservation system to reduce peak congestion and use available capacity in the off-peak period.
  - The ferry operator uses pre-paid fares to reduce queuing and delays at terminals.
  - The ferry operator sets performance metrics to measure effectiveness (e.g., occupancy per seat, change in occupancy per seat, and so forth).
  - The ferry operator sets fares that are both competitive with other transit modes and ensure a reasonable farebox recovery rate (or profit) for the operator.
- Environmental criteria
  - The ferry service operates with emissions no greater than generated on a competing mode, based on a comparable trip (i.e., a highway trip might be longer and result in additional vehicle miles traveled).
  - The ferry operator uses the best available engine technology to reduce emissions.

– The ferry operator implements environmental best practice operations (e.g., reduced idling, reduced energy use, and so forth).
– The ferry operator selects and operates vessels to ensure minimum impact on coastal and shore areas.

Using Criteria to Assess the Potential for Ferry Service

Table 7-2 presents a ferry service evaluation criteria matrix. The matrix displays criteria for assessing ferry service potential and can be used as a tool in the decisionmaking process. It is not necessary that an envisioned ferry service achieve a "satisfactory" score on every criterion listed in the evaluation criteria matrix. Most transportation options have impacts or deficiencies for at least one, and often several, criteria. Rather, the evaluation criteria matrix can be used to summarize the results of discussions on whether the proposed ferry service meets overall service and public policy goals (or private goals) and, if so, how it does so, and who the service may impact (positively or negatively).

The actual scoring of the criteria can be either quantitative (needs a number) or qualitative (needs a "yes" or "no"). The green boxes (see Table 7-2) indicate whether the criterion is quantitative or qualitative. The red boxes indicate what those sponsors would not consider (the public sponsor doesn't care about a reasonable return, it has other reasons for doing the service). The private sponsor doesn't really care whether the life-cycle costs are comparable to a highway, because it doesn't operate a highway. Quantitative criteria include a range or threshold. Quantitative criteria can be compared to industry averages or to local conditions; sometimes the answer is either simply Satisfactory or Unsatisfactory (as when measuring emissions compared to competing modes—either better or worse, or the same). In other cases, listed criteria will not be applicable, and users of the matrix should substitute more meaningful criteria; for example, "Use reservation system to manage demand" is not necessary when the ferry system has excess capacity. Instead, other measures of efficiency would be identified by decisionmakers to measure actual system use. Evaluation criteria are relative because they depend on other factors or conditions that are often site or area specific. Nonetheless, in all cases, criteria and measures should be developed in the early stages of any assessment of ferry service.

The Go/No-Go Decision

After the evaluation criteria are developed, the next step is to measure the costs, impacts, and benefits of the proposed service. Several of the criteria involve economic or environmental assessments, and these assessments are typically quantitative.

One of the most critical analyses for ferries is fuel consumption. Fuel consumption lies at the intersection of both economics and environmental criteria and is often the most significant element in Go/No-Go considerations. Fuel use (and cost) of ferries on a per-passenger basis can be a good metric for measuring the cost-effectiveness of the proposed service; fuel consumption can also be a proxy for environmental impacts, including greenhouse gas and other emissions.

Table 7-3 illustrates fuel use for various ferries and modes, such as urban buses and automobiles, using information from the case studies prepared in this research. In Table 7-3, it can be seen that high-speed ferries (ferries traveling at speeds greater than 25 kn) compare favorably to automobiles on fuel use per passenger carried, but less favorably to buses—all other factors being equal.

However, all other factors are usually not equal. When potential ferry service is being evaluated, there are several variables that need to be considered to develop a robust analysis. Highways and bridges that parallel the ferry service could be congested, available waterside land

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Table 7-2. Ferry service evaluation criteria matrix.

Ferry Service Evaluation Criteria Matrix					
	Criteria	Public Systems	Private Systems	Measures: Quantitative	Measures: Qualitative
All Systems	***Economic & Financial***				
	Land Use Coordination				✓
	Transportation Plan Consistency				✓
	Overriding Considerations				✓
	Delivers Desired Capacity			✓	
	No Diversion from Other Carriers			✓	
	Provides Emergency Capacity			✓	
	No Diversion from Other Facilities with Capacity			✓	
	Life-cycle Costs Comparable to Other Modes		×	✓	
	Ridership Estimate Certainty		×		✓
	Makes Reasonable Profit	×		✓	
	Risk/Reward in Balance	×			✓
	Generates Reasonable Rate of Return	×		✓	
	Equity				
	Provide an Essential Lifeline				✓
Urban Services	***Efficiency & Effectiveness***				
	Reduce the Need for Additional Fixed Facilities				✓
	Use = 50% of Freeway Lane			✓	
	Targeted to Areas with Poor Transit Options				✓
	Time Savings Compared to Other Transit Options			✓	
	Enables Transit Supportive Land Uses				✓
	Terminals: Simple and Effective				✓
	Environmental				✓
	Per Passenger Emissions Less than Other Options			✓	
	Per Passenger Carbon Emissions Less than Other Options			✓	
Essential Services	***Efficiency & Effectiveness***				
	Average Vehicle Deck Occupancy 50% +			✓	
	Ferry Less Expensive Per Vehicle than Highway/Bridge			✓	
	Services Adjusted to Meet Demand				✓
	Demand Management Used to Reduce Peak Impacts				✓
Operational Criteria	***Safety & Security***				
	Adhere to Safety Regulations			✓	
	Create Culture of Safety				✓
	Adequately and Comprehensively Train Staff				✓
	Adhere to DHS Security Requirements			✓	
	Participate in Emergency Plans/Drills			✓	
	Reliability				✓
	Best Practices Used in Preventive Maintenance, etc.				✓
	Best Practices Used in Operations: Scheduling, Boarding, etc.				✓
	Efficiency & Effectiveness				✓
	Schedule Crew Efficiently			✓	
	Competitively Procure Fuel and Supplies				✓
	Use Performance Metrics to Measure Efficiency			✓	
	Optimize Routing			✓	
	Optimize Terminal Siting				✓
	Minimize Boarding and Terminal Dwell Time			✓	
	Create Seamless Intermodal Transfers				✓
	Use Reservation System to Manage Demand			✓	
	Use Pre-Paid Fares to Minimize Terminal Delay			✓	
	Use Performance Metrics to Measure Effectiveness			✓	
	Set Competitive Fares that Provide Adequate Revenues			✓	
	Environmental				✓
	Ferry Emissions No Greater than Competing Modes			✓	
	Use Best Available Engine Technology				✓
	Use Environmental Best Practices				✓
	Select Minimum Wake/Wash Vessels				✓

Example of Ferry Service Criteria Matrix Use

To see how a ferry service criteria matrix might be used by decision-makers trying to assess the potential for service in their area, consider the following example scenario.

Metro City is located in Metro Region, which is a region that has grown along a lakefront. Metro City, the region's central business district, is on the mainland; Acme Point occupies a peninsula that extends into the lake. Acme Point is connected to Metro City via the Metro Bridge, a congested and unreliable link. Currently, buses and automobiles use the bridge. The highway/bridge route is 22 miles long, as it requires a long diversion because of the region's geography.

Acme Point Council members want to redevelop a centrally located parcel—a 40-acre former lumber mill—into a new, dense, mixed-use and residential development. The development site is located within 500 meters of the water and within 300 meters of the Acme Point town center. In discussions with the town's development advisors, it has been strongly recommended that providing a reliable and fast transportation link to Metro City would assist in marketing the development site. As a result, Acme Point officials assessed several transportation improvement concepts, including a larger bridge, increased bus service, exclusive bus lanes, and direct ferry service. The direct ferry service to Metro City would operate as a publicly sponsored system. Council members were presented with the criteria matrix shown for the proposed improvements.

Ferry Service Evaluation Criteria Matrix - Acme Point to Metro City

	Criteria	Public Systems	Private Systems	Measures: Quantitative	Measures: Qualitative	Notes
All Systems	***Economic & Financial***		NOT APPLICABLE--PUBLICLY SPONSORED SYSTEM			
	Land Use Coordination	↑			✓	Yes, fast-ferry service assists development
	Transportation Plan Consistency	↓			✓	No, ferry not in current regional plans
	Overriding Considerations	-			✓	N/A -- No inconsistency
	Delivers Desired Capacity	↑		✓		Yes, ferry service increases capacity.
	No Diversion from Other Carriers	↑		✓		Determined to service different market than existing service
	Provides Emergency Capacity	↑		✓		Yes, available if bridge is not usable
	No Diversion from Other Facilities with Capacity	↑		✓		Bridge already at capacity so diversion is a moot concern
	Life-cycle Costs Comparable to Other Modes	❂		✓		Unknown, further study required
	Ridership Estimate Certainty	❂			✓	Preliminary estimates appear to justify project, further study needed
	Makes Reasonable Profit	×		✓		N/A
	Risk/Reward in Balance	×			✓	N/A
	Generates Reasonable Rate of Return	×		✓		N/A
	Equity					
	Provide an Essential Lifeline	❂				Bridge already available
Urban Services	***Efficiency & Effectiveness***					
	Reduce the Need for Additional Fixed Facilities	↑			✓	Yes, preliminary results indicate some needed diversion
	Use = 50% of Freeway Lane	↑		✓		Yes, preliminary results indicate about 1,200 passengers/pk hour
	Targeted to Areas with Poor Transit Options	↑			✓	Yes, existing transit from town center is slow and unreliable
	Time Savings Compared to Other Transit Options	↑		✓		Yes, appears to save about 5 - 10 minutes
	Enables Transit Supportive Land Uses	↑			✓	Yes, Acme Point will develop as TOD
	Terminals: Simple and Effective	❂			✓	Unknown design at this point
	Environmental					
	Per Passenger Emissions Less than Other Options	↑		✓		Yes, results in less automobile trips overall
	Per Passenger Carbon Emissions Less than Other Options	❂		✓		Ferry slightly worse in carbon emissions than automobile trips
Ratings	Satisfactory	↑				
	Marginal	❂				
	Unsatisfactory	↓				
	Not Applicable	-				

Definition of Evaluation Criteria Policy Measures and Examples of Where They Are Used.

See the table below for definitions of some criteria and examples of where they have been used.

Criteria	Definition	Examples
Economic & Financial		
Land Use Coordination	The project is consistent with the area's land use plan.	California Requirement
Transportation Plan Consistency	The project is consistent with the region's transportation plan.	Federal Requirement
Overriding Considerations	If the project is not consistent with other plans, it provides an economic benefit to the area that suggests an exception.	Various
Delivers Desired Capacity	The project adds regional capacity.	BC Ferries
No Diversion from Other Carriers	The project does not result in other carriers losing passengers.	San Francisco
Provides Emergency Capacity	The project provides an emergency response capability.	New York
No Diversion from Other Facilities with Capacity	The project does not result in other transportation facilities losing traffic, if those facilities have available capacity.	North Carolina
Life Cycle Costs Comparable to Other Modes	The project's total capital and lifetime operating and maintenance costs are comparable to other modes.	Federal Requirement
Ridership Estimate Certainty	Ridership estimates have been performed for the proposed services and are used to develop overall plans.	San Francisco
Makes Reasonable Profit	For the private sector, the service can make a reasonable profit.	Various
Risk/Reward in Balance	The risk of investment is less than the possible reward.	Various
Generates Reasonable Rate of Return	The project will provide the project sponsor with a reasonable rate of return.	BC Ferries
Equity Criteria		
Provides an Essential Lifeline	The project provides a lifeline access to rural communities.	North Carolina
Efficiency & Effectiveness		
Reduces the Need for Additional Fixed Facilities	The ferry can represent new capacity in stressed corridors.	New York
Use = 50% of Freeway Lane	In the peak hour, the ferry service(s) carry volumes at least equal to half the capacity of a highway lane.	San Francisco
Targeted to Areas with Poor Transit Options	The project serves terminals and other areas that have few other transportation options.	New York
Time Savings Compared to Other Transit Options	The ferry service will be faster for the traveler than other options.	Seattle
Enables Transit Supportive Land Uses	The ferry service supports higher density development adjacent to terminal.	New York
Simple and Effective Terminals	Terminals are simple and well designed.	North Carolina

Table 7-3. Ferry fuel consumption (typical) vs. other modes.

Vessel Type	Speed	Passenger Capacity	Speed (mph)	Hourly Fuel Consumption	Miles per Gallon	Passenger Miles per Gallon
Monohull - Passenger and Auto	< 25kn	1000	14.4	152	0.09	95
Monohull - Passenger Only	< 25kn	300	18	25	0.72	216
	< 25kn	400	14	30	0.47	187
Catamaran - Passenger Only	> 25kn	400	28	197	0.14	57
	> 25kn	300	39	140	0.28	84
	> 25kn	300	34	125	0.27	82
	> 25kn	199	30	100	0.30	60
Hovercraft - Passenger Only	> 35kn	180	45	90	0.50	90
Hydrofoil - Passenger Only	> 35kn	75	40	40	1.00	75
Urban Bus	~45mph	50	40	10	4.00	200
Auto - Standard	~45mph	2	40	1.5	26.67	53

parcels may have poor access (even in uncongested systems), and competing modes could have much longer travel distances.

The analysis of potential ferry service needs to compare the relative trip lengths of the various modes, the congestion in the highway corridor when comparing the ferry service to bus service, and the overall cost of the operation. Table 7-4 shows the output of an electronic worksheet that uses embedded formulas to analyze the costs and benefits of using various modes to make a hypothetical trip.

The preferred analysis compares the following:

- Passenger experience
  - Competitive travel time
- Cost
  - Capital (gross and unit)
  - Operating (gross and unit)

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Table 7-4. Costs and benefits of various surface transportation modes vs. ferry for a hypothetical trip.

	Inputs					
Mode	Route Distance	Average Speed	One-Way Time (min)	Projected Ridership (peak hour)	Vehicle Capacity	Frequency (min/sec)
Auto (w/Bus)	22	45	29.3	3000	1.5	~1 sec
Auto (w/Ferry)	22	45	29.3	2000	1.5	~2 sec
Bus (No Ferry)	22	35	37.7	2000	50	1.5 min
Ferry (No Bus)	12	30	24.0	3000	350	7.0 min

Mode	Capital Costs								Operating Costs				
	Equipment Required	Equipment Cost (Unit, $M)	Useful Life (yr)	Equipment Cost (Total $M)	Terminal Costs ($M)	Total Capital Costs/30 yr	Capital Cost Per Peak-Hour Seat		Hourly Operating Cost	Peak-Period Span	Weekday Peak Period Vehicle/ Vessel Hours	Total Weekday Annualized Operating Costs (Peak Periods Only/$M)	Annualized Operating Costs Per Seat (Peak Periods Only)
Auto (w/Bus)	2,000												
Auto (w/Ferry)	1,333												
Bus (No Ferry)	50	$0.5	12	$62.9	$0	$62.9	$31,429		$100	6	302	$7,844,57	$2.51
Ferry (No Bus)	7	$11	30	$75.4	$10	$85.4	$28,476		$1,250	6	41	$13,371,42	$2.86

- Outputs
  - Capacity
  - Cost per seat trip
  - Cost per passenger trip

This basic information allows the operator or financial sponsor to consider the margin—the difference between the cost and the revenue potential of various transportation alternatives. For the hypothetical route analyzed in Table 7-4, a ferry provides a better passenger experience than a bus, primarily because it saves about one-third of the travel time compared to a bus and is faster than the automobile journey. In this example, while the ferry costs more to operate, depending on the tariff charged, it may result in either less deficit (as a public operation) or more fare revenue, since a higher price can be charged for a better service.

The worksheet shown in Table 7-4 does not factor in reliability (which is dependent on local conditions, but a ferry may be a more reliable service than a bus operating in mixed-flow traffic), amenities (which tend to be better on ferries), or (from a public policy perspective) the potentially greater development potential with a ferry operation than a bus-based system. These factors should all be considered but are usually measured qualitatively rather than quantitatively.

Land use coordination is also an important qualitative analysis. Ferry terminals are similar to rail terminals, and, with high-frequency and reliable service, they can provide both an important amenity to an adjacent area and also necessary transportation capacity to provide access to a development site.

Ferries versus New Fixed Crossing

NCHRP Report 399: Multimodal Corridor and Capacity Analysis Manual provides additional guidance on evaluating transit modes versus additional highway capacity. The authors of

NCHRP 399 note that the manual "distinguishes between two fundamentally different approaches to capacity determination: (1) physical capacity and (2) economic capacity" (Cambridge Systematics, Inc., 1998, p. 10).

When planners consider alternatives among transit modes (i.e., between buses and ferries, for example) in a constrained corridor, usually more emphasis is placed on physical capacity. As volumes increase, higher capacity modes become more competitive, especially as bus volumes begin to exceed the capacity of bus stops (i.e., terminal capacity becomes the constraint to additional buses). Capacity discussions usually lead into financial discussions (total life-cycle cost) in these studies (i.e., economic capacity).

When planners compare two transportation modes (i.e., a new bridge and additional ferries), more emphasis is usually placed on economics. Not only is the ability of the users to fund a crossing important, but the mode's reliability and the speed of travel it provides contribute to an area's general economic conditions and can become a catalyst for economic development.

Chapter 4 of *NCHRP Report 399* identifies the Process Steps used to consider alternatives in a transportation corridor. Chapter 5 outlines the capacity analysis process and Chapter 9 deals with economic capacity. The appendix highlights the Strategic Implementation Plan for Sonoma and Marin Counties in California, which used an upgraded ferry system rather than highway improvements. Limited capacity of downstream roadways was identified as one of the reasons to maintain the present bridge capacity and encourage ferries as an alternative (Cambridge Systematics, Inc., 1998).

NCHRP Report 399 was written before the issue of climate change and the effects of greenhouse gas emissions on climate change fully entered public discussion (Cambridge Systematics, Inc., 1998). The discussion continues to evolve, but considerations of ferry service relative to greenhouse gas emissions involve two interrelated conditions: (1) ferries use more fuel per mile per person than buses, and (2) ferries require little infrastructure.

While the research herein identifies a method to assess the fuel (and by extension carbon) impacts of ferries relative to buses and other modes and also relative to route lengths (which are likely to be different, with ferry routes usually being shorter), assessing the fuel impacts of different transportation modes can be complex. For instance, consider a case in which the fuel impacts of a potential new fixed crossing are being assessed in relation to the fuel impacts of a potential ferry service that will have the same route length as the new fixed crossing. The ferry will consume more fuel per passenger than an automobile or a bus travelling on the new fixed crossing; however, the ferry will have a much lower cost of embodied carbon in its infrastructure than the new fixed crossing.

Several organizations are currently developing protocols for assessing carbon life-cycle costs that include energy use embodied within the infrastructure. Embodied energy should be a consideration in any discussion of ferries relative to new fixed crossings.

SECTION 8

Issues in Ferry Service Management and Operation

The research and case studies conducted for TCRP Project H-40 identified several major management and operational concerns that are common to all ferry operators. These include recruiting, development, and retention of personnel; vessel technology; terminal design; energy and environmental impacts; land use and traffic and transit coordination issues; regulatory and safety requirements; maintenance requirements; and marketability.

Recruiting, Development, and Retention of Personnel

Ferry systems require operating, maintenance, and administrative personnel. Vessel operation requires crews that include licensed as well as unlicensed personnel.

Operational control of all ferries resides with the Master, a licensed officer. The Master must understand all aspects of vessel operation. Aside from the technical knowledge required to be the Master (i.e., fire prevention, basic first aid, safety, and so forth), the Master is the manager on the vessel and needs to engage in management best practices, including planning work assignments and activities, organizing the work flow, and controlling and assessing the actual work performed. This requires good communication with the operational staff.

Operational activities require ongoing training and development and are challenging even under normal conditions. When the employees are entrusted by top management to safely navigate assets worth tens of millions of dollars large distances, then personnel development is critical.

The case studies conducted for TCRP Project H-40 indicate that most systems prefer to recruit and develop vessel crew members at the entry level and develop their skills onboard; in contrast, systems tend to recruit for mechanical and administrative positions at all levels on the open market. The onboard crew members are often recruited from high schools and community colleges or are hired after working in the local fishing fleet. Most crew members start as deckhands and eventually work their way into either a captain position or into management and administration. Public policy has created rigorous new standards for personnel in safety-related positions. Maritime crews must submit to drug testing as well as security clearances as part of their initial and ongoing job requirements.

Continual training and education is a best practice identified in the case studies conducted for TCRP Project H-40, along with career counseling and encouraging staff to pursue opportunities for promotion. In addition, some ferry operations, due to the seasonal nature of the business, have seasonal employees with the same status as full-time staff, even though they do not work in the winter months.

Fast ferries require additional employee training and supervision. Some fast-ferry operators use aircraft protocol (bridge crew only speak as required, bridge is restricted, and so forth) due

to the intensive nature of the operation. Overtakes, small-craft identification, and marine conditions all require highly skilled crews. As an example, bow-diving is a recently identified concern that occurs when high-speed craft overtake a wave and then dive after cresting the wave. As a response to this concern, additional employee training has been suggested.

Maintenance employees must be highly skilled, as vessel and engine technology continues to evolve into more challenging and complex systems. Some operators have found that mechanics with marine experience are highly valued due to their understanding of the implications of operating machinery in marine environments.

Vessel Technology

Vessel technology is a critical factor in delivering reliable and competitive ferry service. In the selection of a vessel, issues of reliability, cost, and suitability must be balanced.

A key concern is the relationship of a vessel's speed to its power and the influence of hull form on the speed-power relationship. In general, when length and displacement and hull form are constant, the required power increases rapidly with speed at a point called the "hump speed" (Working Group 41 of the Maritime Navigation Commission, 2003). One study provides an example in which a "70 ft. planing hull, driven at 50 knots, will require nearly 44 times the horsepower that the displacement hull requires at 10 knots even though the speed was increased by a factor of 5" (Savitsky 2003, p. 8).

These large increases in the power-to-speed ratio can be mitigated, but not eliminated, by selecting proper hull forms. Hull forms, in general, fall into three preferred categories—monohull, multi-hull, and air-cushioned vessels. The preferred hull form for a vessel operating in a particular service depends on the operating conditions.

Vessel Type

Multi-hulls (especially catamarans), monohulls, and air-cushioned vessels all have their appropriate niche in the universe of ferry applications (Ad Hoc Ferry Transit Environmental Impact Panel, 2000; van Renen van Niekerk, 2000).

Although catamarans have been used for centuries, they have become popular in the last 30 years as catamaran designers (mostly in Australia) have perfected catamaran design. Catamarans offer a more stable platform than the monohull, good maneuverability (resulting from propulsion from two separate hulls), a wide platform that increases passenger comfort and reduces friction with the water (resulting in higher speeds), and less draft and good wake/wash characteristics. Catamarans are used as small, fast boats in San Francisco and New York (for example, New York Waterways) and a catamaran will be used as a new vessel in Puget Sound in metropolitan Seattle. Larger catamarans provide high-speed service in New York and the San Francisco Bay Area (Larkspur and Vallejo routes). Figure 8-1 shows an example of a catamaran.

Monohulls tend to cost less to operate than other vessel types, are less costly to build, and are the most common ferry vessel built. Large passenger and vehicle ferries are often monohulls, such as the Long Island-to-Connecticut car ferries and the Staten Island ferry. See Figures 8-2 and 8-3 for examples of monohull vessels.

Hovercraft are specialty vessels that use an air cushion to ride above the water. They are used by the Canadian Coast Guard for search-and-rescue operations, while they provide passenger operation between Portsmouth and the Isle of Wight in the UK. In areas of low water depth, hovercraft allow for shore access without dredging and can reach very high speeds

Figure 8-1. Passenger-only catamaran.

(above 45 mph). Hovercraft have a lower payload-to-power ratio than either monohulls or catamarans.

There are other hull forms available and some are in commercial use (such as hydrofoils, surface effect ships, and so forth) but these multi-hulls, monohulls and air-cushioned vessels offer the most appropriate range of hull form options for ferry operators.

Off-the-Shelf Designs

The most successful ferry applications over the last 20 years have used proven, "off-the-shelf" ferry designs. These applications include the New York Harbor passenger-only ferries, new ferries in the San Francisco Bay Area, and passenger ferries to the islands of Massachusetts and Rhode Island. Even in cases where ferries are custom-built (which is common for vehicle ferries such as those used by the North Carolina and Washington State systems), components (engines, systems, and so forth) are proven, off-the-shelf, equipment.

Figure 8-2. Monohull vessel.

Figure 8-3. Passenger-only monohull vessel.

Size and Stability

A critical factor in ferry service is using a vessel that meets passenger demand, but is not too large. Vessels that are too large will incur unnecessary financial costs and will waste fuel. Vessels that are too small may result in denials of service to waiting passengers. Smaller vessels may also be uncomfortable for passengers due to inadequate space and/or inadequate ride quality. There are several methods to help operators balance capacity with demand and size vessels to ensure passenger acceptance.

Sizing the vessel to achieve passenger comfort is a technical consideration and requires engineering analysis. For example, the Alaska Marine Highway System's design for new vessels specifies "it will have 99% schedule reliability in Sea State 4" (Value Management Strategies, Inc. 2009).

Managing capacity is a difficult policy issue. Jurisdictions previously considered access an "entitlement," and additional capacity was provided as demand increased (usually corresponding to and encouraging economic development). As funding decreased and costs increased, several jurisdictions now are taking a more "market-based" approach to transportation capacity. For highway-oriented ferry services, reservations are now a standard practice. This allows the ferry operator to spread out demand throughout the day and make better use of facilities and vessels. Some systems use peak-period pricing to further discourage travel during the peak times (and also to recoup the marginal cost of providing additional—and expensive—service during that period). Best practices for managing highway-oriented ferry capacity include the following:

- Establishing Level-of-Service standards (as is currently done in Washington State).
- Providing reservations for most sailings.
- Establishing peak-period fare/tariff surcharges.
- Managing fleet assets to have a mix of vessel types and capacities, maintaining a small reserve fleet to deploy as needed.

For urban ferry services, ferry demand is usually related to the overall corridor demand within the metropolitan system. Since metropolitan systems are usually subsidized, best practices for urban ferries would include the following:

- Developing a service that has a competitive "per-trip per-seat" net cost to other modes. This approach allows ferries to charge a fare premium for a faster and more direct service.

Table 8-1. Size and stability worksheet.

		Desired Characteristics									
				Passenger Capacity		Speed			Cost		
		Safety	Stable Ride	Large	Small	<25k	>25k	>35k	Capital Cost	O&M Cost	Passenger Acceptance
Vessel 1		↑	↑	↑		↑			↑	↑	↓
Vessel 2		↑	❂		↑		↑		❂	❂	❂
Vessel 3		↑	❂	↑				↑	↓	↓	↑

Satisfactory ↑
Marginal ❂
Unsatisfactory ↓

- Size boats to meet peak loads at service frequencies of 15 minutes for trips less than 15 minutes and service frequencies of 30 minutes for trips of more than 15 minutes.

Services that follow these guidelines give passengers an average waiting time of about half the in-vehicle time; the guidelines also correspond to the de facto practice of New York Waterways in New York Harbor.

Table 8-1 illustrates the tradeoffs that ferry operators make among speed, stability, size, and passenger acceptance. Every market is unique, but Table 8-1 presents a generic template for consideration.

Terminal Design

Passengers' travel time is the duration from leaving the origin to arrival at the destination. Studies indicate passengers value terminal and waiting time more than in-vehicle time (Evans et al., 2004, p. 9-8). Because the cost of speed on the water is high and is a continuing cost and because, to the passenger, the cost of terminal time is also high, ferry planning should minimize time spent in or at the terminal (both for vessels and for passengers) rather than try to maximize speed on the water. Minimizing passenger time at the terminal should be an important part of terminal design decisions.

Ferry docks and terminals range from being simple waterside facilities with limited shelter and relatively small passenger flow volumes to being major terminals with multiple ferries receiving and discharging large numbers of passengers and vehicles. Design elements include docks, shelter, queuing areas, and fare collection. All of these elements should be designed to provide safety and reliability and to reduce time as much as possible.

Since waterside locations are particularly exposed to the weather, protection from the climate can be an important factor in providing a good quality of travel. The effect of tides, changing river levels, and waves must be adequately addressed and poses unique challenges for passenger access, especially where extreme height changes are experienced, potentially requiring long or steep ramps to reach the vessel.

Docks and Loading Facilities

Docking configurations largely depend upon the vessel and the design parameters for capacity and overall travel time. Since there are no standard designs for ferry terminals (as there are standard highway designs), great care must be taken to configure terminals to work for the ferry system and the ferry vessels.

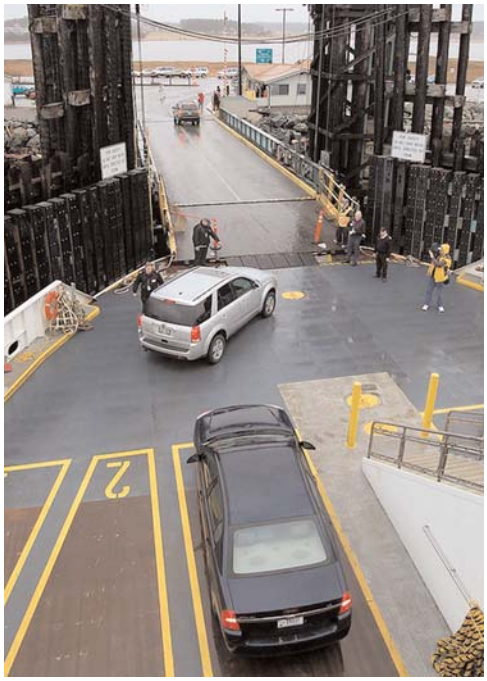

Figure 8-4. Vehicle unloading.

Automobile ferries are typically end loaded and hence have dock facilities that accommodate this process. Departing vehicles are stored at the landside or dockside vehicle staging areas. A critical aspect of an automobile ferry facility is its ability to accommodate vehicle loading and unloading (see a vehicle unloading operation in Figure 8-4). The process of vehicle loading and unloading is time consuming and hence requires adequate access facilities and circulation provisions at the terminal. One of the key facilities in this process is the vehicle staging lot. This area allows for the storage of queuing vehicles and a smooth transition between embarking and disembarking vehicle movements. The staging areas can be located dockside or landside.

Because vehicle ferries operate on a time-based schedule with long headways, passenger vehicles often arrive early to enter the boarding queue. For ferry routes without reservation systems, early arrival to the ferry terminal is important for ensuring a space on the next ferry. To ensure on-time departures, the process of staging vehicles for loading can be as important as the actual loading and unloading of the vehicles. Popular ferry routes generate large numbers of passenger vehicles queuing in the holding lanes for the next ferry. Oversold routes can lead to backups in the holding lanes that extend beyond the toll plaza. Because terminals are often located next to major highways or arterials, the queues can create congestion on surface streets and increase chances for roadway delays or incidents (Value Management Strategies, Inc., 2009).

Passenger loading areas for automobile ferries are generally located on a floating platform or stable approach (e.g., facilities supported by pilings). The passenger loading area also includes the gangway (between the vessel and the loading platform) and walkway facilities (between the shore and the loading platform) that accommodate loading and unloading.

For many years, conventional passenger-only ferry design used side loading. Side loading can use either parallel or linear berthing facilities. The most typical dock design has parallel berths, such as those found at Sydney's Circular Quay. Some dock facilities may have a variety of berthing arrangements to facilitate a range of vessel types. See Figure 8-5 for an example of a side-loading design.

Figure 8-5. Side-loading vessel.

Passenger Loading Examples

Brisbane (Australia) CityCat: Loading occurs from floating platforms (some covered, some not) approximately 110 ft² (10 m²) in area. Passengers first disembark from a single manual gangway that is 3 feet (1 meter) wide. When all arriving passengers have disembarked, departing passengers may then embark. Fares are collected by an onboard cashier (for those paying cash) and an onboard ticket-validating machine (for those holding multiple-ride tickets and passes).

Sydney (Australia) Ferries: Passenger loading at Circular Quay occurs from a large, covered floating platform, which blends seamlessly with the terminal. Passengers pay their fares prior to entering the platform area. The facility design allows passengers to disembark using the upper-deck gangway, while other passengers simultaneously embark on the lower-deck gangway. The disembarking movement is connected to a fenced walkway that leads directly into the terminal.

Golden Gate Ferries (San Francisco): Passenger loading occurs from a covered, fare-paid area. Passenger loading occurs via one (monohull vessel) or two (catamaran) wide gangways. The latter configuration can serve hundreds of peak-direction passengers in minutes.

In recent years, bow-loading designs have gained favor. New York Waterways, New York Water Taxi, and the Staten Island Ferry use bow loading. Bow loading offers the advantage of faster mooring and loading as vessels can maneuver into the dock and "push" against it without tying up. This reduces docking time. Another bow-loading advantage is the wide ramp that allows several streams of passengers into (or out of) the vessel at one time. This speeds boarding and decreases terminal time. See Figure 8-6 for an example of a bow-loading design.

Interface between the Dock and the Vessel

There are a number of safety concerns at the dock platform (Kettleson & Associates, Inc., et al., 2003):

- **Height difference between the stable approach and the water.** The stable approach to a passenger boarding facility is typically high enough above average water level to prevent submergence in all but the most extreme conditions. The height of the stable approach can range from several feet to over 20 feet (1 meter to over 6 meters) and is based on historical data.
- **Water level changes.** All waterfront facilities experience changes in the height of the water relative to the stable approach. Coastal facilities undergo tidal cycles, with normal ranges from little more than 1 foot to over 20 feet. Non-tidal (inland) facilities experience water level changes less frequently, as the result of rain, snowmelt, dam releases, and so forth, which tend to occur in predictable patterns. However, the changes can sometimes be more severe, with ranges

Figure 8-6. Bow loading/unloading.

in excess of 20 feet (6 meters). Extreme weather conditions increase the range of changes in water level at all facilities.

- **Height difference between passenger loading platform and the vessel.** When a loading platform (dock) is in the pathway between the stable approach and the vessel, the freeboard difference between the dock and the vessel is an access barrier. Because freeboards of docks and vessels vary greatly, there will be widely varied and unique height differences for dock-vessel combinations. This height difference may also vary for a particular dock-vessel pair, depending on loading and weather conditions.

Safety features to accommodate these conditions should include the following:

- **Guardrails.** Guardrails are critical to ensuring passenger safety because of the inherent dangers of accidentally leaving the path of travel at a marine facility.
- **Edge treatments and detectable warnings.** Tactile edge treatments and detectable warnings for the sight-impaired are important in ensuring passenger safety.
- **Changes in slopes, heights, materials, and so forth.** The path of travel from land to vessel is likely to have frequent changes, particularly slopes. Changes in the height of the loading platform relative to the shore or the vessel due to tides or fluctuations in lake and river level will need to be accounted for. Attention must be paid to the slope of the ramp for passengers with disabilities.
- **Non-slip surfaces.** Most areas at a marine facility will periodically get wet or damp from water spray. The wide use and application of non-slip surfaces is important for passenger safety.
- **Passenger rescue equipment.** Passenger rescue equipment should be easily accessible in the event that a person falls into the water and requires immediate rescue.

Shelters, Waiting Areas, and Seating

Shelters provide protection from rain, wind, and sun. The design of shelters is influenced both by local climate and the desired level of amenity. For example, in colder, windier climates, shelters may include enclosing walls, whereas in milder climates shelters may have only partial walls to act as a wind break. Ferry terminal design must take into account any special concerns related to proximity to waterfronts. For example, extremely cold temperatures can contribute to icing conditions that can prove dangerous to pedestrians and vehicles.

In ferry terminals, as in other transportation facilities, the provision of waiting areas, restrooms, vending machines, concessions, and other passenger amenities is related to the frequency

of service and the expected length of wait. There has been little research on the appropriate level of seating required, but, in general, passengers appear to desire some seating and that desire increases as wait time increases. In terminals where the average wait is less than 10 minutes, bench-type seating close to the boarding areas may be appropriate, along with leaning bars. Larger, more formal waiting rooms may be appropriate in terminals with service frequencies requiring average wait times longer than 10 minutes. In all cases, seating is particularly useful for the older people. Waiting rooms for longer waits can include telephones and vending machines and may provide a climate-controlled area in which passengers can use those facilities.

When designing seating and determining the desired number of seats, it should be recognized that closely spaced seats may not be used, even though additional people may wish to sit, due to some people's discomfort with sitting close to people they don't know. Another issue is partial occupancy of a seat by a person sitting in the next seat.

Fare Collection, Barriers, Gates, and Turnstiles

Fare collection influences all aspects of terminal operation. How fares are collected determines the speed of terminal operations, the speed of passenger boarding, and the design of the terminal facilities.

There are three types of fare collection/terminal design (Multisystems, Inc., et al., 2003):

- **Pay as you enter.** This is the traditional fare collection system used in most North American transit systems. In this system, passengers give a ticket to an employee while boarding the vessel. The advantages of this system include simple operations and simple terminal design; for example, payment can be in cash, eliminating the need for a ticket office or ticket vending machines. Additional advantages include the default inspection of passengers as they board (since they are surrendering their ticket). The disadvantages include delays to sailings as passenger fares are collected while the vessel is at dock (when it could have been already in motion).
- **Barrier system.** This is a common system for subways and many ferry operations. Fares are collected at a designated point inside the terminal and away from the vessel. Fare control barriers, gates, and turnstiles are typically used to control access into the "paid area" and ensure revenue control. The advantages of this system include very fast passenger boarding on the vessel (since the fare control queuing occurs outside the boarding apron), good revenue control through a barrier system, and control of passenger capacity (since the gates can count passengers per sailing and lock when the limit is reached). Downsides include high capital cost for equipment and a reduction in passenger flow at the terminals.
- **Proof of payment.** In this system, either the terminal or the vessel becomes a "paid area" and the passenger is required to possess a valid ticket or pass on the vessel and is subject to random inspection by roving ticket inspectors (or the vessel crew at random times). If the passenger does not have a valid fare, the inspector issues a citation (depending on the state law, it can be either a civil violation or a criminal infraction). The advantages of this approach are that it combines the vessel boarding efficiency of the barrier system with the low-cost approach of the pay-as-you-enter systems. The disadvantages are less control over the number of passengers entering the vessels, and the costs of inspection (especially within the terminal, where the maritime crew cannot do the inspections). Fines for fare evasions usually do not compensate for the cost of inspection where a dedicated inspection force is needed. Research indicates that in high-volume transportation systems that experience crowding, a barrier system is usually more efficient because the cost per "inspected" passenger

is less (the capital costs of fare gates are spread over a higher volume, resulting in lower overall costs).

In the barrier and proof-of-payment systems, ticket dispensing is required, and, even in pay-as-you-enter systems, it is preferred. At a terminal, waiting passengers can pay their fares at ticket machines or pay booths or to ticket collectors. At an automobile ferry, passengers can pay their tariffs at a toll booth or in the staging area. At larger terminals, several ticket machines are typically provided to handle peak passenger demand for tickets.

In all terminals, turnstiles are preferred (as in Vancouver) to ensure that accurate passenger counts are performed for the crew's reporting requirements. Staffed ticket booths are used at more heavily traveled terminals or at major intermodal connections. Passengers can purchase tickets in several ways, including at ticket vending machines and staffed ticket booths, onboard the vessel, or online in the form of multiple tickets or annual passes. Transit and ferry systems are increasingly using either electronic fare media or web-based ticketing (usually combined with reservations). Fare purchase methods are set by the individual operator according to what best fits the operation. Operators that are integrated with a transit agency or part of a regional coordination effort may offer universal fare cards such as Seattle's ORCA card or the San Francisco Bay Area Clipper card (Multisystems, Inc., et al., 2002).

Figures 8-7 and 8-8 show two kinds of fare collection systems.

Access Requirements for Persons with Disabilities

U.S. Ferries have generally not been subject to overall guidance on access for persons with disabilities, although some jurisdictions have instituted local design practices and formal federal guidance is expected soon. As with any commercial activity, reasonable accommodations must be made for persons with disabilities. In some locations, gangways are designed for maximum slope with flat, rest areas at designated intervals. In tidal areas, there can be conflicts between designs that accommodate persons with disabilities and regulatory policies that limit overwater coverage. Coverage (and cost) can be reduced through more flexible design criteria, such as "gangway slopes will not exceed [stated objective] 97 percent of the time." This prevents minus tides and other infrequent events from dictating overdesign. On vessels, width requirements for various areas should take into account access for persons with disabilities, and concession area design should also provide access for persons with disabilities.

Figure 8-7. Ticket gate.

Figure 8-8. Smart card unit.

Vancouver SeaBus

Vancouver's SeaBus service is a uniquely designed maritime link between suburban North Vancouver and the Vancouver central business district. SeaBus passenger ferry service is operated by two double-ended catamaran ferries, seating up to 400 passengers at a time. The trip from downtown Vancouver to the North Shore is just 12 minutes across Vancouver's Burrard Inlet. There are two terminals: Waterfront in downtown Vancouver and Lonsdale Quay in North Vancouver.

The system is unique for its seamless, intermodal terminal design that quickly moves passengers through the facility. Floats are located on both sides of the vessel, forming a ferry "slip." Passengers are unloaded from one side and loaded on the opposite side. Entering passengers fares are not collected; the system uses a proof-of-payment system. The passengers do, however, enter through turnstiles whose function is to count passengers. When the maximum number is reached, the turnstiles lock and stop any additional passengers from boarding. Transit police perform random fare inspections, and violators are subject to a $173 fine.

This system allows the 400-passenger vessels to be loaded and unloaded within 90 seconds. Service is provided every 15 minutes on weekdays and Saturdays and every 30 minutes at night and on Sundays.

In downtown Vancouver, the SeaBus service connects with the SkyTrain rapid transit system and also the regional commuter rail service. In North Vancouver, the ferry terminal provides transfers to 10 bus routes located on 10 bus berths adjacent to ferry terminal. SeaBus employs about 75 people, including marine attendants, deck officers, engineers, coordinators, and office staff.

Energy and Environmental Impacts

Boats use more energy to travel than land vehicles, especially at speeds above 25 knots. However, ferry systems can offer environmental tradeoffs that offset their operational energy consumption.

Fuel Use

As fuel prices have increased and carbon emissions have become an important public policy concern, the fuel use of ferries has become increasingly important. As an example, a fast ferry (which travels at speeds above 25 knots) can use about 200 gallons of fuel per hour. This level of fuel use represents almost half the hourly operational cost of the ferry service. Several ferry operators have retrofitted their engines to more efficient models. This retrofitting either increases power or decreases fuel consumption. It is important for ferry operators to choose the right size ferry to make the most efficient use of fuel since fuel represents such a large part of ferry operating costs. When comparing potential transportation investments, the embedded energy cost of, for example, a new bridge or a rail system, should be considered against the ferry's operational fuel consumption.

Environmental Impacts

Impacts on the environment are closely related to emissions and to impacts on shorelines and marine life. As the case studies conducted for this research indicate, it is appropriate and beneficial for proposers of ferry service to assess these impacts comprehensively and transparently. The impacts on marine life can be identified in an environmental study and mitigations proposed, and improvements in hull design and operational protocols can mitigate wake/wash impacts.

Reducing fuel use can reduce costs, and reducing fuel use through improved engines, better hull designs, and thoughtful routings also benefits the environment. In the analysis of ferry operation, tradeoffs are constantly being made among speed, power, fuel consumption, and emissions. Tradeoffs can also be made within emissions; for example, reducing NO_x can require heavy catalytic converters that add weight, which results in more fuel consumption, which results in more carbon dioxide emissions. Noise can be an important consideration in urban areas, again requiring more thoughtful design. A thorough analysis can provide decisionmakers with empirical information to use in making tradeoffs.

When compared to other alternatives in a corridor analysis, ferries may provide a net benefit in emissions. In many metropolitan areas, bridges and tunnels are at capacity in the peak travel period, but not outside the peak period. Building a new fixed crossing involves huge impacts and cost simply to solve a 4- or 5-hour congestion problem. In such a case, a ferry could be a better option as it could result in fewer impacts (just the embedded energy cost of a new crossing can easily exceed the operation energy cost of a ferry operation for many generations).

Land Use and Traffic and Transit Coordination Issues

Like all other transportation services and facilities, ferries play an important role in providing access to land use and increasing the value of land. Societies balance economic development against environmental protection; transportation facilities and activities support both goals.

Ferries can be a preferred transportation service that operates from an area that has travel patterns that are direct for ferries but indirect for landside travel. Ferries can also be located in an urban redevelopment zone where the local jurisdiction is developing dense, walkable commu-

nities, and where services from other areas can "feed" the ferry system. Research suggests that in these transit-oriented areas, vehicle miles travelled could decline by 5 to 25 percent (Transportation Research Board of the National Academies, 2009).

This land use pattern fits in many urban areas—examples include decommissioned military bases, old waterfront industrial areas, and vacated waterfront freight transportation facilities (such as antiquated docks and rail yards). The New Jersey–Hudson waterfront fits this description in many ways, and ferry operation has benefitted economic development in these areas. Figure 8-9 shows the San Francisco Ferry Building, an example of transit-oriented development.

Ferries located in urban locales are often part of a larger public transportation network. Ferry terminals, given their necessary location at piers or docks at the edge of urban centers, often rely on land-based transit to convey passengers to their final destination. Conversely, in congested urban transportation systems, such as those in New York City and San Francisco, ferries can help deliver more workers into the center city than would be possible over the existing congested network. Ferries can represent additional, incremental capacity at an incremental, rather than system, cost.

As with other transportation terminals, adjacent property owners, neighbors, and government officials often are concerned about the impacts of automobile traffic generated by a ferry terminal. Research suggests a multipronged approach to mitigating these potential problems (Reconnecting America Center for Transit-Oriented Development, 2007). To begin with, the ferry

Figure 8-9. San Francisco Ferry Building—example of transit-oriented development.

terminal should be in a dense, mixed-use location that allows many of the ferry passengers to simply walk to the ferry terminal. By design, mixed-use, dense neighborhoods create internal walking trips rather than the external automobile trips often generated in traditional suburban neighborhoods. Also, passengers that access the ferry from more distant neighborhoods should be encouraged to use transit rather than driving.

Developing timed transfers from ferries to landside transit is a critical component for ferry commuters. Timed transfers reduce overall travel commute times and increase the perception of reliability, thereby building commuter confidence in the overall transit network. Ferries often operate on longer headways than rail transit or bus services, so being able to time a trip is a benefit for ferry commuters or any ferry passenger.

New York offers a good example of a well-designed bus and rail feeder system that provides both route and temporal coordination. Ferries serve as feeders to the rail system, and the rail and bus systems feed the ferries. New York Waterway, at the Hoboken commuter rail terminal, provides the "last mile" link to several locations in Manhattan. The ferry schedule is designed to provide minimal waits for arriving and departing rail passengers; ferry schedules are even listed on the rail schedules as identified connections. In addition, in Manhattan, a dedicated bus fleet provides free timed and coordinated distribution for ferry passengers. As a result, the system is coordinated geographically, temporally and by fare, creating a seamless experience for passengers. In Seattle, the ORCA Card, a regional smart card, offers the Puget Pass, which combines a bus pass with a ferry monthly pass, eliminating different fare media.

New York Guidelines for Urban Ferry Services

The New York metropolitan area is transit rich, with high ridership and many transit options. In the past 25 years, ferries have, mainly through trial and error, evolved into a unique market niche in the New York metropolitan area. Public agencies in the area are developing a documented paradigm for New York Harbor Ferries. Within this paradigm, ferries are a transit service

- For areas that have few or poor transit options.
- That is supplemental to overburdened parallel systems.
- That may require modest public subsidies not exceeding other transit modes.
- That provides a time savings relative to other alternatives.
- That serves land uses that can create enough demand to use the vessels efficiently.
- Available for emergency response.

When agencies or private operators consider starting urban ferry services, it would be appropriate to consider these factors as part of due diligence.

Regulatory and Safety Requirements

The U.S. federal government and numerous states have released new laws in recent years that directly and indirectly affect the ferry industry in the United States. Many of the regulations are still being written or refined. As a result, operators may not be clear on actual intent as they attempt to conform to those regulations. As regulations continue to shift, it is important that all operators of ferry services in the United States, public and private, large and small, keep abreast of the changes they will be required to make once laws take effect.

Operators should be aware that issues pertaining to ferries can be contained within U.S. state and federal air quality regulations, U.S. Coast Guard regulations, security requirements, landing rights and insurance.

State and Federal Air Quality Regulations

In the United States, EPA has addressed small marine emissions through changes in the fuel mix and improvements in the engines. EPA now requires that marine diesel fuel have a 99-percent reduction in sulfur content compared to 2004. In March 2008, EPA finalized a three-part program to reduce particulate matter emissions from marine diesel engines by about 90 percent and

NO_x emissions by almost 80 percent when fully implemented. These new engine standards will be gradually implemented over the next decade.

State and federal water quality regulations are also now applied to ferry operations in the United States. For many years, EPA did not regulate discharges from ships under the Clean Water Act. But federal courts have ordered EPA to enforce the Clean Water Act, primarily due to ballast water resulting in the introduction of invasive species such as zebra mussels and the round goby in the Great Lakes and other U.S. waterways. As a result, some ferry discharge operations have come under EPA review (the most current case involves coal waste discharge from the S.S. Badger in Lake Michigan).

U.S. Coast Guard Regulations

U.S. Coast Guard approval is always required for the operation of for-hire passenger vessels. Title 46 Code of Federal Regulations (CFR) contains regulatory requirements applicable to the design, construction, and operation of ferries operating in U.S. waters. Smaller ferries (less than 150 passengers) are regulated under Subchapter T and have less stringent security and safety requirements. Larger ferries are regulated in Subchapter K. The High-Speed Craft (HSC) Code was adopted in 1994 by the International Maritime Organization to provide regulations for high-speed (low-displacement) craft. The U.S. Coast Guard accepts compliance with the HSC Code as equivalent to compliance with the regulations in Subchapter K of Title 46 CFR. The HSC safety philosophy is based on the management and reduction of risks while recognizing that additional hazards exist for high-speed craft compared with a conventional ship.

Whichever code or regulation is used, ferries are required to be periodically inspected, to operate within the terms contained in a U.S. Coast Guard Certificate of Inspection, and to be in the charge of a person possessing a license as Master, with gross tonnage restrictions dependent on the type of vessel.

The Coast Guard inspects vessels to ensure compliance with federal regulations. Certificates of Inspection are issued to inspect vessels once they are deemed to be in compliance with applicable regulations. Prior to an initial inspection, the Coast Guard reviews vessel plans that include the following:

- Midship section
- Arrangement of decks
- Outboard profile
- Inboard profile
- Machinery installation
- Electrical installation
- Fuel tanks
- Piping systems
- Hull penetrations operation and shell connections
- Marine sanitation device installation
- Steering system diagram

U.S. federal law also requires that a commercial ferry must be documented, unless it is used solely within the U.S. Virgin Islands. Vessel documentation is a national form of registration. Documentation requires the demonstration of ownership of the vessel, U.S. citizenship (individual, corporate, or other entity), and evidence that the vessel was built in the United States.

Security Requirements

In the United States, the Coast Guard and TSA both regulate security on ferries.

The Coast Guard is charged with ensuring that vessels in U.S. waters comply with maritime security standards and with reviewing and ensuring compliance with security plans and standards. The TSA, in addition to issuing TWIC identification, coordinates with the Coast Guard on training and other operations. In addition, local and state law enforcement agencies provide landside support and enforcement as necessary.

The owners and operators of ferries are responsible for ensuring their security by conducting vulnerability assessments and implementing security plans as required by the Coast Guard. Operators may reduce the risk of security breaches by securing wheelhouses; having local law enforcement officers onboard on some trips; and sometimes screening passengers, vehicles, or packages boarding the vessel. Coast Guard guidance is to enact measures that protect passengers without unduly compromising service to the community (U.S. Government Accountability Office, 2010).

TCRP Report 86: Public Transportation Security—Volume 11: Security Measures for Ferry Systems includes a detailed list of general security measures (GSMs) and five sets of evaluation criteria weighted by the user that are accessible in a seven-step spreadsheet tool (Science Applications International Corporation, 2006).

Security regulations instituted by the Coast Guard require ferry operators to address six specific security measures to maintain an appropriate level of security (Science Applications International Corporation, 2006):

- **Access control.** Prevent unauthorized entries and devices from being introduced that would damage or injure people or property.
- **Restricted areas.** Prevent and deter unauthorized persons from accessing sensitive areas of the ferry system.
- **Cargo handling.** Ensure the safety and security of cargo.
- **Delivery of vessel stores and bunkers.** Deter people from tampering with, contaminating, and using vessel stores and bunkers to injure people or damage property.
- **Monitoring.** Continuously monitor the fleet and facilities within the ferry system.
- **Security incident procedures.** Develop an emergency response plan that is coordinated with local, state, and federal agencies.

In addition to the 6 security measures, *TCRP Report 86, Volume 11,* identifies 11 security locations within ferry systems that define area specific threats.

Landing Rights

In the United States, many states and most local jurisdictions require ferry operators to obtain permission (either through a lease or permit) to access landing locations and other property that are commonly sovereign lands of the state. Requirements vary on landing rights.

Insurance

Many states, even though they do not regulate ferry services economically, do require that operators carry a minimum level of insurance. This insurance coverage includes public liability, garageman, and other risk management and liability tools. In addition, federal law mandates maritime worker coverage for work-related injuries.

Maintenance Requirements

Daily and long-term maintenance is a major consideration for all ferry operators and factors into decisions on operating and capital budgets, vessel replacement schedules, and staff levels.

Large operators can afford to manage in-house maintenance facilities and staff while smaller operators often contract services out to dedicated docks or companies. All operators consider a number of issues related to maintenance to determine the arrangement that fits best with the size of the operation and its budget. These issues include the following:

- Retaining in-house maintenance staff or contracting to an external company
- Determining the types of maintenance that can be completed in-house versus contracting to an external company
- Determining daily cleaning requirements
- Handling environmental concerns (i.e., gray water/bilge water/wastewater disposal)
- Handling engine re-hauling/dry docking
- Handling emergency repairs
- If managing an in-house maintenance facility, identifying the optimal location for the facility given the service's terminals and docks

Determining the optimal maintenance arrangement for an operator is often influenced by how the service is provided. Smaller operators may contract for many services, and daily maintenance such as cleaning and other necessary repairs may be covered within the contract. Other operators may use internal maintenance staff for all maintenance needs. Larger operators typically use this maintenance approach.

In addition, Coast Guard regulations require that the vessel be inspected annually, and every 5 years ferry hull inspections (where the vessel is either dry docked or the hull is inspected by divers in the water) are required.

Marketability

FTA and TRB have conducted extensive research on passenger behavior and transit best practices to encourage ridership. Most of these transit best practices are applicable to ferry passengers (Diaz et al., 2004).

Reliability

Ferry operators, like their land-based counterparts, consider reliability to be of paramount importance to the marketability of a service. Following best practices regarding choosing the appropriate vessel, using off-the-shelf designs, and then maintaining and operating service well will contribute to delivering a reliable service.

Service Frequency

Frequency of service and "clock" headway service (where the service leaves at the same time every hour throughout the day) are best practices for ferry operators, as for all transit providers. For an urban service, service that is frequent enough to allow random and unscheduled system entry by passengers makes the service more marketable. Likewise, scheduled service that operates on easy-to-remember clock headways (such as 10 minutes and 40 minutes after the hour and so forth) becomes familiar and seems friendlier to the user. Longer spans of service (hours of operation through the day) also encourage ridership.

Passenger Information

Because delays are inevitable, it is important to passengers to have real-time information (it is also helpful for transit systems, especially when the information shows that schedule adher-

Figure 8-10. Real-time information.

ence is the norm, and encourages patronage). Internet and mobile-phone-based applications are effective in not only providing basic information (e.g., on schedules and fares) but also in broadcasting delays, schedule changes, and other breaking news. See Figure 8-10 for an example of in-terminal real-time information.

Branding

Ferries, and all transit systems, benefit from distinctive branding that defines the service relative to other transportation options. The ferry-operator best practice is to use branding to reinforce a positive and attractive identity that motivates potential customers and makes it easier for them to use the service.

SECTION 9

Strategic Plan/Business Plan

Ferry services are highly capital intensive and operate with small margins between revenue and cost. As a result, the relationship between ferry service strategic plans and business plans is important. Additionally, the strategic plan for a ferry operation can actually be a part of the overall transportation strategy for a region or a state, or it can be part of an overall corporate strategy involving multiple businesses.

Strategic Plan

In general, strategic planning identifies the values and mission of an organization and broadly outlines what needs to be done to achieve the organization's mission. A strategic plan includes the following:

- A critical assessment of the organization's performance.
- The context of where the business operates.
- The organization's vision and its mission.
- The organization's values.
- Obstacles to reaching the vision.
- Strategic, long-term goals and directions.

Within a metropolitan area, this strategic analysis may be performed at the regional or state level. On the other hand, a private operator may engage in a strategic plan for its entire line of businesses (for example, a ferry operator that also develops or manages property or a general maritime company that also operates ferries). The focus of a strategic plan is usually on the entire organization, while the focus of a business plan is usually on a particular product, service, or program.

In the public sector, the strategic plan of a ferry operation is tied to its place in the overall transportation strategy of the area. This may be an explicit or an implicit relationship. For example, in a metropolitan area where ferries are identified specifically as a means to relieve overcrowding at a fixed crossing, that reference becomes the ferry strategic plan. In an area that simply acknowledges vehicle ferries in the highway network, the strategy is implicit (Rice, accessed December 3, 2010). A metropolitan plan may identify access as an important outcome and inventory the existing system's ability to deliver that outcome. If the system is deficient, then a strategic plan could identify ferries as a means to deliver the additional increment of access. The strategic plan could also identify, at a policy level, the resources necessary for implementation. The business plan then becomes the tactical document that is used to deliver this element of the overall strategy.

In the private sector, corporations also employ strategic plans for their entire suite of businesses, with the end result of delivering a profit to their shareholders. A business plan focuses on each individual business entity.

Business Plan

An effective business plan identifies the product provided and the resources necessary to produce and deliver the product and provides a plan to use the resources efficiently to produce and deliver the product.

In the business plan of a transportation organization, the following are necessary components (U.S. Small Business Administration, Small Business Training Network, accessed December 3, 2010):

- Business description and vision
- Definition of the market
- Description of products and services
- Organization and management
- Marketing and sales
- Financial management

If the ferry operation, or even a ferry system, is considered one product of a broader business, whether that be a private corporation's suite of businesses or a government's overall transportation strategy, the ferry "product" needs a specific business plan.

Business Description and Vision

The business description and vision summarize what the ferry operation is, who will run it, and how it will be operated. This component of the business plan references the mission statement and vision identified in the strategic plan and then identifies the near-term goals for the ferry product.

As an example, a ferry operation in an urban area could be described as follows:

> Acme Ferry Service provides direct ferry service from Acme Point to Metro City to fulfill Metro Region's Vision to connect the central business district directly to all communities of more than 25,000 residents. We work closely with Acme Point city officials to develop and operate a service to meet resident needs and support the city's development and transportation objectives. Our goals include operating ferry services at frequencies that compete with other modes and travel times that are better than our competition. Acme Ferries have high on-time performance and moderate operating cost, which allows us to charge a premium fare for a value-added service. We expect to generate a small profit of at least 5 percent of fares annually. Acme Ferry Service is led by CEO Ben Jefferson, who has 25 years experience in transportation and ferry services, and he is supported by CFO Penny Payup and Chief of Operations Jonas Grumby.

Definition of the Market

The definition of the market component describes and explains the critical need for the ferry service. The market should be identified, and the targeted demographics should also be developed. In addition, the business plan should estimate the market share for the service. An example definition of the market is the following:

> Acme Ferries operates in the competitive Acme Point to Metro City travel market. Each day, more than 50,000 trips are taken between the two locations. Our niche is the high-value, time-sensitive traveler willing to pay for more time savings and reliability. Our competition includes the public bus service and the private automobile, via the Metro Bridge. Acme Ferries passengers can travel from their homes to their jobs in Metro City in 20 minutes. Our bus competitors can make the same trip in 35 minutes, and automobile passengers can make the trip in 15 minutes on most days, although reliability is poor. As a result of our time advantages, Acme Ferries carries about 18,000 passengers daily, or more than one-third of the market. Our goal for the next year is to increase our market share to 40 percent of the market, or about 20,000 commuter trips daily; we also seek to capture about 5,000 to 7,000 daily midday non-commute trips.

Description of Products and Services

The description of products and services presents, from a passenger perspective, the ferry service offered and its competitive advantage. In the Acme Ferries example, this section could expand on the definition of the market and merge that with a description of the service provided, as follows:

> Acme Ferries operates a fleet of five 400-passenger ferries that carry more than 18,000 weekday passengers. Our ferries operate every 7.5 minutes in the morning and afternoon peak periods and provide a 15-minute trip between the Acme Point terminal and Union Ferry Depot in Metro City. At midday and on nights and weekends, service is provided every 15 minutes. Ferries are large, stable catamarans that are well appointed and have a full complement of beverages and snacks. At Acme Point, the ferry terminal is integrated into Acme Point's Waterview Development. Waterview includes more than 7,500 residential units, all within a 5-minute walk of the ferry terminal. Most Waterview units are condominiums and sell for about $500,000 each, resulting in a high-income neighborhood adjacent to our services. In addition to this walk-in market, we also operate a network of shuttle feeder buses to more distant locations in Acme Point, so that everyone in town can have a connected ride to Metro City. At Union Ferry Depot in Metro City, almost 400,000 jobs are within a 10-minute walk of the terminal; also there are connections to local buses. Acme Ferry charges a round trip fare of $6, and our competition charges $5 for the bus and $2 for the Metro Bridge toll. We also partner with other businesses and with educational institutions to promote our services in lower demand periods.

Organization and Management

The organization and management component of the business plan covers operations and maintenance plans for the ferry service. The basic organization structure should be provided, identifying the key roles and the tasks that are performed in those roles. The relationship between different functions and departments should be presented. In a transportation operation, under the chief executive, are the following departments: the operating department, the maintenance department (sometimes reports to the operating department), the engineering department (both for ongoing facilities and for capital projects), the finance and administration department, and the planning and marketing department.

An example of a simple work flow statement is the following:

> Acme Ferries is organized into five major groups: operations, maintenance, engineering, finance/administration, and planning/marketing. Planning and marketing are responsible for developing services, projects, and proposals that will entice customers and encourage use of our product; this group designs the service plan and then seeks to fill our seats. Operations runs the vessels according to the service plan and schedules developed by planning/marketing; operations management seeks to deliver a quality customer experience through safe and reliable operations and great customer service provided by happy and motivated employees. Maintenance is responsible for upkeep of the vessels and other system assets; maintenance will produce the vessels for operations to sail and will ensure system vessel safety and reliability. Finance and administration provides the staff functions for all departments to ensure that budgets are met and revenue is collected and accounted for.

Key elements of the organization and management section of the business plan are operations and maintenance plans. These are detailed plans that identify how the service product will be delivered, what resources are necessary to deliver the product, and what constraints are on those resources.

The operations plan must identify the total employees needed to staff each vessel and the total service delivery. The operations plan must also describe the qualifications necessary for staff filling those positions, and it must provide an estimate of the cost to deliver the people and services identified. Other issues, such as operations of terminals, descriptions of the actual routings, and "deadheading" routes should all be included.

The maintenance plan should include the actions necessary and the people and resources required to keep the fleet and facilities in a "state-of-good-repair," including the location and

suitability of maintenance facilities, the option of internal versus external work force for certain tasks (such as engine rebuilding), and the overall cost to deliver maintenance for the anticipated service. Key performance metrics should be identified (i.e., goals for on-time performance, total passengers annually, seats occupied, and so forth) so that monthly and annual reports can assess performance against plan.

Planning, Marketing, and Sales

The planning, marketing, and sales component of the business plan details the ferry system's understanding of its existing passengers and the availability and potential of its market. Ferries usually operate in a transportation market best characterized as fragmented, competitive, and dynamic. The transportation market typically has low barriers to entry (which can mean anything from a potential customer buying an automobile, to taking a fixed-link route, to taking a bus competitor instead). However, ferry operation has high fixed costs (vessels, terminals, and so forth), normally requires some governmental permitting (or regulation), and has assets that are often not easily transferable. The marketing challenge is not moving assets and products to new markets, but maximizing sales at the times when the service has excess capacity and maximizing yield at times of highest demand.

As the case studies conducted in this research indicate, moving demand from the peak periods (which can be either times of day or even entire days) to lower demand times reduces both operating and fixed expenses and spreads more revenue across a lower fixed-cost basis, resulting in better economic performance. This can be done through pricing, and it can also be done through better services in the off-peak periods, including shuttle systems that expand the reach of the system during those times and promotional incentives with specialized traffic generators (often recreational activities).

An example of a simple marketing and sales statement is the following:

> Acme Ferries has high demand during the traditional 7:00 to 9:00 a.m. and 4:00 to 7:00 p.m. weekday peak periods. Our base level of commuter ridership results in a midday hourly use level of about 25 percent of the peak-hour level (as measured by total passengers served during those hours).

We seek to use our assets at a higher level outside of the peak periods. Our current passenger distribution is the following:

AM Peak Period	6,000 passengers
Midday Period	5,200 passengers
PM Peak Period	6,000 passengers
Nights	800 passengers

Our target passenger distribution is the following:

AM Peak Period	6,000 passengers
Midday Period	12,200 passengers
PM Peak Period	6,000 passengers
Nights	800 passengers

The fares charged for the projected 7,000 additional midday trips would be priced to pay for the marginal operating costs of the service plus contribute to a share of the system's fixed costs and profit.

To achieve this objective, our staff actively works with non-traditional markets to encourage off-peak ridership. As part of this plan, we have done the following:

- Enacted a peak-period ticket surcharge on all commute passengers to encourage commuters to move trip times by a few minutes and reduce our peak ridership and our peak expenses.

- Created a deeply discounted, "reverse-peak" fare for peak-period trips that are essentially free to operate (since our peak direction fare is priced to pay for the operational round trip).
- Entered into an agreement with the local "Big Box" store (which has poor access via traditional transit and little automobile parking) to provide a midday and evening shuttle service between the Union Ferry Depot and Big Box.
- Created 3-day per week "lunch cruises" from Union Ferry Depot that operate from 11:30 a.m. to 1:30 p.m. and are aimed at the business lunch market.
- Marketed our "school field trip" service from Acme Point to cultural and educational institutions with water access, such as Metro Zoo and the Metro Science Academy.

Acme Ferries actively markets these promotions through the local business community, by attending community events, and providing liaisons to community groups and educational institutions. We sponsor school fairs and Metro Zoo events to maintain a presence in the community and a high profile.

Financial Management

The financial management component of the business plan details the ferry system's finances to ensure a good understanding of costs and identify adequate revenue to support a safe and quality service.

Four crucial elements of the financial management section are the following:

Capital Expenditures. These expenditures include vessels, real property, leases, facilities, and equipment.

Profit and Loss Projections. These include operating expenses such as labor, materials and supplies (and loan payments if capital was borrowed), and operating revenues such as ticket sales and concession revenues. These expenses and revenues are typically calculated on a monthly basis.

Cash Flow Projections. These projections reveal the liquidity, or cash position, of the ferry operation. While profit and loss statements include invoiced expenses and revenues, cash flow shows the funds actually received versus expended. Cash flow is important, especially in seasonal operations, because positive revenue may be generated in only a few months, and this revenue needs to be either banked or loaned against to cover periods of negative cash activity.

It should be noted that sometimes public agencies subsidize private ferry operators. There are a variety of ways to provide public funds to the private sector; these include a direct contract, in which the agency keeps all the revenue and simply purchases services; a "bounty" system, in which the public agency pays a reward for each passenger carried; or even a simple system, in which the public agency builds and operates capital facilities for use by private operators. How the payment is structured is included in the cash flow projections of the operator.

Balance Sheet. This document lists the net worth of the enterprise. In a ferry operation, capital expenditures can be expensive. Often, new operators tend to overestimate revenues, which leads to liquidity problems. Start-up costs typically include a long lead time in which to establish a presence in the market during which an enterprise may incur a negative cash flow.

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APPENDIX B

Ferry Operators' Survey Results

Methodology

Following the approval of the survey instrument, the survey was pretested with several panel members and was refined before being fielded. Telephone interviews were conducted from May through July 2009. The telephone interviews covered the same topics as the literature review.

The survey sample was designed to include representatives of the full range of ferry operators, from very small to those that carry more than a million passengers, from seasonal to year-round, and from private ownership and operation to federal, state/provincial, and local public operation. The sample also selected operators from various geographic regions. The survey was designed to allow for multiple respondents from the same operator to answer questions, which occurred during interviews with larger operators. A $100 incentive was offered to encourage participation in order to complete the desired number of interviews.

Results

Forty-three interviews were completed. The survey respondents answered anonymously during the reporting process. Additional characteristics of the respondents include:

- Of the 15 publicly owned ferries surveyed, one is a federal agency, seven are state or provincial governments, and seven are local operators.
- Twenty are privately owned and operated, while seven are publicly owned but operated by private companies under contract.
- Fourteen ferries are seasonal, while 16 operate year-round.
- The number of passengers carried annually ranged from less than 500 to 2 million.
- Twenty-five respondents operated one to two lines, 10 had three to six lines, and six had seven or more lines.

Respondents were asked to rate the importance of the survey topics on a scale of 1 to 10, where 1 is not at all important and 10 is extremely important. Average responses for major areas are presented in Figure B-1.

Overall, respondents assigned the highest importance to ferry operation and maintenance (O&M) issues that directly affect everyday functioning, such as engine, hull, and terminal maintenance. Regulatory compliance, funding issues, labor relations, and ferry planning all received only slightly lower importance ratings averaging 8.5 to 8.8, indicating that these functions, too, are considered quite important by ferry operators. Somewhat lower-average importance ratings were assigned to disaster response/passenger security (7.4) and to marketing (6.9) and emission/greenhouse gas issues (6.4).

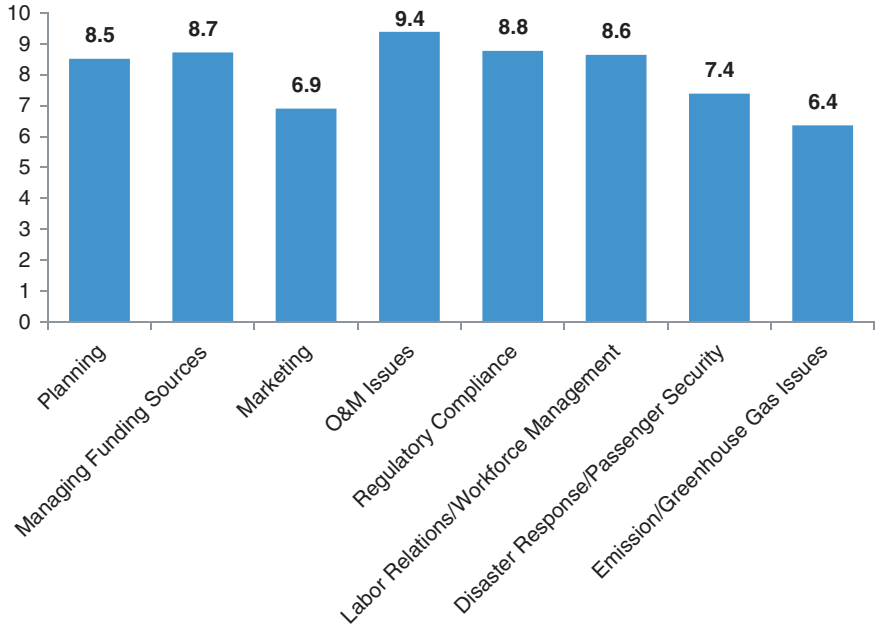

Figure B-1. Importance ratings of ferry management and operations issues.

Each of these broad issues is discussed in greater detail in the following sections, with the goal of identifying specific tools or activities that individual operators have found to be helpful in successfully meeting challenges.

Planning

The questions related to ferry planning were geared toward gaining a better understanding from operators how they treated planning, both in the short and long term. Survey respondents were asked to rate the importance of various planning-related issues, as well as list any planning-related activities that were to be performed in the near term. General themes include:

- Respondents who rated the importance of planning highly explained their rating by stating, among other reasons, that planning is a critical element of ferry management, that it is essential to coordinate repairs and USGS inspections, and cited their own organization's failure to plan in the past leading to the need for service cutbacks within the past several years.
- Those who assigned lower importance to planning explained that they were long-established operations meeting the needs of a specific market (for example, National Park visitors, island residents) so that little planning was required.
- Across all respondents, individual planning tools received lower-average importance ratings than did planning overall.
- Among individual planning tools, use of models to plan routes or terminals received the lowest rating, although several operators said that they informally use past and current passenger and traffic data to plan future operations.
- Publicly owned ferries and those operated by private contractor assigned higher important ratings to several planning tools, including political considerations, public input and feedback, and the need to plan for regulatory requirements.
- While private owner/operators assigned significantly greater importance to planning overall than did either public agencies or contract operators of publicly owned ferries, they assigned lower levels of importance to specific planning tools that involve external feedback or input.

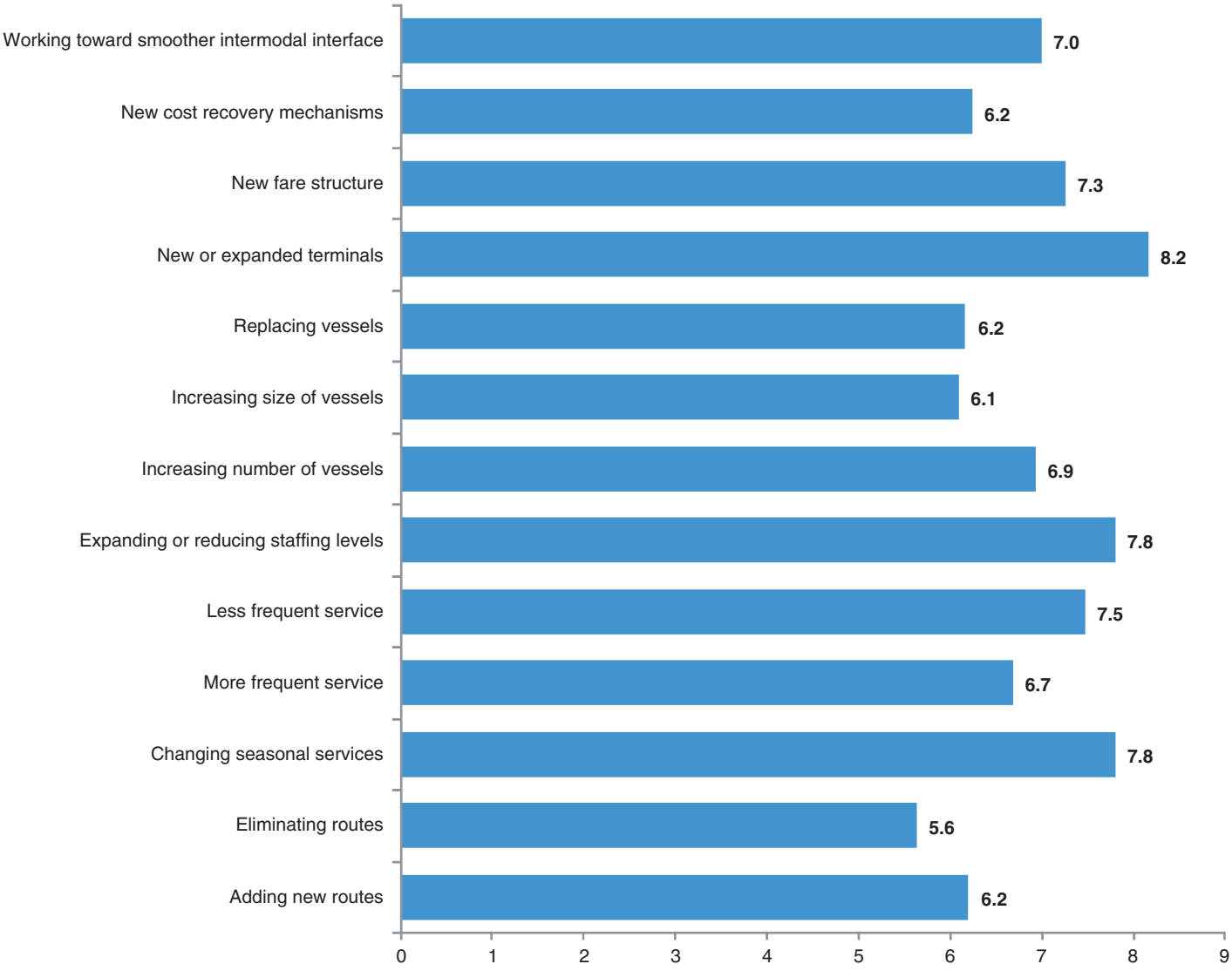

Figure B-2. Success of planning efforts toward selected goals (0 to 10 scale).

Respondents were also asked to rate how successful they felt their planning had been with regard to specific activities. Results are summarized in Figure B-2.

Planning for new or expanded terminals, changing staffing levels, and adjusting seasonal services were seen as the most successful planning activities, while efforts to eliminate routes were considered least successful (note that planning efforts to reduce the frequency of service were seen as considerably less problematic).

The most commonly mentioned major planning challenge for the near future was the economy and the effect of the recession on ferry usage as well as on public sector budgets. Respondents mentioned dealing with specific challenges such as cost control, personnel management, fleet upgrades, tighter regulations, and maintenance issues in the context of the more restrictive operating environment. One large operator mentioned a long-term challenge of planning expanded parking and ferry service despite local opposition; another described a planned consolidation of three ferries operated by individual cities into a single public entity.

Based on the planning experiences and challenges faced by survey respondents, best practices with regard to planning appear to include the following:

- Use public input to assess customer needs and to help advance operational improvements.
- Take advantage of the knowledge and experience of ferry staff.
- Observe and learn from the experience of other ferry operators.
- Plan service to accommodate the needs of passengers.
- Recruit informed stakeholders as part of an Advisory Board.
- Conduct periodic audits of internal procedures.
- Focus on planning for and managing vehicle traffic.

Managing Funding Sources

Managing funding sources is a critical element for service management for operators. Whether it is public operators relying on public funds to private operators relying on profits from ridership, maintaining a constant funding source is of the utmost importance. This section focuses on the aspects of funding management that operators view as important to their operation.

Both public and private operators view funding management as important. The survey developed specific questions aimed at the different interests each sector faces. These issues are presented in Tables B-1 and B-2.

Tab. 1, 2

Private owner/operators were most concerned with increasing their revenues (9.5 average rating) and managing operating expenses, with other funding issues taking on less importance. Specifically, making capital investments to reduce operating expenses (average rating of 7.2) and refinancing or restructuring existing debt (6.1) were deemed less critical to the success of operations.

For operators of publicly owned facilities, managing existing operating funding sources was significantly more important than either investigating new operating funding sources or managing existing capital funding sources. Identifying new capital funding sources was relatively more important, however, with respondents recognizing that these new capital sources would be crucial to future success. Several commented on both the difficulty of securing capital to perform the required upgrades to their aging vessels and terminals and on the opportunities offered

Table B-1. Importance of funding issues to operators of privately owned ferries.

Ability to manage finances and increase revenues	Managing operating expenses	Making capital investments that reduce operating expenses	Refinancing/ restructuring existing debt	Working to increase revenues
9.5	9.1	7.2	6.1	9.5

Table B-2. Importance of funding issues to operators of publicly owned ferries.

Managing existing operating funding sources	Identifying and investigating new operating funding sources	Managing existing capital funding sources	Identifying and investigating new capital funding sources	How important will these new capital funding sources be in the future
9.1	6.4	8.0	8.8	9.2

Table B-3. Percentage of respondents using alternate pricing strategies.

HOV lane pricing at terminals	Congestion pricing	Different pricing for different times of day, days of week, or seasons	Different pricing for different categories of customers	Different pricing for different payment methods
6.5%	9.7%	45.2%	71.0%	22.6%

by economic stimulus funds. Operators specifically mentioned the Ferry Boat Discretionary Fund and the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, as well as the Economic Recovery Act.

Most operators, both public and private, must look to multiple funding sources. The questions in Table B-3 highlight some of the funding strategies that have begun to be implemented with other transit modes.

One severe funding challenge faced by all the ferries was the sharp run-up in fuel prices in 2008. When asked how they had coped with the fuel price increase, almost half (45%) of public ferries reported having instituted a fuel surcharge, compared to about 20% of private and contract operators. While several operators said the surcharge had allowed them to cope with the cost increases, at least one reported that the surcharge had cut their market share. Among those that did not increase fuel-specific surcharges, several said they raised fares, while others said the increased cost was simply reflected in a larger operating loss.

Among both groups, a significant number said they were successful at instituting fuel-saving operational changes, including:

- Turning off engines in lieu of idling.
- Reducing speed or optimizing engine revolutions per minute.
- Limiting the amount of excess fuel on board to reduce weight.
- Making fewer trips.
- Installing a fuel monitoring system to track consumption.
- Assigning responsibility for fuel management to individual captains.

Based on the funding experiences and challenges faced by survey respondents, best practices with regard to managing funding resources appear to include the following:

- Use stimulus money.
- Dedicate staff resources to pursuing grants and other sources of capital funds.
- Manage fuel costs through contracts, competitive bidding, and operational adjustments, including fuel monitoring systems and assign responsibility for fuel management to captains; use fuel surcharges cautiously.
- Consider and apply alternate pricing, particularly seasonal pricing and systems that offer discounts to heavy users through a paperless ticketing system.

Marketing

Engaging in marketing practices can assist operators in raising their profile among the many transportation options people can choose from. This section looks to highlight what types of marketing activities and strategies operators use, as discussed in Table B-4.

Generally, there were two perceptions of the importance of marketing. One group included those who do not see marketing as important. Most of these were publicly owned (either publicly

Table B-4. Importance of marketing to ferry success.

	Marketing	Using marketing to improve image as a viable transit alternative	Using marketing or market research to improve service	Using marketing to address other issues
All Public	5.0	3.3	4.3	4.1
All Private	7.9	6.0	5.5	4.5
Privately Owned	8.6	6.5	6.1	4.7
Contract Operator	5.7	4.3	3.8	3.7
All	**6.9**	**5.1**	**5.1**	**4.3**

or privately operated) operations, often quite small, that do not think they need to market to retain what they often see as a captive audience. The majority of respondents, however, assigned relatively higher importance ratings to marketing.

Private owner-operators rated marketing higher than did either publicly operated ferries or private contractors who operate publicly owned ferries. Even with small sample sizes for each group, the difference between the perceived importance of marketing among public operators (5.0) and private owner-operators (8.6) is significant. Public ferries had lower importance ratings for all specific aspects of marketing, whether using marketing to improve their image as a viable transit alternative, using marketing or market research to improve service, or using marketing to address other issues.

When asked about their biggest marketing challenge in the next several years, responses tended to fall into three categories:

- Difficulties of coping with the economy, which had led to decreased ridership and reduced marketing budgets, so that the need for marketing is greatest just when the resources to support it are declining.
- Need to continue to promote the availability and benefits of their ferry.
- Ability to recognize the importance of electronic media and marketing.

Despite the relatively low importance assigned to marketing, a few operators appear to be using marketing and market research effectively to improve their business. Candidates for best practices include:

- Creating and building a brand or image to help build awareness and differentiate one ferry line from others.
- Using electronic media (including timely, updated Web sites and social media) to stay in touch with customers and market.
- Fielding surveys to gather customer feedback and, as needed, make operational adjustments.

Operations and Maintenance

O&M was the only category of issues to receive an average importance rating higher than 9. As shown in Table B-5, O&M issues were rated highly by every category of ferry operation, with every group assigning an average of importance of at least 9.3.

For all public and private operators, the average importance of maintenance-related issues to the success of operations was consistently high, as shown below.

Engine, transmission, and generator maintenance received the highest average rating (9.4). However, regular haul-outs/inspections required by USGS (8.7), hull maintenance (8.4), cabin

Table B-5. Importance of operational and maintenance issues.

	Importance ratings for operations and maintenance issues
All Public	9.3
All Private	9.4
Privately Owned	9.4
Contract Operator	9.7
All	**9.4**

cleaning (8.3), terminal maintenance (7.4), and even vessel restroom maintenance (6.8) all rated higher than any other non-maintenance operational issues such as automated reservations or ticketing, managing wait times, or managing entry/exit queuing and metering, as shown in Table B-6.

When asked about their most serious maintenance challenge, respondents offered a variety of concerns but most often mentioned rising costs, the difficulty of maintaining aging vessels and engines, and the need to comply with a variety of regulations. Often those concerns overlap, such as when operators cite the high cost of replacing old engines to comply with more stringent environmental regulations.

When looking at their greatest operational challenge more broadly, ferry managers again mentioned cost (10 respondents) and regulations (cited by seven respondents). However, three also mentioned operating in severe weather as a challenge, and two noted problems associated with operating in shallow water (for example, rudder, propeller damage) as their biggest challenge. Work force issues were mentioned as a major issue by five operators.

With the very high importance assigned to operations and maintenance, ferry managers are using whatever tools they feel are most effective in overcoming significant operational challenges. Potential best practices include:

- Use computerized maintenance records to track vessel usage and identify needed scheduled maintenance.
- Use automated scheduling and ticketing.
- Use online reservations to reduce wait times.
- Provide online information on ferry status.
- Pro-actively conduct maintenance to anticipate USGS inspections.
- Conduct preventive maintenance off-season.
- Use centralized maintenance base for economies of scale.
- Maintain good relationship with USGS to support flexible solutions to maintenance emergencies.
- Structure fares to encourage foot traffic rather than vehicles.

Table B-6. Importance of non-maintenance issues.

	Automated ferry scheduling	Automated ticketing/ reservations	Managing wait times for vehicles	Managing wait times for other passengers	Encouraging motorists to switch to other modes	Increasing passenger-only ferry service	Managing entry/exit queuing and metering
All Public	2.3	4.2	5.1	5.4	2.5	2.3	4.1
All Private	1.9	5.2	2.3	3.8	2.1	4.8	3.6
Privately Owned	1.6	5.8	2.5	4.2	1.6	4.8	3.8
Contract Operator	2.7	3.3	1.8	2.7	3.6	4.7	2.8
All	2.0	4.9	3.2	4.3	2.2	3.9	3.8

- Clean cabins and restrooms after every trip.
- Assign clear responsibility for maintenance tasks, with captains ultimately responsible for onboard maintenance.

Regulatory Issues

Regulatory issues were considered important across the board but were rated especially important by privately owned and operated ferries. Ferries must comply with a range of regulations, whose relative importance is summarized in Table B-7.

USGS and safety issues received the highest average importance ratings, followed by homeland security issues, emissions requirements, ADA compliance, and EPA discharge regulations. Note that several classes of regulatory concerns were deemed less important by private owner-operators than by publicly owned and operated ferries, including emission requirements (6.8 versus 7.4), use of automatic ID systems (3.5 versus 5.4), EPA regulations (5.8 versus 7.4), ADA compliance (5.9 versus 7.1), and homeland security issues (7.0 versus 8.3).

Respondents were also asked specifically which of the above regulatory issues has had the greatest impact on their operations. Answers are summarized in Table B-8.

Operators emphasize the multiple regulations they are required to comply with, that all the regulations are equally important (and, in many ways, equally burdensome), and that failure to comply leads to the operation being shut down.

When asked about the importance of regulatory issues over the next several years, 10 respondents specifically mentioned Transportation Worker Identification Credential (TWIC) and installing the required card readers as a potential challenge. Both engine emissions and vessel discharge requirements were also mentioned as very important future concerns.

The ferries most successful in dealing with regulatory concerns appear to be those that say they have anticipated requirements and that work closely with regulators such as the USGS to identify potential compliance issues. Several respondents described how they provided input during public comment periods on proposed new regulations and were able to make them "come into play in a more reasonable fashion than what they were proposed."

Table B-7. Importance of regulatory issues.

	Regulatory compliance issues	ADA compliance	Coast Guard issues	Use of automatic ID systems	EPA vessel general permit (VGP)	Emissions requirements	Safety issues	Homeland security issues
All Public	8.3	7.1	9.0	5.4	7.4	7.4	9.0	8.3
All Private	8.8	5.9	8.7	3.7	5.6	6.6	8.5	7.4
Privately Owned	9.3	5.9	8.8	3.5	5.8	6.8	8.7	7.0
Contract Operator	7.3	5.7	8.6	4.1	5.2	6.1	7.9	8.4
All	8.8	6.3	8.8	4.1	6.1	6.9	8.6	7.7

Table B-8. Regulatory issue importance ranking.

ADA	4.7%
Coast Guard	25.6%
HL Security	18.6%
Safety issues	25.6%
All equal	25.6%

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As indicated in the discussions above, strict compliance with applicable regulations is a minimal requirement for continued operation. However, it appears that there are some steps ferry operators can take to best anticipate regulations and interact with regulators. Some of these potential best practices include the following:

- Establish and maintain good relations with the USGS, especially local personnel.
- Provide well-documented input regarding local effects of proposed new regulations during public comment periods.
- Plan and budget for likely regulatory changes, such as stricter emission requirements, even when the specific regulations have not been finalized.

Workforce Management Issues

Labor relations and workforce management issues received an overall rating of 8.6 when respondents were asked how important these issues had been to the success of ferry operations over the past 2 years—roughly the same as planning, managing funding sources, and regulatory compliance. Ratings for workforce management are presented in Table B-9.

Private operators of publicly owned ferries appear to be somewhat less concerned than other groups about labor relations and workforce management issues overall, but they assigned greater importance to the availability of licensed, experienced staff, issues associated with drug testing, and providing benefits (recall that there are only seven of these contract operators, so that individual responses can more significantly affect the group average).

When asked about the most significant workforce management issues for the next several years, most responses focused on the need to replace an aging workforce as existing staff retire, the cost of healthcare and other benefits, and generally being able to find good people at a manageable cost.

The extent to which operators have flexibility in implementing new workforce management practices depends in part on whether and how much of the work force is unionized. Overall, however, the following appear to be consistent with efficient operation and good employee morale:

- Because customer interaction is an important function for almost all positions on the ferry, select and recruit personnel accordingly.
- Cooperate with other firms to have drug testing performed to reduce cost.
- Train and promote from within the company to ensure high-quality staff and employee retention.
- Take advantage of cyclical downturns in other industries to improve the ability of ferry operators to hire qualified staff even at relatively lower compensation levels.

Table B-9. Importance of workforce management issues.

	Labor relations and workforce management	Availability of licensed (experienced) captains and deckhands	Cost/ efficiency of drug testing	Adapting to use of TWIC cards	Providing benefits (health care, retirement plans, etc.)	Interacting with unions and union negotiations
All Public	8.3	7.7	6.1	5.4	8.3	5.7
All Private	8.8	8.4	7.1	5.2	7.6	2.4
Privately Owned	9.3	8.1	6.8	5.3	7.4	2.5
Contract Operator	7.3	9.8	8.2	4.8	8.4	2.0
All	8.6	8.2	6.8	5.2	7.8	3.5

Disaster Response and Passenger Security Issues

The perceived importance of disaster response and passenger security issues to the success of operations seems to depend on whether respondents interpret it to mean homeland security–related issues or operational issues that affect the safety of passengers. As shown in Table B-10, disaster response and passenger security issues overall received an importance rating of 7.4, somewhat lower than several other issues investigated in this study. Publicly operated ferries assigned a higher level of importance to this issue overall than did private operators, particularly operators of privately owned facilities.

Several specific issues related to disaster response and security were also perceived as moderately important, including ferry disaster response and support (7.5), development of a security plan (6.8), protection and safety from terrorist attacks (5.8), and passenger screening (5.5).

Passenger safety and other operational safety issues received importance ratings of more than 9.0 for all categories of operators, suggesting that respondents see the traditional emphasis on safety as more consistent with their success than the need to comply with security-related regulations imposed by DHS and the USGS. The different perceptions regarding these two distinct types of passenger security are reflected in the comments offered for each set of issues.

As with other issues, a number of operators tie future security and safety challenges to funding and the economic downturn, since there may be a tendency to want to save money on training, maintenance, and other aspects of operations that directly affect safety and security. Also cited were concerns regarding the need to adapt to new and changing regulations (including installing TWIC card readers), the possibility of renewed terrorist threats that would raise security alert levels and require more rigorous passenger screening, and the need to hire skilled captains and crews capable of meeting high safety standards.

Strategies used by ferry operators to address safety and security issues that may be candidates for best practices include the following:

- Use a PVA plan or develop own safety plan, working with USGS and DHS, as well as other law enforcement agencies.
- Coordinate safety and security plans with other ferry operators in the region.
- Implement standard procedures in accordance with plan and ensure they are followed.
- Implement regular, rigorous training on all aspects of disaster response.
- Conduct anonymous (mystery shopper) review of safety and security procedures.

Table B-10. Importance of disaster response and passenger security issues.

	Disaster response and passenger security issues	Development of security plan/ alternate security plan (ASP)	Passenger screening and response screening	Ferry protection and safety from terror attacks	Passenger safety	Ferry operational Safety	Ferry disaster response and support
All Public	8.2	6.4	5.0	6.1	9.2	9.1	8.3
All Private	7.0	7.0	5.8	5.7	9.2	9.2	7.1
Privately Owned	6.9	6.8	5.9	5.3	9.1	9.1	7.4
Contract Operator	7.6	7.7	5.4	6.7	9.4	9.7	6.3
All	7.4	6.8	5.5	5.8	9.2	9.2	7.5

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Table B-11. Importance of emission and greenhouse gas issues.

	Emission and greenhouse gas issues	Emission monitoring programs	New programs/ initiatives to reduce emissions	Use of alternative fuels	Retrofitting vessel to reduce emissions	Use of tools, models to understand total fuel cycle energy, emissions impacts	New engine technologies to reduce emissions	Planning new routes to conform to air quality planning goals
All Public	6.3	3.3	5.4	3.3	4.7	2.2	5.5	1.5
All Private	6.4	2.9	4.7	2.8	4.4	3.4	5.2	2.3
Privately Owned	6.4	3.0	5.2	2.8	5.2	3.9	5.9	2.2
Contract Operator	6.6	2.7	3.4	3.2	2.0	2.0	3.2	2.5
All	6.4	3.0	4.9	3.0	4.5	3.1	5.3	2.1

Emissions and Greenhouse Gas Issues

Emissions and greenhouse gas issues are viewed overall as less important than other regulatory issues, workforce management issues, and marketing, with the lowest mean importance rating across all respondents of any category of issues, as shown in Table B-11.

The importance rating for emissions issues is consistent across public and private operators with a difference of just 0.3 point between the highest and lowest rating. For individual issues, the level of importance shows more variation across different types of operators. The importance of new programs to reduce emissions, for example, ranges from 3.4 for contract operators to 5.4 for public ferries, while the rating for new engine technologies averages 5.9 for private owner-operators but only 3.2 for contract operators.

Only a handful of operators said they had received or were working towards any specific green certification. Three respondents said they had received Travel Green Wisconsin certification, while two mentioned a PVA Best Practices program, and one reported that they had worked with EPA to develop a Green Port strategy and were now seeking funding to implement the strategy.

When asked what they see as the most significant emission- and greenhouse gas-related challenge over the next 2 years, almost all respondents focused on the increasingly stringent EPA regulations, with at least one noting the uncertainty that surrounds current planning efforts. "We are heading into period where everything might have to be scrapped for 2014 regulations . . . it is holding everybody back."

Since most of the actions taken to address emissions and greenhouse gas issues involve complying with new and sometimes unforeseen regulations, best practices tend to be similar to those for regulatory issues. Candidates for best practices include the following:

- Use engine manufacturers for support in complying with engine emissions guidelines.
- Select cleanest fuel consistent with engine operating requirements.
- Work with appropriate agencies to seek recognition for "green" practices.
- Work together with ports and other authorities to establish and use emission monitoring program.
- Seek out stimulus funding, grants, or other sources to help pay for engine retrofits or replacements.

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation