U.S. Department
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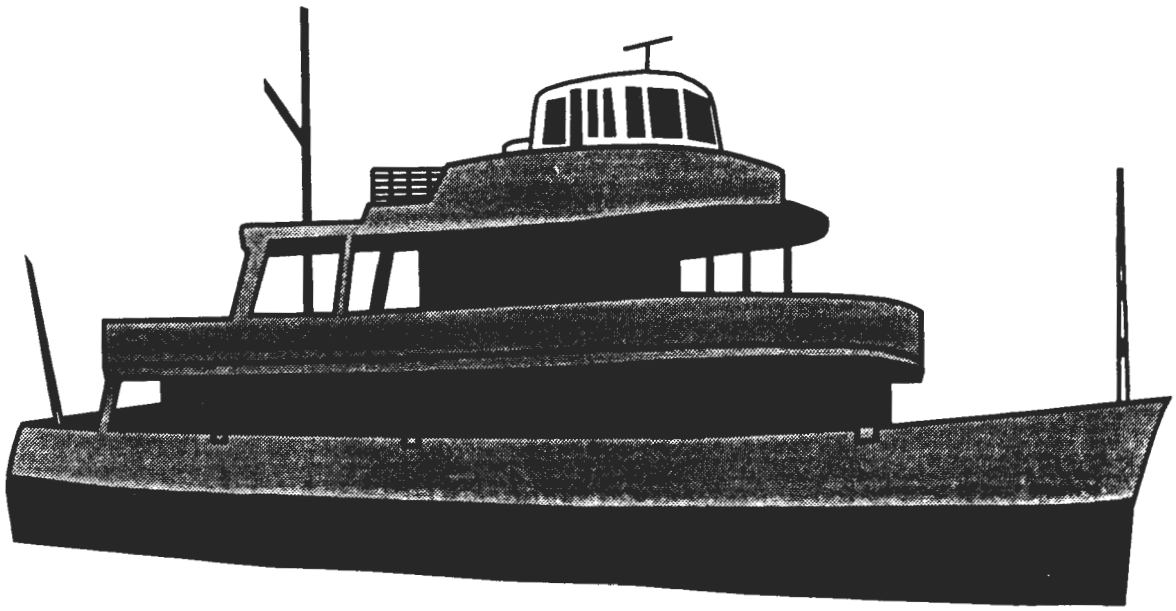
Access for Persons with Disabilities to Passenger Vessels and Shore Facilities

The Impact of the Americans with Disabilities Act of 1990

July 1996



Office of Environment, Energy and Safety
Office of the Secretary of Transportation

Access for Persons with Disabilities to Passenger Vessels and Shore Facilities

The Impact of the Americans with Disabilities Act of 1990

Final Report
July 1996

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CONTENTS

APPENDICES

GLOSSARY

ADA	Americans with Disabilities Act of 1990
ADAAG	ADA Access Guide, specifications for accessible accommodations developed by the Architecture and Transportation Barriers Compliance Board
ABS	American Bureau of Shipping, an independent classification society, performing inspection and certification of vessels.
Displacement	Weight of water displaced by a vessel, equal to the weight of the vessel
Edge treatments/ detectable warnings[1]	A standardized surface feature or a physical barrier built in or applied to the walking surface, to warn visually impaired people of hazards along the path of travel.
Fixed ramp[1]	A walking surface that has a fixed running slope greater than 1:20 but no greater that or equal to 1:12.
Freeboard	The vertical distance between the surface of a floating dock or ship's deck and the water line.
Gangway[1]	A walking surface which spans any two marine facilities or vessels. Gangways are not fixed and their slope depends on the relative position of the facilities they are spanning.
Heel	The transverse (to starboard or port) aspect of a vessel's static (still) condition, determined by its loading arrangement, i.e. the angle from the horizontal.
Incremental cost	The additional cost to making a vessel or marine facility ADA compliant, over and above what would otherwise be spent to make the vessel or facility accessible to the general public.
Lift	A portable or permanently installed mechanical device to move people from one level to another.
Navigable waterway	Waters over which commerce may travel, as defined by the U.S. Army Corps of Engineers
Nominal marine condition	The assumed environmental condition for providing access from shore facilities to vessels, including limits on water height ranges and the stipulation that no movement results from the effects of wind, waves, wakes, and currents.
Non-navigable waterway	As defined by the U.S. Army Corps of Engineers, waters over which commerce does not travel.
Non-tidal	Condition at a marine facility with no tidal influence, e.g. on inland waters.
Passenger loading platform	A floating platform, located between the stable approach and vessel, from which passenger embark onto, or disembark from, the vessel.
Path of travel	The path or route connecting all elements of the marine facility.

Pier	A fixed structure extending from the shore into the water, usually built on pilings or stoneworks to convey pasengers from the land to a floating dock or vessel.
Primary function area	ADA definition for that part of a public accommodation housing its main public activities
Ramp clear width	The unobstructed area on a ramp, usually as measured between the two closest inside handrails.
Slip resistant surface	A surface specifically designed to prevent passengers and crew from slipping, especially when it is wet.
Stability	The characteristic of a floating structure (vessel or dock) to remain upright in the presence of externally applied forces, such as wind, waves, shifting loads, etc.
Stable approach	Relative to the passenger loading platform or vessel, the last non floating structure, including land, that passengers access on their way to the boat.
Sub-Chapter T vessels	Passenger vessels under 100 gross tons and carrying fewer than 150 passengers.
Sub-Chapter H vessels	Passenger vessels over 100 gross tons carrying any number of passengers.
Sub-Chapter K vessels	Passenger vessels under 100 gross tons and carrying more than 150 passengers.
Takeoff and landing points	Points at which the gangway or ramp connects to the marine facility and the vessel deck.
Tidal	Related to the periodic rising and falling of waters.
Tidal cycles	The regular and predictable occurrence of low and high tides.
Tidal range	The predictable normal difference between low and high tides.
Transition plate[1]	The element connected to the end of a gangway or ramp which provides access from the end of the gangway or ramp to a level surface. The slope of the transition plate depends on the relative position of the gangway or ramp with the level surface. Transition plates are typically 3 feet in length or less.
Unassisted access[1]	The accommodation over a path of travel enabling access for persons with disabilities without the assistance of another person, except at those points and under those conditions under which individuals without disabilities would be in need of assistance from another person.
Vessel deck	For purposes of access from the shore, the deck of the passenger vessel designated for embarkation and disembarkation.
Water sheet	The horizontal surface area of the water available for maneuvering and docking or mooring at a shore facility.

1. The source for all or part of the definition of this term was the Massachusetts Architectural Access Board's Draft Regulation published in December 1994.

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1. EXECUTIVE SUMMARY

This report, prepared on behalf of the Office of Environment, Energy, and Safety, Office of the Secretary of Transportation (OST) and the Architectural and Transportation Barriers Compliance Board (ATBCB), is an assessment of the feasibility of implementation of the Americans with Disabilities Act of 1990 (ADA) in the passenger vessel industry. The results are findings on technical feasibility and a set of cost data based on assumed access solutions. This exploration of implementation issues will be, in part, the basis for future decision making by OST in the matter of access to waterborne transportation and accommodation assets.

This document was preceded by the "Interim Report: Approach and Methodology" dated 1 October 1995, which established the approach for the cost analysis, the technical, economic, and social factors considered, and the assumptions for developing unit costs and applying them to the industry.

The scope of the cost calculations includes new construction and alterations for the Coast Guard inspected passenger vessel fleet, and access provisions to the vessels over the piers and docks serving the fleet. It does not include foreign flagged cruise ships at this time. Neither are terminals and other associated shoreside facilities included as they are already subject to ADA regulations for transportation terminals. Recommendations for additional future research are found at the end of the report.

1.1 APPROACH

The calculations include only the costs of implementation, i.e., capital and operating expenses and revenue impacts. The benefit of providing a civil right cannot be quantified, especially in the larger sense of the improved quality of a barrier-free society. The industry may realize benefits due to increased business from persons with disabilities, insurance premium reductions, and reduced employee injuries, but data from analogous access upgrades to quantify this are not available.

The approach characterizes, by type, the numbers of vessels and shore facilities to find the costs associated with compliance based upon assumed sets of access solutions. Unit costs reflect the *access premium*, that is, the increased cost of providing access relative to current practice. The industry implementation costs are scheduled based upon analysis of fleet growth and replacement rates (from 25 to 40 years), and an assumed replacement/upgrade of the existing dock and pier population within 40 years.

The access solutions do not anticipate all outcomes but were developed as widely applicable and practical designs for an industry uniquely diverse among the transportation modes, both in its services and its physical assets. The solutions also take account of the interactive complexities of ADA.

1.2 ACCESS ISSUES

A lot of good faith effort has been made by some operators to provide access accommodations. Their knowledge of ADA is weak, however, since no regulations for vessel access have been issued. This study proposes access solution sets to be flexibly applied to a very diverse industry, since vessel size or function may present difficult technical problems and because previous ADA statutes and regulations have defined areas where access specifications may be relaxed. There is precedent for this approach, which is critical for a reasonable application to marine transportation.

1.2.1 Fleet

Multi-deck access for wheelchairs is the critical issue, from the standpoints of cost, safety, and operations. The study finds that elevators or lifts are feasible for most multi-deck vessels, but that lift technology needs improved capacity and better availability to the marine market. Integration of these features in new vessels will be a matter of good design practice. Elevator and lift retrofit on existing vessels, more difficult and costly than for new construction, is assumed for major alterations of larger vessels only.

Other access features include unisex heads (rest rooms), doors and passageways, signage and alarms, wheelchair tiedowns, and improved food service. These can be incorporated with ease in new designs, with a cost premium mainly for added space and weight. Retrofitted access features for vessel alterations may be smaller in scope, but can carry proportionally greater costs because of the difficulties encountered with modifying tightly arranged existing compartments.

1.2.2 Dock and pier

The solutions developed for access from the shore over docks and piers account for manmade and environmental height barriers for wheelchair passage along that path of travel. Features for other disabilities are considered in the cost calculation, but are small items relative to solving the wheelchair barriers. This study proposes five practicable and widely applicable access solutions which include extra long gangways, fixed intermediate ramps, extra floating docks, and accessible gangways to the vessels' decks.

1.3 DATA ISSUES

Available industry data lacked in several key areas and was "pushed" to develop the schedule for industry implementation. On the vessel side, the study first develops a detailed snapshot of the current passenger vessel fleet based upon Coast Guard data. The determination of vessel service life values and replacement rates is based on limited available historical data and evidence from industry. An overall fleet growth projection of zero is used, based on Coast Guard and Army Corps of Engineers data.

Industry-wide shore facility population data are very weak, except for the ferry lines. Those data available were augmented by site visits and empirically linked to the vessel population to

produce a national model. Industry-wide growth projections for shore facilities are also assumed to be zero because 1) available fleet data show no overall growth trend, and 2) shore facility data to support a growth assumption do not exist.

1.4 RESULTS

Costs are found using current Office of Management and Budget (OMB) guidance for nominal and real interest rates, assuming 1998 as the start year for implementation and present valued to 1996. The calculation of the impact costs focuses on societal cost, which is the value to society of lost or diverted resources. These include capital outlays for access on new and modified assets and increased operating costs associated with the access features; they are calculated in a forty year cost stream and the present value found at a 4.9% real discount rate. Amortization of capital outlays is not included.

The industry implementation costs are separately calculated for the fleet and shore sectors. The total societal cost for both sectors is estimated from $428.7 million to $502.6 million.

1.4.1 Fleet societal costs

The cost for phasing in an accessible fleet follows from a single set of assumptions derived from a high-confidence set of population data. Table 1-1 shows the results, sorted by Coast Guard regulatory category (in descending order of vessel size) and between new construction and existing vessel alterations. Total societal costs for the fleet are calculated at $396.7 million, including $33.2 million for technical and sensitivity training for industry personnel.

Table 1-1
Fleet sector societal costs ($millions), 1996 present value

Vessel type		Capital	Fuel	Maintenance	Revenue	Total
H	New construction	$11.1	$2.6	$2.0	NA	$15.7
K	New construction	$27.8	$22.3	$6.5	NA	$56.6
T	New construction	$74.8	$33.6	$9.2	NA	$117.6
Total	**New construction**	**$113.7**	**$58.5**	**$17.7**	**$0**	**$189.9**
H	Alteration	$10.5	$2.1	$2.1	$13.3	$28.0
K	Alteration	$21.2	$7.1	$3.0	$38.7	$70.0
T	Alteration	$22.9	$1.8	$2.2	$48.7	$75.6
Total	**Alteration**	**$54.6**	**$11.0**	**$7.3**	**$100.7**	**$173.6**
TOTAL	**FLEET**	**$168.3**	**$69.5**	**$25.0**	**$100.7**	**$363.5**
TOTAL	**Plus training**	**$33.2**				**$396.7**

1.4.2 Shore access societal costs

Shore-to-vessel access costs are calculated separately for ferry terminals, because of known population data for that particular sector, and non-ferry facilities, for which two assumed facility/vessel ratios are used. Three distributions of high and low cost access solutions are used for both population sectors, since data on hydrographic features is scant. The calculation considers only capital costs phased in over 40 years. The range of societal costs is $32.0 million to $105.9 million.

Table 1-2
Terminal access societal cost summary, 1996 present value ($millions)

Vessel type/ cost distribution	Facility/ vessel ratio	H/K facilities	T facilities	Total
Ferry low	0.91	$4.1	$1.9	$6.0
Ferry medium	0.91	$6.8	$3.2	$10.0
Ferry high	0.91	$9.5	$4.5	$14.0
Non-ferry, low	0.33	$4.5	$21.5	$26.0
Non-ferry, med.	0.33	$7.4	$32.6	$40.1
Non-ferry, high	0.33	$10.4	$45.6	$56.0
Non-ferry, low	0.55	$7.4	$35.8	$43.3
Non-ferry, med.	0.55	$12.4	$54.8	$67.2
Non-ferry, high	0.55	$17.4	$74.5	$91.9
All facilities, low		**$8.6**	**$23.4**	**$32.0**
All facilities, high		**$26.9**	**$79.0**	**$105.9**

1.4.3 Other cost bases

The body of the report also has calculations of the "business" cost, which is the same as societal cost but includes the expense of amortizing capital outlays. Amortization is at a 7.9% nominal discount rate, also present valued to 1996. The total business cost is estimated from $483.6 million to $573.9 million. The "actual" cost is a simple total of the cost stream with no present value discounting; its total is estimated from $968.4 million to $1.15 billion.

A detailed business cost summary for the vessel access sector appears in Table 5-22; Tables 7-6 an 7-7 contain the data for shoreside access.

1.4.4 Scenarios

A brief study of the impact on five fictional small operators shows that some would bear potentially large expense for providing accessible vessels and docks. The fictional operators of fishing and commuter boats, which don't need elevators or lifts, would face relatively low business expenses of $37.5K and $20.8K, respectively. Three other fictional operators, each with two ferries or excursion boats, would incur present value expenses from $358K to $787K.

2. INTRODUCTION

The ADA was signed into law in 1990. Six years later, the impact on the passenger vessel industry is unclear as no regulations have been developed for that mode of transport. This may be partly due to the fact that marine transportation is the "forgotten stepchild" among the major modes. However, the marine industry's unique missions and operating environment and the difficulties of applying ADA's various titles thereto are probably a better explanation for the slow pace of implementation.

The original act defined lines of applicability in five Titles, none of which made use of the words "vessel", "boat", or "ferry". Three Titles affect the passenger vessel industry: Title I (employment opportunity), Title II (program access and public transportation), and Title III (public accommodations and public transport). Title II applies to the public sector and Title III to the private sector. Both present a dual regulatory format, broadly dividing public agencies and private businesses into two groups: (1) those providing "public accommodations" as "facilities", and (2) those providing "public transportation" by "vehicles"[1].

While most entities must comply with either Title II or III, this is not the case for many passenger vessel operators, who may have to comply with both. The industry is subject to both sets of ADA regulations with the additional challenge of existing Coast Guard regulations.[1]

Passenger vessel operators have been subject to some general provisions of ADA since its passage, that is, the broad anti-discrimination language and the requirement to make "readily achievable" and "reasonable accommodations", within limits proscribed by health and safety risks and "undue burden".

2.1 GOVERNMENT ACTIONS

The OST has been given the lead in the investigation of access for persons with disabilities on passenger vessels. Background work was conducted by the Urban Harbors Institute (UHI) of the University of Massachusetts, Boston[2] for the Federal Transit Administration (FTA). The UHI conducted two seminars for affected parties and completed a report highlighting the concerns of the stakeholders and the safety and regulatory questions implied by the ADA. The report did not identify a set of marine transportation access requirements or any associated cost impacts.

Shore facilities access has been examined by the Recreational Access Advisory Committee of the United States Architectural and Transportation Barriers Compliance Board. The Committee developed a flexible access regime for recreational boating and fishing facilities and proposed a new section in the ADA Access Guidelines (ADAAG) for such unique features as gangways from dock to vessel[3]. The State of Massachusetts completed a study and a negotiated regulation process titled "Marine Facilities Access" in 1992[4].

The Coast Guard has an advisory role relative to passenger safety issues for ADA and the existing requirements of the Shipping Chapters of the Code of Federal Regulations (CFR). Coast

Guard Headquarters and the Marine Safety Office (MSO) field units have also assisted in preparation of this report by providing vessel data for the fleet characterization.

The Coast Guard has also sponsored a study by students of the Worcester Polytechnic Institute (WPI) to rank, in order of feasibility and benefit, several access accommodations on new passenger vessels[5]. They found that crew training, onboard ramps, signs and alarms, and accessible rest rooms were practicable and that elevators, 1:12 boarding ramps, and emergency equipment were less so. In the latter cases, the effects on small boat designs were given strong consideration.

A recently published interim final rule overhauls the Coast Guard's inspection and certification requirements for small passenger vessels. The rule acknowledges the potential impact of ADA on the passenger fleet, but does not address ADA compliance. The Coast Guard's response to pertinent comments in the docket is that they will work with the Department of Transportation to study the feasibility of ADA implementation[6].

State and local public sector entities, such as the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority and the City of San Francisco, have developed marine access standards[7, 8]. We have incorporated some aspects of these documents in the access solutions proposed herein.

The Volpe Center chaired an Internal Working Advisory Group (IWAG) made up of government, industry, and advocacy representatives to steer some aspects of the cost study. They were assembled for their advice and comments on the direction of the impact study, although not necessarily to achieve consensus views. The Group met on March 23, 1995 and later reviewed the interim report; the approach used here reflects their comments.

A working meeting was held on April 15, 1996 among representatives of the passenger vessel industry, government, and national advocacy groups to consider in depth the safety and technical issues of access onboard passenger vessels. The findings of that group are included in several portions of this report, including the recommendations sections where the needs for future work are identified. The agenda and minutes of that meeting appear as Appendix I.

2.2 Industry Activities

Passenger vessel operators have, on the whole, been slow to provide this access to their businesses, in good part because the Government has not begun a topical rulemaking process. There have, nonetheless, been many efforts to improve access using "readily achievable" modifications and, particularly among publicly operated services, to make substantial investments in access accommodations in both new and existing vessels and facilities.

Dock access modifications and onboard accommodations are appearing on a steadily increasing number of waterfronts and vessels, mostly associated with large ferries, leisure cruise and gaming boats. Several ocean-going cruise ships offer full access and berthing arrangements to persons with disabilities[10]. The smaller vessels and operators, however, tend to have more

limited resources-- as well as more daunting size-related technical problems-- and have not moved as quickly to upgrade their facilities.

2.3 The Industry and ADA

The passenger vessel industry is notable for its great variety of services, physical assets, and operating environments. The challenge of providing access includes understanding the provisions of ADA for different types of public facilities.

The spectrum of passenger vessel types and designs is almost limitless, including large cruise ships, small charter fishing vessels, historical replicas, and state-of-the-art high speed craft, among many others. The variety of designs-- the term "custom built" applies to a large number of these vessels-- and services sets passenger vessels quite apart from other modes such as air and rail, which offer more narrowly focused transportation services within much more severely proscribed design limitations.

Similarly, docks and piers are constructed in a wide variety of sizes and shapes to serve the many vessel types, under diverse sets of site constraints such as available watersheet, tides, currents, and shoreside features.

The application of ADA will, generally, include the provisions for public transport and public accommodation. These definitions and the rationale for access solution sets for vessels, docks, and piers are given in Chapter 3 "Approach". Chapters 4 and 6 describe the particulars of the solution sets, while the unit and industry costs are found in Chapters 5 and 7. Chapter 8 shows the results of several cost scenarios developed for fictional small business operators. Chapter 9 is a brief technical treatment of the effects of elevator installations on vessel stability. Chapter 10 addresses additional matters such as qualitative assessment of benefits and implementation issues, and Chapter11 is a brief compendium of conclusions and recommendations.

3. APPROACH

3.1 SCOPE

The cost impact study consists of onboard and dockside access elements. Vessel onboard access accommodations for both new construction and alterations are determined for the fleet during the phase-in period, which reflects estimated fleet replacement rates. Dock and pier access costs are calculated over the same phase-in period, on the assumption that ADA path-of-travel requirements will cause upgrades of access from shore facilities.

The results will be unit costs for sample vessels and dock facilities, and the cost of the industry implementation, referring to the cost of inaugurating new services and products throughout the industry. Several scenario costs are estimated for fictional small operators.

The study does not consider the cost impact of "readily achievable" access modifications to existing assets under ADA, as such accommodations are already required, and in many cases already completed. In addition, implementation of this vague requirement is not easy to gauge within the great variety of the industry.

3.2 GENERAL

The study addresses only the projected costs of ADA implementation. The benefits, and therefor the cost-benefit ratios, are not calculated for two essential reasons. First, the civil rights afforded by ADA provisions of access and mobility are not calculable benefits. Second, those aspects of accessibility which can be perceived to offer tangible benefits, such as ridership increases or reduced liability, cannot be supported by solid data at this time. A more detailed discussion of this issue appears in Section 9.1.

A spectrum of full access solutions is instead advanced for the purpose of finding the cost to implement the rights to access and mobility guaranteed by ADA. The practicability and acceptability of these solutions has been tested by field work, and contacts with industry and disabilities advocacy representatives.

The costs to be calculated are:

- **Capital costs** associated with the installation of accessible accommodations at dock and pier facilities and for the new construction and retrofitted access features during major alterations of vessels.
- **Operating costs** expected for such items as increased fuel consumption by heavier vessels, and maintenance of new equipment.
- **Revenue losses** due to onboard capacity lost to provide space for accessible accommodations. This applies to vessel alterations only, where available passenger space is a given and lost area will result in real passenger capacity reductions. For new construction, it is assumed that owner-specified capacities will be met and that

access accommodation costs will be strictly a matter of capital costs and operating costs associated with added vessel weight.

- **Personnel training costs** for awareness, sensitivity, assistance techniques and technical matters (i.e. handling of wheelchairs).

3.2.1 Methodology

The following steps were taken to determine the costs of access. Sub-heads indicate tasks specific to either passenger vessels or shore facilities.

- ***Characterize affected populations by type and age.***
  - ***-Passenger vessel fleet***
  - ***-Vessel life expectancy, build rates, and frequency of alterations in the passenger fleet***
  - ***-Dock and pier facilities population snapshot***
- ***Identify physical barriers to access***
- ***Identify constraints to solutions unique to the marine environment***
- ***Develop access solutions***
- ***Calculate unit costs***
  - ***-Sample vessels for calculation of unit costs***
- ***Calculate costs to industry implementation***
  - ***-Linking of solutions to affected populations***

3.2.2 General considerations

The following are the baseline conditions and assumptions of the analysis:

- **Access standards**-- ADA Accessibility Guidelines (ADAAG)[10] are used as the standard for full access. ADAAG deals primarily with mobility, sight, and hearing impaired people. Onboard capacity of persons with disabilities as a function of total capacity will follow the guidelines for reserved parking space densities. Some modifications and exemptions to the guidelines are suggested as a result of limiting factors; development of new standards was not however a goal of the study.
- **ADA applicability**-- This study addresses Titles II and III of ADA, Public Services (including "public transport") and Public Accommodations. Title I, covering employment opportunities, and other legal civil rights matters under Title IV are not included.

  The study determines unit costs and industry implementation costs for new construction and alterations of vessels, and the access premium for upgrading the modeled dock and pier population. Application of ADA "alterations" language to vessels is assumed to cover modifications to "primary function" areas, that is the part of the vessel housing the main public activities.

- **Economic factors**-- The study used current OMB guidelines[11] for real discount rate (4.9% for 30 year or greater terms) and nominal discount rate for amortized capital outlays (7.9%). Time duration of the analysis is based upon assumed vessel replacement rates, fleet turnover, and expected frequency of alterations. Implementation of dock access accommodations is assumed to be over the same period of time. The assumed zero year for implementation of regulations is 1998.

  The industry implementation calculations include society and business costs. For business costs, amortizations of capital outlays are included, whereas society costs count only absolute capital expenses.
- **Access solutions**-- Two sets of variegated access solutions are advanced, one each for onboard the vessels and for shore-to-vessel transition. They all provide full access but will offer the flexibility needed for a diverse industry. Previously developed public and private standards were also used for guidance, within the legal framework of ADA. See Section 3.3 for the supporting rationale and Chapters 4 and 6 for detailed descriptions of the access solutions adopted for this study. Design and engineering impacts are assessed.
- **Cost sampling**-- Representative unit costs are found in the field and the technical literature for both the passenger fleet and docks/piers.
- **Industry implementation**-- Cost for the industry implementation is based upon available fleet and port data. Coast Guard passenger vessel data from the Marine Safety Information System (MSIS) and a broad sampling of data from the Marine Safety Offices (MSO) fleets of responsibility are the basis of the nation-wide fleet characterization.

  Acquisition of national dock and pier facility data has proven difficult. The Army Corps of Engineers produces catalogs known as the Port Series[12] for many areas, but coverage is far from complete, especially for small passenger boat facilities. A complete ferry system data base compiled by Urban Harbors Institute for the FTA[13] and data gathered during field visits are extrapolated to the vessel fleet to complete a national population model.

3.3 Access Solution Sets

Passenger vessel operators occupy a unique niche in the transportation industry, providing a wide variety of services from basic A-to-B transit to a wide spectrum of leisure and entertainment activities. Many operators offer a mix of services, either on separate sailings or simultaneously. An approach of multiple access solutions is the reasonable and logical way to deal with the diverse vessel and dock populations in this sector. There is precedent for this approach, in the Federal Air Access Act regulations, the work of the Recreation Access Advisory Committee of the ATBCB, and in the draft Marine Facilities Access regulations developed for the Massachusetts Architectural Access Board[4].

3.3.1 Vessels

ADA treats vessel types according to several definitions. The primary distinction made by the Act in this arena is between "public transport" and "public accommodation". The meaning of the

former is straightforward-- transportation provided by public or private entities on a regular and continuing basis-- and may be directly equated with such vessels as ferries, commuter boats, and water taxis.

Public accommodation means private entities whose operations affect commerce; the relevance for passenger vessels appears to be in such "public gathering" activities as food service, entertainment, and recreation. Many vessel types are, therefore, subject to public accommodations provisions of ADA and may be subject to those of public transport as well.

ADA also draws certain distinctions between publicly and privately owned assets. Publicly owned services such as commuter ferries are expected to satisfy more demanding access standards for existing assets than private entities; there is, however, no distinction for new construction. There is, likewise, a public expectation that transport lines meeting the "fixed route" definition of regularly scheduled service, e.g. larger operations with printed schedules, will provide for access more quickly and effectively than "demand response" services.

Finally comes the marine environment in which passenger vessels operate. Weather and water create problems of motion, safety, reliability and maintenance, for both vessels and shore facilities. Addressing access needs in this milieu is the single, most unique, factor separating this industry from other modes of public transport and accommodation.

3.3.2 Docks and piers

The shoreside infrastructure presents a wide variety of construction and design types to meet the requirements of tide, current, vessel use, and space limitations. They are built to match vessels of varied size, service and number, to fit varied sizes of available "watersheet" (area available for docks/piers and vessel maneuvering), and to function in a great spectrum of coastal and inland settings. The basic engineering and design types are limited, but, in arrangement and accommodation details, their diversity nearly matches that of the vessel population.

3.3.3 Summary

The necessity of a multi-tiered access approach is compelling given the unique nature and wide variety of services in the passenger vessel industry. Two access solution sets are proposed, one for onboard accommodation and one for shore-to-vessel transition. These are based upon field visits and interviews as well as the input of the Internal Working Advisory Group.

The access solution sets are a well informed attempt to anticipate the regulatory standards for a complex industry. One size will certainly not fit all in the passenger vessel trade; a pragmatic approach allowing for varied access solutions is the most probable and logical outcome of the regulation. The cost impact is, therefore, calculated based upon a set of access models which sensibly provide achievable accommodations. The solutions are limited in number compared to the probable outcomes in the fleet, but result in representative unit costs for the population.

4. VESSEL ONBOARD ACCESS

The challenge of access for persons with disabilities on passenger vessels is obvious: there are intrinsically unique barriers in this transportation mode due to their function in a dynamic, waterborne environment. The approach to finding access solutions is the topic of this chapter, which follows the sequence laid out in Chapter 3. A characterization of the fleet population (4.1) is followed by discussion of barriers and constraints (4.2 and 4.3) and access solutions (4.4). The specific solutions for the selected sample vessels appear in Chapter 5 in the development of unit costs.

4.1 FLEET POPULATION

The analysis includes all passenger vessels inspected by the Coast Guard under Subchapters T and H of Title 46 of the CFR; foreign flagged cruise ships operating in the United States are not included at this time. This industry is contesting the jurisdiction of the United States Government as regards ADA; visits to representative terminals and ships were not possible.

A pending Coast Guard rulemaking suggests a new regulatory structure for passenger vessels which would establish T, K, K' and H classes, roughly in increasing order of size and passenger capacity[13]. Although fleet population data currently available are sorted according to the existing regulatory framework, the fleet is characterized according to the new regulations (T, K, and H) which will be in force for the foreseeable future.

4.1.1 Approach to fleet characterization

The Coast Guard proved to be the only source of available fleet-wide data, both through the Headquarters inspected vessel data base and the knowledge of field inspectors in the local Marine Safety Offices (MSOs) (see Appendix A). A data base specific to ferry systems was recently developed for the Federal Transit Administration by the Urban Harbors Institute[12].

The cost calculations require a rather detailed characterization of the present-day passenger vessel fleet, sorted both by Coast Guard's defining regulations and the access categories found in ADA. The latter requires more specific knowledge of vessel use than is of normal interest to the Coast Guard and, therefore, is not reliably found in their data base.

The approach is:

- Obtain global regulatory definition data from Coast Guard Headquarters.
- Gather vessel use data by queries to selected Coast Guard field offices.
- Extrapolate vessel use data to the known global population.
- Sort vessel uses by ADA definitions of "public transport" and "public accommodation".
- Compare Urban Harbors Institute national ferry data to extrapolated Coast Guard data to test the latter's validity relative to one service segment of the fleet.

- Calculate service lives for Subchapters T, K, and H vessels using fleet age data and apply uniformly to all service types within those groupings.

Coast Guard regulatory definitions The existing 46 CFR Subchapters T (subdivided into small and large) and H define classes according to size and capacity and specify certification requirements, operations, and safety standards for construction, fire protection, lifesaving and other systems. The proposed Subchapter K creates a new group of small vessels with high passenger capacity. Definitions of inspected classes follow:

Existing regulations	Proposed regulations
T-S (small)-- vessels under 100 gross tons and 65' or less carrying more than six passengers	**T**-- vessels under 100 gross tons, carrying 150 or fewer passengers
T-L (large)-- vessels under 100 gross tons and longer than 65' carrying any number of passengers	**K**-- vessels under 100 gross tons, carrying more than 150 passengers
H-- All passenger vessels of more than 100 gross tons	**H**-- All passenger vessels of more than 100 gross tons

One assumption for data analysis is necessary to bridge the gap between the existing and proposed Coast Guard regulations: T-S vessels are correlated with new Subchapter T boats and T-L to new Subchapter K. While the definitions do not correlate well (from vessel length to passenger capacity), the numerical comparison was tested (Section 4.3.3) and found to be valid for purposes of characterizing the affected population.

4.1.2 Exceptions

The bounds of the study except several vessel types, which are small segments of the fleet population, for the purpose of simplifying the approach to a first order cost estimate. These exceptions are not on the basis of merit relative to ADA; the reasons for each case follow below:

- Nautical school vessels (Subchapter R)-- not publicly available as "for hire", e.g. military and merchant marine academy vessels.
- Industry crew boats and offshore supply vessels-- not publicly available.
- Cargo vessels carrying limited numbers of passengers for hire-- not inspected as passenger vessels by Coast Guard.
- "Six packs", small vessels carrying six or fewer passengers-- not inspected as passenger vessels by Coast Guard.
- Vessels preserved for historic value-- it is usually not feasible to provide access without threatening or destroying historical significance (the relevant citation is Department of Justice (DOJ) regulation 28 CFR Part 36.405). Access provision will be unique on each of these vessels, and non-quantifiable for these purposes.
- Passenger submarines-- special separate provisions for safety and access need to be developed for this newly emerging class of passenger vessels.

The study also does not include passenger vessels that operate on non-navigable waterways and which are inspected by state safety authorities rather than the Coast Guard. It is recognized that these may represent hundreds of vessels, but gaining access to and acquiring the needed data from many different authorities was judged an inappropriately large task within the scope of the project.

Gaming boats will be included in the new construction cost calculation, despite the volatile and uncertain growth patterns. Gaming vessels are high-capital ventures in which no expense has been spared to provide easy and comfortable access for players of all ages, often as a requirement of state regulatory authorities, which treat the vessels as floating buildings. Indeed Coast Guard inspectors have observed that all gaming boats have come into service with full access, including elevators.

4.1.3 Fleet data

Coast Guard Headquarters and the Marine Safety Offices (MSO) were canvassed for passenger fleet data. The input from MSO field inspectors is summarized in Table 4-1 (existing Subchapter classes) as a snapshot characterization of the inspected passenger carrying fleet, including only those vessels in the fleets of responsibility of MSOs which answered the data call. It is roughly half complete, including representative areas from the Atlantic, Pacific, and Gulf coasts and inland waterways. These data may be confidently extrapolated to the entire fleet.

Data from the Headquarters Marine Safety Information System (MSIS) yielded global fleet distributions, presented for comparison's sake as the bottom row of Table 4-1. Note that the MSIS data includes all vessels, without the service data obtained from field units. Table 4-2 shows the MSO fleet data extrapolation (ratio and proportion to global fleet population relative to MSIS) which will be used for cost implementation. It indicates the correlation between new and existing Coast Guard classifications, as well as applicable ADA use definitions.

Data checks The data extrapolation indicates a valid sampling of vessel service information from the Coast Guard MSOs. The acquired data accounts for 52.7% of the national fleet; the global/sample ratio is 1.895. The component ratios for T (T-L and T-S) and H vessels are 1.894 (nearly identical to global) and 1.961, respectively. These factors are used to extrapolate the detailed fleet characterization from Table 4-1 to Table 4-2. The Subchapter H sampling is within 3.5% of global and, therefore, valid. The only independent comparison available for a particular vessel service is the Urban Harbors Institute ferry systems report. They found, among the responders to their questionnaire, the following:

- 168 ferry systems operating 391 ferries, excluding 73 of the barge type.
- 97 Subchapter H ferries.
- 142 Subchapter T ferries carrying more than 150 passengers (i.e. future K vessels).
- 152 T ferries carrying 150 passengers or fewer (i.e. future T vessels).

Table 4-1
Subchapter T and H fleets
(MSO data)

	Subchapter H	Old Subchapter T	T-L	T-S
Dinner/excursion	5	300	213	87
Ferry	48	163	81	82
Gaming	29	15	15	0
Cruise	1*	15	1	14
Whalewatcher/ sightseeing	15	476	20	456
Commuter boat/shuttle	0	233	0	233
Fishing/dive	0	1471	47	1424
Sailing	0	57	xxx	xxx
Other	8	208	xxx	xxx
TOTAL MSO	**106**	**2938**	**377**	**2296**
MSIS global	**205**	**5565**	**xxx**	**xxx**

Table 4-2
Extrapolated Fleet Population

	ADA Use	Subchapter H	Old Subchapter T	T-L (New K)	T-S (New T)
Dinner/excursion	Accomm.	10	568	403	165
Ferry	Transport	93	309	153	156
Gaming	Accomm.	56	29	29	0
Cruise	Accomm.	2*	29	2	27
Whalewatch/sightsee	Accomm.	29	902	38	864
Commuter /shuttle	Transport	0	441	0	441
Fishing/dive	Accomm.	0	2785	88	2697
Sailing*	Accomm.	0	108	0	108
Other	xxx	15	394	55	339
Total		**205**	**5565**	**768**	**4797**

*Sailing vessels are assumed to all be in proposed Subchapter T, i.e. <150 passengers

The Urban Harbors Institute data validate two key points in our treatment of available Coast Guard data:

- The extrapolation of service types to global MSIS data tracks well for ferries, since all values are well within 10% of Urban Harbors Institute's findings.
- The assumption that T-L vessel numbers will correlate with the future Subchapter K population works well for the ferry population. It may reasonably be extended to other types.

4.2 Access Barriers

Access onboard a passenger vessel is comprised of the same generic issues as in any other venue. Rather than reiterate ADAAG requirements, this study identifies the unique aspects of marine access as cost factors to be included in a total cost calculation. Access requirements are categorized by mobility, safety, and amenities.

The primary issue is access for people in wheelchairs and those with other mobility impairments, both from cost and technical viewpoints. Access barriers for the sight- and hearing-impaired can be solved by more routine improvements; nonetheless these cost factors must also be addressed.

4.2.1 Wheelchair access

The most obvious, and difficult, barriers to overcome relate to the mobility, safety, and amenities for people in wheelchairs. The deck arrangements and safety features, particularly on smaller vessels, pose an array of problems. Skillful design on new construction vessels will solve many, while retrofit for alterations can have a larger impact.

Mobility Barriers commonly found onboard are the following: transition from dock or gangway at the deck edge, adequate passageway width (especially on small vessels), door widths, door sills, door opening arrangements, and access between decks.

Safety The attitude (still water condition) and motion of a passenger vessel will have a singular effect on a person in a wheelchair. Tiedowns and deck fittings are required. Crew training for evacuation and other assistance must be provided, covering all types of disabilities.

Amenities The heads (bathrooms) on passenger vessels are usually non-accessible, particularly on smaller craft. Food service arrangements, i.e. bar heights and chairless tables, are often lacking. There may be additional need to adapt amenities, particularly on "event" vessels such as gaming boats and tour boats.

4.2.2 Sight and hearing impaired access

Safety issues are paramount for the sight and hearing impaired. Mobility requirements are low impact, including such safety measures as tactile strips, Braille signage, and limitations on projections into passageways. Amenities such as reading cards or tapes for certain "event" vessels may be needed but are not specifically considered herein.

Safety Most vessels lack tactile hazard indicators and Braille signage for the blind. Audible and visual emergency alarms must be provided.

4.3 CONSTRAINTS ON SOLUTIONS

The design and operation of passenger vessels are driven by their unique environment. The safety of crew and passengers depends upon a stable and watertight platform and a robust structure capable of responding to dynamic loads and sustaining damage from collisions and groundings.

Space is critical on many designs, particularly on high-density craft where passenger capacity is determined by available seating. The impact of ADA space requirements varies with the Coast Guard per passenger space minima. 10 ft^2 per capita area is the most commonly used, but high passenger density craft need only 3.75 ft^2/seat.

Constraints arise mainly in regard to access for the mobility-impaired. Access is constrained by vessel safety features such as door arrangements, deck fittings, and cambered decks, as well as space restricted passageways, heads, and other passenger service spaces. Access features for the sight- and hearing-impaired are not substantially constrained by marine design practices. The ADAAG specifications include provisions on passageway clearances for the safety of blind people. The designer should consider these as part of the overall accessible passage configuration, whose primary purpose is for wheelchairs.

4.3.1 Safety

The approach to safety is in the context of Coast Guard regulations. The costs of those ADAAG specifications which exceed Coast Guard standards (e.g. passage width and door sills) are calculated; others are subsumed by regulations which exceed the access requirements.

The solutions herein are based on the best currently available solutions and information. The Coast Guard has suggested that a hazard analysis is necessary to address all access safety issues. Such an analysis might show different or additional safety solutions and may be a valuable follow on effort to this study. The following are the specific items considered for this study:

Doors and sills Several operators and Coast Guard personnel have pointed out the access problems arising from the narrow widths, high sills, and large opening force required for marine service doors, particularly watertight and weathertight doors. For the cost estimates, we assume that width requirements must be met, but that the safety provisions of sill heights and closing forces cannot be overridden by the ADAAG. Good detail design practice will solve the sill

ramping problem. The operation of some doors however may require power assist or crew assistance.

Passageways The ADAAG specification for aisle/corridor widths, turns, etc. exceeds Coast Guard requirements. Passageways on most larger vessels that were observed satisfy ADAAG, but this is not the case on small vessels. Designers will provide proper passageways for new construction of almost any type, with possible exceptions among the smallest vessels. Retrofits for alterations will be problematic on many small passenger vessels and some leeway for exceptions and equivalent facilitations may be necessary.

Elevators and lifts Installation of elevators for multi-deck access is attended by two major regulatory issues, stability and fire protection. The added weight and vertical moment of an elevator can have serious impact on the intact and damage stability characteristics, especially in the case of a small vessel.

Elevator shafting must satisfy Coast Guard fire protection regulations since deck penetrations cross "fire stopper" and weathertight boundaries. These and other installation requirements (power, controls, etc.) will be addressed in greater detail in the final cost calculations.

Elevators are subject to approval by the Coast Guard, by the American Bureau of Shipping or other classification society, if the vessel is classed for insurance purposes, and sometimes by state authorities. For example, the Illinois gaming boats' elevators were built to landside specifications and approved by the Coast Guard after weight testing. New technologies, including hydraulic and screw-column elevators, may become available, limiting the impact of shipboard elevator installations. The cost basis for this study is for conventional overhead lift types as seen in the field.

Stair lifts have been used with mixed success in some passenger vessels. Installation requires power, rails in the stairwell, storage space for the lift, and adequate stairway width for normal egress. In addition, an extra stairwell may be required to satisfy egress requirements. An emergency situation involving loss of power while the lift is in transit in the stairway can cause a serious safety problem. Stair lifts, unlike elevators, are not "universal use" and can attract undue attention to the user. Use of lifts is assumed on portions of the small boat sector in the cost model, but there is a need to define the limited situations in which lifts would be permissible since ADAAG restricts their use.

4.3.2 Engineering

Most significant issues arising here relate to elevator installations. The vessel's intact and damage stability characteristics must be maintained within specified limits under the influence of substantial added mass which is often "high weight". Power requirements may dictate a larger auxiliary electric plant onboard. Regular maintenance of the system will be required.

Weight is added both for new access components and because of the extra space needed for access accommodations, resulting in vessel speed losses and/or increased power requirements.

Main power plants will use more fuel and, in some cases, require extra maintenance. The stability aspect of added weight due to elevators is explored in Chapter 9, through the use of five sample passenger vessels.

4.3.3 Space requirements

The accommodations for wheelchair access taken together can require considerable deck area, with two implications. The first is that added space for new construction means added weight. Secondly, there is a revenue premium if passenger accommodation spaces are reduced, as in the case of alterations to existing vessels.

4.3.4 Egress and evacuation

The Coast Guard and some operators have expressed concern on the efficacy of emergency evacuation of persons with disabilities. Their concern is twofold: 1) safety of passengers of all abilities; and 2) the costs of added accommodations, if necessary, for egress of persons with disabilities.

Safety must be viewed both from the standpoint of existing and pending lifesaving requirements (found in 46 CFR Parts 75 and 180 and the international Safety of Life at Sea Convention (SOLAS)) and the fast evolving evacuation technology. The CFR and the interim rule cover lifesaving appliances, evacuation routes, and crew training requirements, and requires lifeboats, liferafts, or lifefloats for Coast Guard inspected vessels on sliding scales tied to vessel size, passenger capacity, and service area. All passenger vessels must provide Type 1 lifejackets for 100% of the people onboard.

Current practice and the regulations provide that crew training and lifesaving appliances will effect proper evacuation of all passengers, including the elderly, injured and persons with disabilities. While some operators request an able-bodied companion to accompany and assist each person with a disability during the trip, crew are required by statute, and bound by maritime tradition, to safely evacuate all passengers in cases of emergency. This study could not identify any appliances specially provided for use by persons with disabilities.

The regulations require adequately sized and protected egress to muster areas or locations where lifejackets are available. Vessels built to accessible standards will of course have proper corridor and door design, but assistance for movement between decks will be necessary (elevators/lifts not available). Crew on any vessel will assist entry into available lifeboats or liferafts. If passengers must enter the water, they will all wear Type 1 lifejackets, which are designed to float persons face up and should preserve even persons with severe disabilities. Crew manning requirements relative to the number of boarded passengers with disabilities have not been addressed at this time due to lack of data and experience.

No additional cost is assumed to accrue due to the evacuation requirements for persons with disabilities, because both existing and new emergency procedures must intrinsically account for all passengers, including those injured during casualties and those with disabilities, that is, they

have a significant element of "universality". It is clear that providing accessible egress from within the vessel to muster or lifejacket storage areas is the most important design issue, and that crew training and evacuation procedures are the critical pieces for safe evacuation in an emergency.

4.4 Access Solutions

The previously described diversity of the inspected passenger fleet leads to a consideration of how to provide access thereto without using a rigidly applied standard. The solutions must account for vessel construction and compartment arrangements while satisfying the legal standards of ADA.

4.4.1 Affected vessel population

For purposes of the study, new construction and retrofit are separately considered and are defined as follows:

- ***New construction:*** Keel laid on or after assumed effective date of new regulations of 1 January 1998.

- ***Alteration:*** Alteration undertaken on or after effective date of 1 January 1998. The study will not include "readily achievable" access features on existing vessels and will limit its consideration to large "primary function" alterations, that is alterations to those parts of the vessels housing their main public activities.

According to ADA, alterations to the "primary function area" of an establishment trigger an additional requirement to provide an accessible "path of travel" to the primary function. This kind of alteration involves significant cost, occurs with predictable frequency, and implies a reasonable limit on the number of unit cost calculations needed for the cost model. Smaller alterations such as in-kind component replacement are too varied, numerous, and unpredictable to measure. In any event, they are already covered by the general access provisions of ADA and likely involve minimal cost premiums.

DOJ regulations, 28 CFR Part 36, define alteration as any "change...that affects or could affect usability of the building or facility or any part thereof." and except "normal maintenance, reroofing, painting or wallpapering, asbestos removal, or changes to mechanical and electrical systems" which do not "affect the usability of the building or facility." DOJ requires that any alterations meet the ADAAG to the maximum extent feasible.

4.4.2 Description of access solutions

A set of full access solutions is proposed to deal with the spectrum of passenger vessel types and sizes, both for alterations and new construction. The extent of access varies due to physical and

practical limitations of the vessels. Specific requirements for access accommodations (Table 4-3) are based upon observation of vessels and facilities designed or modified for access for persons with disabilities, and practical application of the ADAAG. The following are the proposed solutions:

- ***Access 1***-- All passenger areas of all decks accessible in accordance with the ADAAG, for mobility, sight, and hearing impaired people. This includes passage widths and slopes, elevators or lifts to all decks, accessible heads, signage and alarms, food service accommodations, and tiedowns for wheelchairs.
- ***Access 2***-- Full access accommodations and passenger services provided to the extent available to all passengers, on at least one deck. Access features on a single deck will most often result, except when other amenities, for example access to open deck, are only available on another deck.
- ***Access 3***-- Access accommodations, including passage size, accessible heads, signage and alarms, and food service, provided on one deck. "Equivalent facilitation" on that single deck may substitute for some services available on other decks. Multi-deck access is not required since this solution applies only to alterations of small (T) boats, where technical and cost impacts are likely to be much more burdensome.
- ***Access 4 (T fishing boats)***-- Single deck access to and within primary function area on one deck only. Accessible head is provided, and other amenities to the extent available to all passengers. Figure 4-3 shows a generic arrangement. Access 4 should apply only to new construction and large alterations of primary function passenger areas. For the cost industry implementation, only new construction is considered since large alterations of these craft are rare.

Table 4-3
Vessel Access Solution Set

Access feature	Access 1	Access 2	Access 3	Access 4
Elevator/lift	Yes	Note #1	No	No
Embarkation	Yes	Yes	Yes	Yes
Passage	Yes	Yes	One deck	Primary function area
Heads	Yes	Yes	One deck	Yes
Signage	Yes	Yes	One deck	No
Alarms	Yes	Yes	One deck	No
Food service	Yes	Yes	One deck	Yes

1. Access to more than one deck may be needed in some cases; single deck access with full amenities will often result.

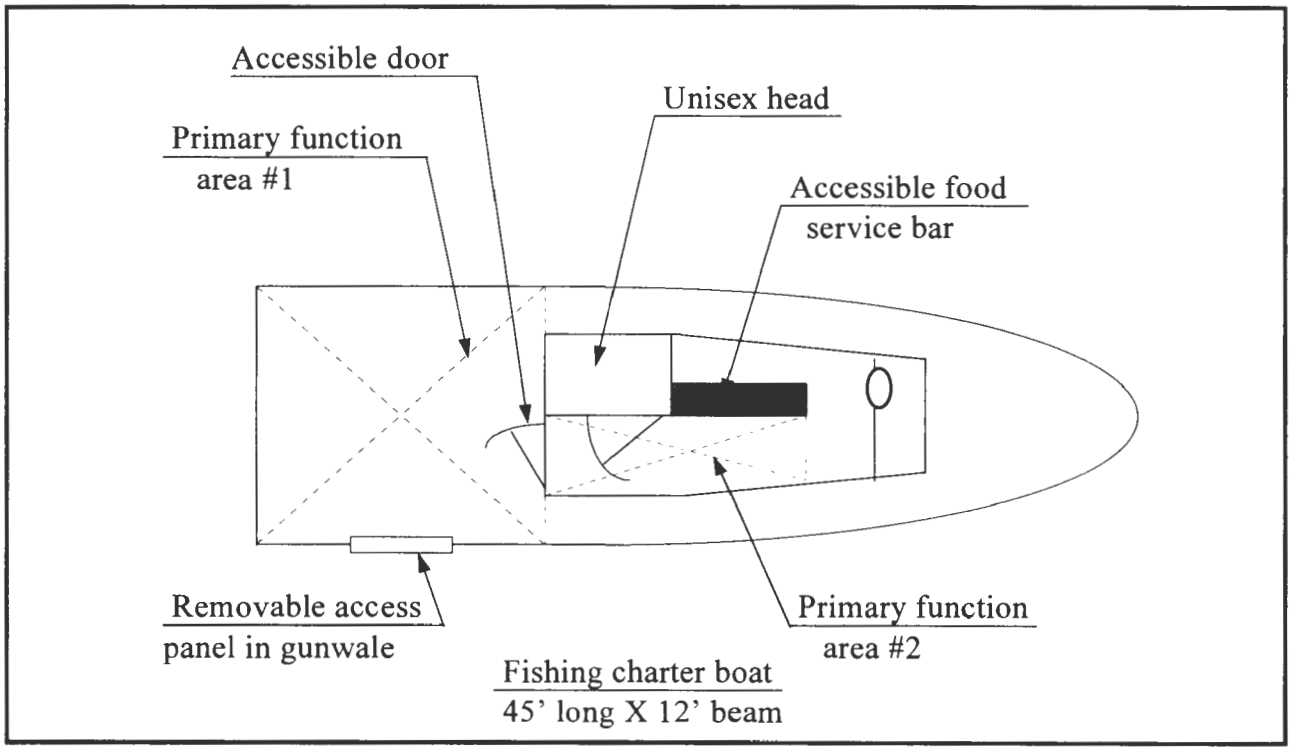
4.4.3 Application to fleet population

The access solution set (Table 4-3) will be applied to the passenger fleet taking account of:

- The size of the vessel and its ability to support the space and weight requirements of the pertinent access features.
- The type and service of the vessel and its categorization as "public accommodation" or "public transport".
- The differentiation between new construction and alterations.

Table 4-4 sorts the vessels by Coast Guard subchapter and ADA applicability definitions, and shows the application of the access solutions. The ADA sort is limited to the distinctions between public accommodation and transport and between new construction and alteration. Available fleet data do not distinguish fixed route from demand response vessels.

Figure 4-3
"Access 4" for T Fishing Boats



Again, the largest cost and technical impact is clearly from multi-deck access with elevators or, to a lesser extent, with lifts. The access solutions are differentiated mainly along the lines of their multi-deck access requirements. Proposed access requirements are generally along the lines of size and service, with the following main points in mind:

- New public accommodation vessels must provide full multi-deck access, excepting some T boats, where power and stability limitations may allow for full access and services on one deck only.
- Alterations of H and K public accommodations require full access and services, whether available on one deck or more; for T boats, some equivalent facilitation is allowable in a single deck access configuration. The engineering limitations of existing vessels are the reason for reduced multi-deck access.
- New and alteration public transport vessels will provide full access and services, on one deck, although equivalent facilitation will be acceptable for alterations. All vehicle ferries with separate car and accommodation decks, on runs longer than one half hour, will need elevators. Toilet and food service accommodations are not required for short run ferries (Coast Guard definition is less than 30 minutes). Access provisions on commuter boats are assumed to include only boarding, passageway, and wheelchair safety features.
- T fishing boats are generally among the smallest inspected vessels and are most often operated by small businesses. "Access 4" provides basic single-deck access.

Table 4-4
Access Solutions by Vessel Type

Coast Guard Subchapter	*Public accommodation*		*Public transport*	
	New	*Alteration*	*New*	*Alteration*
H	Access 1	Access 2	Access 2[1]	Access 2[1]
K	Access 1	Access 2	Access 2[1]	Access 2[1]
T	Access 2	Access 3	Access 2[1]	Access 2[1]
T fishing	Access 4	Access 4	NA	NA

Notes: 1) Elevators for ferries with separate vehicle and passenger decks only.

Table 4-4 shows a clear breakpoint between K and T public accommodation vessels in the matter of multi-deck access. Relaxation of this requirement for small vessels, particularly for alterations, is technically and legally logical. The latter point is the "elevator exemption", in 28 CFR Part 36, provided for small existing buildings, defined as fewer than three stories or less than 3000 ft^2 per story. A similar approach, with different area values, can be applied, as demonstrated by the sample boat data in the following section.

4.5 Sample Vessels

A representative sample of vessels was selected from files at Coast Guard Headquarters and field units, data available to the Volpe Center, field visits to operators, a search of pertinent literature, and an engineering analysis of several boats in the San Francisco Bay area. The sample vessels are the basis for the development of unit costs, which result in specific impact scenarios and inputs for the industry implementation cost calculations.

Appendix B includes results of the Bay area study and Appendix C is a compilation of unit cost data found in the field and the technical literature.

Table 4-5 groups sample vessels roughly by service and Subchapter, showing total and per passenger areas. Gross areas of passenger accommodation (hotel, restaurant, and public spaces) are found and reduced by the areas taken by other appurtenances such as lifesaving equipment, vents, and rails. Table 4-5 shows that reasonable passenger area breakpoints can be found in the structuring of the Coast Guard's passenger vessel categories. While a strict application of 3000 ft^2 per deck would eliminate all but the largest passenger vessels, a total deck area of 3000 ft^2 appears to fall nicely between the proposed T and K Subchapters. Some exceptions, notably the high density craft, appear among the representative existing designs shown in the Table (see shaded rows).

Common per passenger areas run from 10 to 20 ft^2 (Coast Guard requires 10 ft^2/passenger as one measure of allowable capacity) resulting in less than 3000 ft^2 for almost all T boats (150 or fewer passengers). K vessels will tend towards capacities significantly greater than 150 as a matter of optimal revenues and, for the unit areas required, will most often be above 3000 ft^2 of accommodation spaces.

Table 4-5
Sample Vessel Passenger Accommodation Areas

VESSEL	Old/new Sub-Chapter	Passenger capacity	Passenger decks	Accom'd'tion feet^2	feet^2/ passenger
52' excursion boat	T-S/T	49	2	900	18.4
64' excursion boat	T-S/T	130	2	1440	11.1
65' dinner boat	T-S/T	149	1	895	6.0
91' crew boat conv.	T-L/T	149	3	2305	15.5
96' whalewatcher	T-L/T	120	2	1314	11.0
102' crew boat conv.	T-L/T	150	2	3200	21.3
122' crew boat conv.	T-L/T	149	3	2558	17.2
180' cruise boat	T-L/T	112	4	17475	156.0
80' shuttle boat	T-L/K	200	2	1560	7.8
100' crew boat conv.	T-L/K	185	3	2400	13.0
105' dinner boat	T-L/K	600	3	8301	13.8
106' dinner boat	T-L/K	550	3	7200	13.1
183' dinner boat	T-L/K	1000	3	8280	8.3
192' excursion boat	T-L/K	600	4	14272	23.8
200' excursion boat	T-L/K	800	3	12250	15.3
80' paddle wheeler	T-L/K	500	3	5920	11.8
198' casino boat	T-L/K	1900	5	32400	17.1
274' paddle wheeler	T-L/K	1200	4	32100	26.8
84' ferry, veh. dk. only	T-L/T	90	1	2000	22.2
97' ferry	T-L/K	250	2	3731	14.9
127' ferry	T-L/K	693	3	5624	8.1
175' ferry	T-L/K	1600	3	10700	6.7
40' fishing boat	T-S/T	15	1	275	18.3
45' fishing boat	T-S/T	10	1	300	30.0
59' fishing boat	T-S/T	149	2	1118	7.5
60' fishing boat	T-S/T	12	2	820	68.3

5. VESSEL ACCESS COSTS

Fleet costs are developed in parallel for both new construction (5.2) and alterations (5.3) by the following steps:

- develop installation schedule (5.1)
- calculate unit capital, operating, and life cycle costs for sample vessels
- calculate cost for industry implementation based on installation schedule and sample unit costs

Section 5.4 is a brief consideration of personnel training costs. Selected cost scenarios, including shore access expenditures, are presented in Chapter 8. The following are brief descriptions of the cost categories used:

- **Capital costs**
  - Direct cost of access features including elevators and lifts, signage/alarms, embarkation access, food service, and tactile materials for the blind. There is a significant cost difference for the installation of these items between new construction and alterations, since in the latter case ripouts of and intereferences with existing systems will often result. It is assumed that these items are installed only once for the service lives of the affected vessels.
  - The space requirement for the access accommodations on new construction, expressed as a capital expense due to the added area and hull weight required.
- **Operating costs**
  - for vessel alterations, lost revenue due to deck area and passenger capacity reductions.
  - for all vessels, the effects of increased power requirements due to increased displacement and wetted surface area. The costs are expressed as increased fuel consumption, ignoring the possible speed loss.
- **Life cycle costs**. Maintenance costs associated with elevators, lifts, and other access features, calculated for all cases.

Cost factors are calculated using Office of Management and Budget guidance[11]:

- Nominal interest rates: from 7.3% for 3 year term to 8.1% for 30 year term.
- Real interest rates: from 4.2% for 3 year term to 4.9% for 30 year term.

This study does not develop an algorithm to predict how owners' decisions to modify or replace will be affected by ADA "alterations" requirements, nor does it account for the "preemptive" effect ADA on alterations of vessels and shoreside facilities. Building and alteration rates are assumed to continue as found in current practice.

5.1 FLEET POPULATION PROJECTIONS

The calculation of industry-wide costs entails the extrapolation of unit costs to the fleet, based upon vessel service lives and replacement rates, and the frequency of alterations. A detailed and accurate current fleet snapshot was developed in Section 4.1.3. Historical data for the fleet

consists of yearly Treasury Department reports from the late 1800s up to 1965. A large data gap existed for the period from 1966 to 1987. The Coast Guard data management system resumed data collection beginning in 1987.

Because the recent data history is limited, development of fleet growth and service life/replacement factors is problematic. The rough half-life data found in Section 4.1.3 is used with supporting evidence from industry to assume average vessel service lives. The outlook for fleet growth is suggested from these data and independent Coast Guard work in support of their passenger vessel rulemaking. The trending results for fleet growth and alterations will be combined with the fleet snapshot to develop installation schedules in Sections 5.2 and 5.3, respectively.

5.1.1 Fleet replacement

Approximate average vessel service lives, according to the half life calculations (para. 4.3.3) and discussions with industry are 40 years and 25 years for Subchapter H and T vessels, respectively. The Coast Guard found that 25 years is the average service life for T boats in their regulatory evaluation for the small passenger vessel rulemaking (1990)[14]. Vessels built under the new Subchapter K are assumed to replace those under the present T-L.

The annual replacement rate for K vessels is assumed in between those for H and T and closer to H because of similarities in size and service. Replacement of the fleet is therefor calculated at annual rates of 2.5%, 3%, and 4% for H, K, and T vessels respectively.

5.1.2 Fleet growth

Overall fleet growth has been stagnant for 30 years; that is, replacement and scrapping rates have been roughly equal. The last annual Treasury Department Merchant Marine Statistics[15] report in 1965 listed 5862 passenger vessels, compared to the current fleet of 5770 according to Coast Guard MSIS.

Treasury data indicate that in the 1950s and early 1960s, the passenger fleet expanded dramatically with the post-war economic expansion and as World War II surplus craft such as PT boats were brought into such services as fishing and charter. Table 5-1 indicates this trend for the build years 1942-46; the same may be observed for build years in the late 1950s as craft from other services moved into the passenger trade.

In the data gap between 1965 and 1987, most of those boats fell out of service while the revival of passenger boats for transportation and leisure bloomed, especially on inland waters and around the large cities. Passenger vessels have become more specialized with a much larger proportion of the fleet purpose-built for particular services. Volatile growth and decline of particular fleet segments (e.g. construction booms in dinner/excursion boats in early 1980s and gaming boats in the 1990s) often occur, reacting to public trends and regulations which cannot be forecast.

Overall, however, the available data indicate a flat to very slow growth rate over the last five years. While Coast Guard MSIS reports the large passenger (Subchapter H) fleet has increased dramatically in that time (approximately 30% to a total of 205), due mainly to new gaming boats, the T fleet has grown at an average annual rate of only 0.4%. The Coast Guard's regulatory evaluation for small passenger vessel certification concluded in 1990 that the T fleet population was staying constant, replacing itself at a 4% annual rate (about 210 per year), with an estimated average service life of 25 years.

The Army Corps of Engineers annual Waterborne Transportation Lines[16] reports support these conclusions. The scope includes ferries and "passenger, steam or motor" vessels, the latter of which are excursion boats and the like. Passenger fishing boats are not covered, and the remaining fleet size tracks reasonably well with the Coast Guard's data. While the summary data in Table 5-2 shows obvious inconsistencies (the ferry fleet certainly did not grow 450% from 1989 to 1991) in data definition and reporting, it is clear that they show no recent growth trend.

The foregoing data leads to the conclusion that the fleet growth rate will be near 0% for Subchapter T, K, and H vessels for the foreseeable future. Gaming boats make up nearly all of the Subchapter H growth since 1990. Otherwise, the statistics do not support any suggestion of growth.

Table 5-1
Post-World War II Passenger Fleet Statistics

Build Year	Reporting Year						
	Treasury Reports					CG MSIS	
	1945	1950	1955	1960	1965	1990	1994
1942	7	100	180	210	182	16	15
1943	22	79	140	173	186	19	14
1944		111	168	205	219	36	34
1945		87	127	143	143	35	43
1946		148	173	178	180	22	19
1956				161	184	38	37
1957				172	177	49	54
1958				152	161	39	40
1959				119	181	58	56
1986						200	215
1987						204	198
1988						229	223
1989						221	230
Total	**2608**	**3829**	**4811**	**5274**	**5862**	**5625**	**5770**

Table 5-2
Army Corps "Waterborne Transportation Lines" Data

Year	Ferries	Ferry passenger capacity	Other passenger vessels, steam or motor	Other vessels passenger capacity
1988	121	Not available	2,461	181,409
1989	134	Not available	2,468	177,955
1991	579	169,172	2,205	123,951
1992	572	170,876	2,323	138,288
1993	572	178,151	2,332	155,672

5.1.3 Alterations

Passenger vessels are assumed to undergo alteration of the primary function area as follows, based upon evidence from interviews with operators:

- ***H and K***-- every ten years. Those within ten years of retirement will not be included in this calculation.
- ***T boats***-- also every ten years, for dinner, excursion, and cruise boats only. The ten year retirement exclusion also applies. Access for all vessels is in accordance with Tables 4-3 and 4-4.

Note that the foregoing assumption is based upon anecdotal evidence which cannot be supported or refuted by available data bases. The ten year alteration cycle may be agressive; a longercycle would reduce business and societal costs.

5.1.4 Elevators

The installation schedules specifically address the provision of elevators and lifts for multi-deck access, the most important impact item. An accurate cost appraisal must include those vessels which will not provide such access, since the access solutions as structured allow for some flexibility in its application. The affected portions of the existing (without exclusions due to the ten year retirement window) and new portions of the fleet are shown in Table 5-3. These numbers are not supported by available data but from knowledge of the fleet gained through interviews and site visits. Explanatory comments follow:

- ***"Access 1"***-- All vessels must provide multi-deck access. Multi-deck construction is assumed for Access 1.
- ***"Access 3 and 4"***-- No elevators or lifts are required by definition of these solutions, which provide for one full access deck. These smaller vessels are, for the most part, single decked and otherwise are the most likely to have technical feasibility issues.

- *"Access 2"--* This solution provides for full access and services on one or more decks, depending on the boat's service and configuration. Assumptions for installation of elevator/lifts follow:

Public accommodation vessels

- Alterations to Subchapter H public accommodation vessels-- 75% will need multi-deck access due to the distinct nature of services usually available on different decks. 25% are assumed to provide all services on one deck.
- Alterations to Subchapter K public accommodation vessels-- 50% will require multi-deck access, and the remainder will not due to single deck accommodations arising from service and technical limitations.
- New construction Subchapter T public accommodation vessels-- 50% will not require multi-deck access because of single deck arrangements or equivalent facilitations, or technical design limitations.

Public transport (ferries)

Multi-deck access is assumed to be required only for those vessels with separate vehicle and passenger accommodation decks. The percentages in Table 5-3 are based upon the Urban Harbors ferry lines study[12]. Otherwise, wheelchair access will be to the vehicle deck only or will be supplied by shore access to an accommodation deck.

- All Subchapter H and K ferries-- Those with car decks, according to the Urban Harbors Institute are assumed to have separate passenger accommodation decks and, therefore, require elevators or lifts.
- New construction T ferries-- Half of those Ts which carry cars are assumed to need multi-deck access.
- T ferry alterations-- Some of those requiring multi-deck access may have structural or stability limitations; therefore the percentage requiring elevators or lifts is reduced. T ferry barges are not included in this category and have no elevator/lift requirement in any case.

Table 5-3
Elevator Requirements by Vessel Type
Access Solutions and Percentages of Vessels Applicable

Subchapter	*Public accommodation*		*Public transport*	
	New	*Alteration*	*New*	*Alteration*
H	Access 1, 100%	Access 2, 75%	Access 2, 80%	Access 2, 80%
K	Access 1, 100%	Access 2, 50%	Access 2, 20%	Access 2, 20%
T	Access 2, 50%	Access 3, 0%	Access 2, 35%	Access 2, 20%
T fishing	Access 4, 0%	Access 4, 0%	NA	NA

5.1.5 Installation schedules

Tables 5-4 and 5-5 are the installation schedules for new construction and alterations, respectively. The schedules include "elevator" and "lift factors", which anticipate the split between those multi-deck access devices and the resulting cost differentials.

Table 5-4
New Construction Schedule

Sub-Chapter	Vessel service	1995 pop.	Annual replace-ment rate %	Annual new-builds	with elev/lift	without elev/lift	Vessel elevator factor	Vessel lift factor
H	Ferry	93	2.5	2.32	1.86	0.46	1	0
	Dinner/excursion	10	2.5	0.25	0.25	0	0.5	0.5
	Gaming	56	2.5	1.4	1.4	0	1	0
	Cruise	2	2.5	0.05	0.05	0	0.5	0.5
	Whalewatcher/ sightseeing	29	2.5	0.72	0.72	0	0.5	0.5
	Other	15	2.5	0.37	0.37	0	0.5	0.5
K	Ferry	153	3.0	5.05	1.10	4.03	1	0
	Dinner/excursion	403	3.0	13.30	13.30	0	0.5	0.5
	Gaming	29	3.0	0.96	0.96	0	0.5	0.5
	Cruise	2	3.0	0.07	0.07	0	0.5	0.5
	Whalewatcher/ sightseeing	38	3.0	1.25	1.25	0	0.25	0.75
	Commuter /shuttle	0	3.0	0	0	0	0	0
	Fishing/dive	88	3.0	2.90	2.90	0	0.25	0.75
	Other	55	3.0	1.82	1.81	0	0.5	0.5
T	Ferry	156	4.0	6.24	2.18	4.056	0.5	0.5
	Dinner/excursion	165	4.0	6.6	3.3	3.3	0.25	0.75
	Gaming	0	4.0	0	0	0	0.25	0.75
	Cruise	27	4.0	1.08	0.54	0.54	0.25	0.75
	Whalewatcher/ sightseeing	864	4.0	34.56	17.28	17.28	0.25	0.75
	Commuter/ shuttle	441	4.0	17.64	0.00	17.64	0	0
	Sailing	108	4.0	4.32	2.16	2.16	0	1
	Fishing/dive	2697	4.0	107.88	0	107.88	0	0
	Other	339	4.0	13.56	6.78	6.78	0.25	0.75

Table 5-5
Alteration Schedule

Sub-Chapter	Vessel service	1995 pop.	10 year excl'sion	Affect'd pop.	10 year schedule			Vessel elevator factor	Vessel lift factor
					Total annual	with elev/ lift	w/o elev/lift		
H	Ferry	93	23	70	6.98	5.58	1.40	1.00	0.00
	Dinner/excursion	10	2	8	0.80	0.60	0.20	0.50	0.50
	Gaming	56	14	42	4.20	3.15	1.05	0.00	0.00
	Cruise	2	1	1	0.10	0.08	0.03	0.50	0.50
	Whalewatcher/ sightseeing	29	7	22	2.18	1.63	0.54	0.50	0.50
	Other	15	4	11	1.13	0.84	0.28	0.50	0.50
K	Ferry	153	46	107	10.66	2.13	8.53	1.00	0.00
	Dinner/excursion	403	122	281	28.09	14.04	14.04	0.50	0.50
	Gaming	29	9	20	2.02	1.01	1.01	0.00	0.00
	Cruise	2	1	1	0.14	0.07	0.07	0.50	0.50
	Whalewatcher/ sightseeing	38	12	26	2.65	1.32	1.32	0.00	0.00
	Commuter /shuttle	0	0	0	0.00	0.00	0.00	0.00	0.00
	Fishing/dive	88	27	61	6.13	3.07	3.07	0.00	0.00
	Other	55	17	38	3.83	1.92	1.92	0.50	0.50
T	Ferry	156	62	94	9.36	1.87	7.49	0.50	0.50
	Dinner/excursion	165	66	99	9.90	0	9.90	0.00	0.00
	Gaming	0	0	0	0.00	0.00	0.00	0.00	0.00
	Cruise	27	11	16	1.62	0.00	1.62	0.00	0.00
	Whalewatcher/ sightseeing	864	346	518	51.84	0.00	51.84	0.00	0.00
	Commuter /shuttle	441	176	265	26.46	0.00	26.46	0.00	0.00
	Sailing	108	43	65	6.48	0.00	6.48	0.00	0.00
	Other	339	136	203	20.34	0.00	20.34	0.00	0.00

5.2 NEW CONSTRUCTION

5.2.1 Unit costs

New construction costs will be calculated as 1) the capital cost of building in the extra space required for accessible accommodations, 2) the direct costs of individual access components; and 3) added operating costs.

Capital costs The added space results from extra area required for access accommodations and is expressed as a cost by multiplying area with the weight/area and cost/weight ratios found for the sample vessels in the engineering study (Appendix B). There is a space premium for elevators, accessible heads, and, for high density craft, wheelchair tiedown

spots provided for safety from ship motion. Details of these calculations are in Appendices B and D. The added weight of the access features (e.g. elevators) themselves does not result in added shipbuilding cost.

The engineering study also showed that no area and weight premium results from design of accessible passageways, signage and alarms, accessible embarkation station and main doors, and food service bars, which for the most part can be smoothly integrated with skilled design practice.

Direct costs The costs of individual access components including installation in the shipyard, are calculated according to the solution set in Table 4-3. These are elevators and lifts, accessible heads, embarkation stations, main doors, signage and alarms, and food bars. No extra design or engineering costs are included for new construction.

Tables 5-6 and 5-7 show the component and total unit capital and direct costs for each vessel type. Detailed notes on these costs appear in Appendices B and D.

The largest cost item is elevators and lifts. Table 5-7 calculates that cost and adds it to the costs found in Table 5-6 for all other items; it includes the average number of decks serviced and "blends" the unit cost to account for the assumed elevator lift factors across the fleet.

The unit elevator cost is $25,000 per deck serviced, multiplied by the factor of 1.50 for installation expense, a result of $37,500 per deck. The installed cost of a stair lift is $20,000 for two decks, plus $20,000 for each additional deck. Single elevator or lift service is assumed for all vessels.

Operating and life-cycle costs The operating cost premium calculation is limited to the extra fuel consumed by the main propulsion plant to drive the added weight of access accommodations. Added weight is from added areas for access accommodations and the component weight of elevators. Other components do not contribute significant weight. Notional values for ship's power, displacement, and annual operating hours are given and the effect of added weights calculated in Table 5-8. The following formula yields the annual fuel cost premium: *(added wt./loaded vessel wt.)X(annual operating hours)X(0.05 bsfc)X(brake horsepower)X($0.70/gallon);* where bsfc = brake specific fuel consumption. See detailed spreadsheets in Appendix D.

Table 5-6

Unit new building costs, excluding elevators

Class and Type		Costs in (quantity) @ (unit cost)							Total cost without elevator
		Tie-d cost (number @)	Head costs	Embark Station	Door costs	Sign /alarm	Food Bar	Deck area compensation	
H	Ferry	8 @ $250	2 @ $1K	$2K	2 @ $ 1K	3 @ $6.5K	1 @ $500	20sqft @ $500/sqft	$38,000
H	Dinner/excursion	8 @ $250	2 @ $1K	$2K	2 @ $1K	3 @ $6.5K	2 @ $500	20sqft @ $500/sqft	$38,500
H	Gaming	8 @ $250	2 @ $1K	(none)	(none)	3 @ $6.5K	2 @ $500	20sqft @ $500/sqft	$34,500
H	Cruise	8 @ $250	2 @ $1K	$2K	2 @ $1K	3 @ $6.5K	2 @ $500	20sqft @ $500/sqft	$38,500
H	Whalewatch/sightsee	8 @ $250	2 @ $1K	$2K	2 @ $1K	3 @ $6.5K	1 @ $500	20sqft @ $500/sqft	$38,000
H	Other	8 @ $250	2 @ $1K	$2K	2 @ $1K	3 @ $6.5K	2 @ $500	20sqft @ $500/sqft	$38,500
K	Ferry	6 @ $250	2 @ $1K	$1K	1 @ $1K	2 @ $5K	1 @ $500	24.5sqft @ $500/sqft	$28,250
K	Dinner/excursion	6 @ $250	2 @ $1K	$1K	1 @ $1K	2 @ $5K	2 @ $500	24.5sqft @ $500/sqft	$28,750
K	Gaming	6 @ $250	2 @ $1K	(none)	(none)	2 @ $5K	1 @ $500	20sqft @ $500/sqft	$24,000
K	Cruise	6 @ $250	2 @ $1K	$1K	1 @ $1K	2 @ $5K	1 @ $500	20sqft @ $500/sqft	$26,000
K	Whalewatch/sightsee	6 @ $250	2 @ $1K	$1K	1 @ $1K	2 @ $5K	1 @ $500	24.5sqft @ $500/sqft	$28,250
K	Commuter /shuttle	4 @ $250	0 @ $1K	$1K	1 @ $1K	2 @ $5K	(none)	12sqft @ $500/sqft	$19,000
K	Fishing/dive	4 @ $250	2 @ $1K	$1K	1 @ $1K	2 @ $5K	0.5@ $500	23sqft @ $500/sqft	$26,750
K	Other	6 @ $250	2 @ $1K	$1K	1 @ $1K	2 @ $5K	1 @ $500	24.5sqft @ $500/sqft	$28,250
T	Ferry	4 @ $250	0.5 @ $1K	$1K	1 @ $1K	2 @ $3.5K	(none)	14sqft @ $1000/sqft	$24,000
T	Dinner/excursion	4 @ $250	1 @ $1K	$1K	1 @ $1K	2 @ $3.5K	1 @ $500	21sqft @ $1000/sqft	$32,500
T	Gaming	4 @ $250	1 @ $1K	$1K	1 @ $1K	2 @ $3.5K	1 @ $500	15sqft @ $1000/sqft	$26,500
T	Cruise	3 @ $250	1 @ $1K	$1K	1 @ $1K	2 @ $3.5K	1 @ $500	15sqft @ $1000/sqft	$26,250
T	Whalewatch/sightsee	3 @ $250	1 @ $1K	$1K	1 @ $1K	2 @ $3.5K	1 @ $500	20sqft @ $1000/sqft	$30,750
T	Commuter /shuttle	2 @ $250	0 @ $1K	$1K	1 @ $1K	(none)	(none)	6sqft @ $1000/sqft	$8,500
T	Sailing	3 @ $250	1 @ $1K	$1K	1 @ $1K	2 @ $3.5K	1 @ $500	15sqft @ $1000/sqft	$26,250
T	Fishing/dive	2 @ $250	1 @ $1K	$1K	1 @ $1K	(none)	(none)	16sqft @ $1000/sqft	$19,500
T	Other	3 @ $250	1 @ $1K	$1K	1 @ $1K	2 @ $3.5K	1 @ $500	20sqft @ $1000/sqft	$30,750

Table 5-7
Unit newbuilding costs, with elevators

Class and Type		Total cost without elevators (Table 5-6)	Elevator Costs				Total cost including elevator
			Ave. decks serviced	elevator/lift factors	elevator / lift equip. costs	elevator / lift area costs	
H	Ferry	$38,000	2.5	1.0/0.0	$93,750	$30,000	$158,500
H	Dinner/excursion	$38,500	2.5	0.5/0.5	$61,875	$15,000	$112,125
H	Gaming	$34,500	2.5	1.0/0.0	$93,750	$30,000	$159,000
H	Cruise	$38,500	2.5	0.5/0.5	$61,875	$15,000	$112,125
H	Whalewatch/sightsee	$38,000	2.5	0.5/0.5	$61,875	$15,000	$111,625
H	Other	$38,500	2.5	0.5/0.5	$61,875	$15,000	$112,125
K	Ferry	$28,250	2	1.0/0.0	$75,000	$24,000	$127,250
K	Dinner/excursion	$28,750	2	0.5/0.5	$47,500	$12,000	$88,250
K	Gaming	$24,000	2	0.5/0.5	$47,500	$12,000	$83,500
K	Cruise	$26,000	2	0.5/0.5	$47,500	$12,000	$85,500
K	Whalewatch/sightsee	$28,250	2	0.25/0.75	$33,750	$6,000	$68,000
K	Commuter /shuttle	$19,000	0	0.0/0.0	$0	$0	$19,000
K	Fishing/dive	$26,750	2	0.25/0.75	$33,750	$6,000	$66,500
K	Other	$28,250	2	0.5/0.5	$47,500	$12,000	$87,750
T	Ferry	$18,000	2	0.5/0.5	$47,500	$24,000	$95,500
T	Dinner/excursion	$24,000	2	0.25/0.75	$33,750	$12,000	$78,250
T	Gaming	$18,000	2	0.25/0.75	$33,750	$12,000	$72,250
T	Cruise	$17,750	2	0.25/0.75	$33,750	$12,000	$72,000
T	Whalewatch/sightsee	$22,250	2	0.25/0.75	$33,750	$12,000	$76,500
T	Commuter /shuttle	$12,000	0	0.0/0.0	$0	$0	$8,500
T	Sailing	$17,750	2	0.0/1.0	$20,000	$0	$46,250
T	Fishing/dive	$19,500	0	0.0/0.0	$0	$0	$19,500
T	Other	$22,250	2	0.25/0.75	$33,750	$12,000	$76,500

Table 5-8

Unit annual newbuilding fuel costs

Vessel type		Notional displ'c'mt (LT)	Notional hp	Annual hrs	Elevator weight	Elev. ft^2	Access ft^2	lb. per ft^2	Annual fuel $ premium w/elev	Annual fuel $ premium w/o elev
H	Ferry	1500	3000	3600	30000	60	20	50	$3,825	$113
H	Dinner/excursion	750	2000	1200	30000	60	20	50	$1,700	$50
H	Gaming	2000	2000	1800	30000	60	20	50	$956	$28
H	Cruise	1000	2500	3600	30000	60	20	50	$4,781	$141
H	Whalewatch/sightsee	500	2500	1800	30000	60	20	50	$4,781	$141
H	Other	500	2000	1200	30000	60	20	50	$2,550	$75
K	Ferry	250	2000	3600	27000	48	24.5	50	$13,781	$551
K	Dinner/excursion	150	2000	1200	27000	48	24.5	50	$7,656	$306
K	Gaming	150	1500	1800	27000	48	20	50	$8,550	$281
K	Cruise	150	2000	3600	27000	48	20	50	$22,800	$750
K	Whalewatch/sightsee	150	2000	1800	27000	48	24.5	50	$11,484	$459
K	Commuter /shuttle	100	2000	3600	0	0	12	50	$675	$675
K	Fishing/dive	100	2000	1800	27000	48	23	50	$17,184	$647
K	Other	150	2000	1200	27000	48	24.5	50	$7,656	$306
T	Ferry	150	1500	3600	27000	48	14	50	$16,917	$380
T	Dinner/excursion	100	1500	1200	27000	48	21	50	$8,564	$295
T	Gaming	100	1000	1800	27000	48	15	50	$8,480	$211
T	Cruise	100	1500	3600	27000	48	15	50	$25,439	$633
T	Whalewatch/sightsee	100	2000	1800	27000	48	20	50	$17,086	$548
T	Commuter /shuttle	100	1000	3600	0	0	6	50	$169	$169
T	Sailing	100	500	300	0	0	15	50	$18	$18
T	Fishing	100	1000	1200	0	0	16	50	$150	$150
T	Other	100	1500	1200	27000	48	20	50	$8,543	$274

The addition of elevators/lifts and other access features means extra maintenance costs. Operators have reported elevator maintenance contracts from $1,000-$4,000 per year. The number used is $1,500 per year since many smaller operators will probably use cheaper service or perform some maintenance themselves. The annual cost for lift maintenance is assumed to be $500.

Additional maintenance for other access features such as signage and alarm systems and special doors are difficult to estimate. Values between $250 and $500 per year are assigned, depending on vessel size. The unit costs appear with the industry implementation calculations in Table 5-10. Detailed notes are in Appendix D.

5.2.2 Industry implementation cost

The unit costs (5.2.1) and installation schedule (Table 5-4) are the basis of the industry implementation cost calculation. The unit capital costs found in Tables 5-6 and 5-7 result in industry implementation present value (PV) society costs of $113.7M (Table 5-9). The amortized industry cost is $132.4M (Table 5-10). The following are the main points re: Tables 5-9 and 5-10:

- Capital costs for each year amortized at nominal discount rate of 7.9% for 10 years (Table 5-10).
- Present values are found to 1996 at a real discount rate of 4.8%.
- Assumed implementation of the regulation is in 1998.
- Annual cost in 1996 dollars given in first cost column, followed by present value samples for selected years. Totals are shown for selected years and by vessel type.
- Present value costs increase to year #10 as the portion of the fleet with access grows, and decline slowly thereafter as debt is retired and real discounts over the long term take effect.
- Capital costs for H vessels are spread over a 40 year phase-in period plus, for Table 5-10, ten more years to amortize the last outlays. Phase-ins for K and T vessels are 33 and 25 years, respectively, and ten additional years are likewise required to finish the amortization.

Operating costs for the industry implementation consist of extra fuel and maintenance, given in Table 5-11. The table includes the annual maintenance costs as calculated in Appendix D. These costs are discounted to 1996 at 4.8% and not amortized. The calculation for total costs covers the 40-year period from 1998-2038.

The annual unit maintenance costs in Table 5-11 are samples which include elevators. The industry implementation costs reflect the model of Table 5-4, which includes a blend of vessels with elevators, or lifts, or neither. The 40-year operating cost premium for new buildings is $57.1 million for fuel, $17.7 million for maintenance, and a total of $74.8 million.

Table 5-9
Industry implementation, newbuilding capital expenses
Societal costs

	Vessel Subchapter and service	Annual cost	P.V. year 1	P.V. year 5	P.V. year 10	P.V. year 20	P.V. year 30	P.V. year 40	P.V. Total
H	Ferry	$310,969	$270,167	$223,969	$177,166	$110,858	$69,367	$43,405	$4,994,377
H	Dinner/excursion	$28,031	$24,353	$20,189	$15,970	$9,993	$6,253	$3,913	$450,202
H	Gaming	$222,600	$193,393	$160,323	$126,821	$79,355	$49,655	$31,071	$3,575,113
H	Cruise	$5,606	$4,871	$4,038	$3,194	$1,999	$1,251	$783	$90,040
H	Whalewatcher/sightseeing	$80,928	$70,310	$58,287	$46,107	$28,850	$18,053	$11,296	$1,299,763
H	Other	$42,047	$36,530	$30,283	$23,955	$14,989	$9,379	$5,869	$675,302
K	Ferry	$242,604	$210,773	$174,731	$138,218	$86,487	$54,117		$3,474,429
K	Dinner/excursion	$1,173,637	$1,019,647	$845,288	$668,649	$418,394	$261,802		$16,808,089
K	Gaming	$79,910	$69,425	$57,553	$45,526	$28,487	$17,825		$1,144,414
K	Cruise	$5,643	$4,903	$4,064	$3,215	$2,012	$1,259		$80,816
K	Whalewatcher/sightseeing	$85,272	$74,084	$61,415	$48,582	$30,399	$19,022		$1,221,212
K	Commuter /shuttle	$0	$0	$0	$0	$0	$0		$0
K	Fishing/dive	$193,116	$167,778	$139,088	$110,023	$68,845	$43,078		$2,765,686
K	Other	$159,266	$138,369	$114,708	$90,738	$56,777	$35,527		$2,280,911
T	Ferry	$305,916	$265,778	$220,330	$174,288	$109,057			$4,005,569
T	Dinner/excursion	$365,475	$317,522	$263,226	$208,220	$130,290			$4,785,417
T	Gaming	$0	$0	$0	$0	$0			$0
T	Cruise	$53,055	$46,094	$38,212	$30,227	$18,914			$694,686
T	Whalewatcher/sightseeing	$1,853,280	$1,610,116	$1,334,787	$1,055,858	$660,683			$24,266,275
T	Commuter /shuttle	$149,940	$130,267	$107,991	$85,424	$53,453			$1,963,268
T	Sailing	$156,600	$136,053	$112,788	$89,219	$55,827			$2,050,472
T	Fishing	$2,103,660	$1,827,644	$1,515,118	$1,198,506	$749,941			$27,544,673
T	Other	$727,155	$631,747	$523,719	$414,278	$259,226			$9,521,143
	Total	**$8,344,710**	**$7,249,823**	**$6,010,108**	**$4,754,183**	**$2,974,836**	**$586,588**	**$96,336**	**$113,691,856**

Table 5-10

Industry implementation, newbuilding capital expenses

Industry costs, with amortization

	Vessel Subchapter and service	Annual cost	P.V. year 1	P.V. year 5	P.V. year 10	P.V. year 20	P.V. year 30	P.V. year 40	P.V. year 50	P.V. Total
H	Ferry	$310,969	$40,081	$166,138	$262,841	$164,467	$102,912	$64,395	$4,029	$6,104,972
H	Dinner/excursion	$28,031	$3,613	$14,976	$23,693	$14,825	$9,277	$5,805	$363	$550,312
H	Gaming	$222,600	$28,691	$118,926	$188,148	$117,730	$73,667	$46,096	$2,884	$4,370,107
H	Cruise	$5,606	$723	$2,995	$4,739	$2,965	$1,855	$1,161	$73	$110,062
H	Whalewatch/sightsee	$80,928	$10,431	$43,237	$68,403	$42,802	$26,782	$16,759	$1,049	$1,588,790
H	Other	$42,047	$5,420	$22,464	$35,539	$22,238	$13,915	$8,707	$545	$825,469
K	Ferry	$242,604	$31,270	$129,614	$205,057	$128,310	$80,288	$5,024		$4,274,706
K	Dinner/excursion	$1,173,637	$151,273	$627,026	$991,994	$620,721	$388,404	$24,304		$20,679,557
K	Gaming	$79,910	$10,300	$42,692	$67,542	$42,263	$26,445	$1,655		$1,408,011
K	Cruise	$5,643	$727	$3,015	$4,770	$2,985	$1,867	$117		$99,430
K	Whalewatch/sightsee	$85,272	$10,991	$45,557	$72,075	$45,099	$28,220	$1,766		$1,502,498
K	Commuter /shuttle	$0	$0	$0	$0	$0	$0	$0		$0
K	Fishing/dive	$193,116	$24,891	$103,174	$163,228	$102,137	$63,910	$3,999		$3,402,717
K	Other	$159,266	$20,528	$85,089	$134,617	$84,234	$52,708	$3,298		$2,806,282
T	Ferry	$268,476	$39,430	$163,438	$258,570	$161,795	$60,744			$4,955,808
T	Dinner/excursion	$309,375	$47,107	$195,258	$308,911	$193,295	$72,570			$5,920,657
T	Gaming	$0	$0	$0	$0	$0	$0			$0
T	Cruise	$43,875	$6,838	$28,345	$44,844	$28,060	$10,535			$859,486
T	Whalewatch/sightsee	$1,559,520	$238,874	$990,132	$1,566,450	$980,175	$367,995			$30,022,944
T	Commuter /shuttle	$211,680	$19,326	$80,107	$126,734	$79,301	$29,773			$2,429,012
T	Sailing	$119,880	$20,185	$83,665	$132,363	$82,824	$31,095			$2,536,904
T	Fishing	$2,103,660	$271,146	$1,123,900	$1,778,079	$1,112,598	$417,712			$34,079,074
T	Other	$611,895	$93,725	$388,489	$614,614	$384,583	$144,387			$11,779,836
	TOTAL	**$7,857,990**	**$1,075,569**	**$4,458,238**	**$7,053,210**	**$4,413,407**	**$2,005,062**	**$183,084**	**$8,943**	**$140,306,633**

Table 5-11

Industry implementation, Newbuilding Operating Costs

	Vessel type	unit maint.	P.V. year 1	P.V. year 5	P.V. year 10	P.V. year 20	P.V. year 30	P.V. year 40	40 year fuel	40 year maint.	TOTAL
H	Ferry	$2,000	$6,390	$39,390	$62,318	$77,989	$73,200	$61,071	$1,676,367	$883,811	$2,560,177
H	Dinner/excursion	$1,500	$406	$2,076	$3,285	$4,111	$3,858	$3,219	$51,167	$83,853	$135,020
H	Gaming	$2,000	$2,903	$14,442	$22,849	$28,594	$26,839	$22,392	$313,143	$626,103	$939,245
H	Cruise	$1,500	$116	$701	$1,109	$1,388	$1,302	$1,087	$28,782	$16,771	$45,552
H	Whalewatch/sightsee	$1,500	$1,677	$10,162	$16,077	$20,120	$18,884	$15,755	$417,332	$243,174	$660,506
H	Other	$1,500	$680	$3,705	$5,862	$7,336	$6,886	$5,745	$115,126	$125,780	$240,906
K	Ferry	$1,875	$9,838	$69,844	$110,497	$138,283	$129,792	$83,546	$3,661,376	$733,143	$4,394,520
K	Dinner/excursion	$1,375	$38,159	$253,504	$401,059	$501,909	$471,090	$294,775	$11,913,567	$3,933,701	$15,847,268
K	Gaming	$1,375	$2,927	$19,739	$31,229	$39,081	$36,682	$22,953	$950,840	$283,070	$1,233,910
K	Cruise	$1,375	$413	$3,110	$4,921	$6,158	$5,780	$3,617	$174,867	$19,522	$194,389
K	Whalewatch/sightsee	$1,125	$2,921	$19,369	$30,643	$38,348	$35,993	$21,316	$892,303	$303,480	$1,195,783
K	Commuter /shuttle	$375	$0	$0	$0	$0	$0	$0	$0	$0	$0
K	Fishing/dive	$1,125	$8,740	$61,227	$96,865	$121,223	$113,779	$67,262	$3,075,208	$702,795	$3,778,003
K	Other	$1,375	$5,208	$34,597	$54,735	$68,499	$64,293	$40,230	$1,625,921	$536,858	$2,162,779
T	Ferry	$1,250	$11,978	$86,430	$136,738	$171,122	$133,845	$83,751	$4,346,020	$761,591	$5,107,612
T	Dinner/excursion	$1,000	$7,230	$45,759	$72,394	$90,598	$68,145	$42,641	$1,829,807	$839,093	$2,668,900
T	Gaming	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Cruise	$1,000	$2,311	$16,840	$26,642	$33,342	$25,126	$15,722	$845,179	$137,306	$982,485
T	Whalewatch/sightsee	$1,000	$57,174	$399,752	$632,432	$791,464	$592,628	$370,825	$18,879,918	$4,393,797	$23,273,714
T	Commuter /shuttle	$250	$4,949	$25,873	$40,933	$51,226	$31,767	$19,878	$522,891	$897,067	$1,419,958
T	Sailing	$750	$1,824	$7,696	$12,175	$15,237	$11,706	$7,325	$13,339	$439,380	$452,719
T	Fishing	$0	$7,029	$87,396	$92,193	$115,376	$90,243	$56,467	$3,442,658	$0	$3,442,658
T	Other	$1,000	$14,729	$63,863	$147,107	$184,099	$138,811	$86,858	$3,703,873	$1,723,955	$5,427,828
TOTAL			**$187,600**	**$1,265,476**	**$2,002,062**	**$2,505,502**	**$2,080,649**	**$1,326,434**	**$58,479,682**	**$17,684,249**	**$76,163,931**

5.3 ALTERATIONS

"Alterations" for the purposes of modeling the access costs for the existing fleet here means major work involving the vessel's primary function area and path of travel to that area. It should, however, be recognized that any alteration to passenger areas, of whatever scope, must result in an accessible installation (for example, replacement or addition of a water fountain). Industry must be keenly aware of the legal requirement and the good business practice of building in access whenever replacement, upgrade, or restoration work is done.

Alteration costs include direct costs for components required in the access solutions (Table 4-4), added operating costs (fuel and maintenance), and lost revenue due to passenger space losses.

The cost models will be based upon accessible retrofit to all passenger accommodation areas of one deck for all sample vessels, and two decks if "Access 2" specification for all amenities (e.g. weather deck access) is required.

5.3.1 Unit costs

Capital costs Again, access accommodations are per Table 4-4. The 20% ceiling provision of ADA is ignored since available data do not support projections of total vessel alteration costs. This may result in high cost projections for some cases. Table 5-12 tallies the unit installation costs, exclusive of elevators and lifts; Table 5-13 adds in the costs for cases where multi-deck access is required.

While the capital costs for retrofitting access accommodations do not include the premium for building extra deck space, component installation costs are higher than those for new construction, as noted previously.

The costs for each item are uniform for all vessel types, except the signage and alarms, where deck coverage requirements will vary the costs from larger to smaller boats. Unit cost for an elevator, assumed in all cases to serve two decks only, is $50,000 X 200% for installation ($100,000). Auxiliary power upgrade due to elevator is not specifically considered. Stability analysis for the weight and moment additions of the elevator is estimated at $5,000, and is assumed not to be required for other access features, including stair lifts. The impact of corrective actions for stability problems, e.g. adding low ballast, is not considered.

Explanatory notes for unit alteration costs follow:

- Costs for gaming boats are limited to safety features (tiedowns and alarm systems) and food service amenities; other access items, particularly doors and elevators, have been observed as standard in the business.

Table 5-12

Unit capital alteration costs, excluding elevators/lifts

Vessel type		Costs in (quantity) @ (unit cost)						Total cost
		Tie-downs	Head	Embark station	Door	Signage/ alarms	Food bar	without elevator
H	Ferry	8 @ $250	2 @ $15K	$ 2 K	2 @ $5K	2 @ $6.5K	1 @ $2.0K	**$59,000**
H	Dinner/excursion	8 @ $250	2 @ $15K	$ 2 K	2 @ $5K	2 @ $6.5K	2 @ $2.0K	**$61,000**
H	Gaming	8 @ $250	0 @ $15K	(none)	0 @ $5K	2 @ $6.5K	2 @ $2.0K	**$19,000**
H	Cruise	8 @ $250	2 @ $15K	$ 2 K	2 @ $5K	2 @ $6.5K	2 @ $2.0K	**$61,000**
H	Whalewatch/sight	8 @ $250	2 @ $15K	$ 2 K	2 @ $5K	2 @ $6.5K	1 @ $2.0K	**$59,000**
H	Other	8 @ $250	2 @ $15K	$ 2 K	2 @ $5K	2 @ $6.5K	2 @ $2.0K	**$61,000**
K	Ferry	6 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $5.0K	1 @ $2.0K	**$34,500**
K	Dinner/excursion	6 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $5.0K	1 @ $2.0K	**$34,500**
K	Gaming	6 @ $250	0 @ $15K	(none)	0 @ $5K	2 @ $5.0K	1 @ $2.0K	**$13,500**
K	Cruise	6 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $5.0K	1 @ $2.0K	**$34,500**
K	Whalewatch/sight	6 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $5.0K	1 @ $2.0K	**$34,500**
K	Commuter /shuttle	4 @ $250	0 @ $15K	$ 1 K	1 @ $5K	2 @ $5.0K	1 @ $2.0K	**$19,000**
K	Fishing/dive	4 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $5.0K	1 @ $2.0K	**$34,000**
K	Other	6 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $5.0K	1 @ $2.0K	**$34,500**
T	Ferry	4 @ $250	0.5 @ $15K	$ 1 K	1 @ $5K	2 @ $3.5K	1 @ $2.0K	**$23,500**
T	Dinner/excursion	4 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $3.5K	1 @ $2.0K	**$31,000**
T	Gaming	4 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $3.5K	1 @ $2.0K	**$31,000**
T	Cruise	3 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $3.5K	1 @ $2.0K	**$30,750**
T	Whalewatch/sight	3 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $3.5K	1 @ $2.0K	**$30,750**
T	Commuter /shuttle	2 @ $250	0 @ $15K	$ 1 K	1 @ $5K	1 @ $3.5K	0 @ $2.0K	**$10,000**
T	Sailing	3 @ $250	1 @ $15K	$ 1 K	1 @ $5K	1 @ $3.5K	1 @ $2.0K	**$27,500**
T	Other	3 @ $250	1 @ $15K	$ 1 K	1 @ $5K	2 @ $3.5K	1 @ $2.0K	**$30,750**

Table 5-13
Unit alteration capital costs, with elevators/lifts

Vessel type		Total cost without elevators	Elevator Costs			Total cost including elevator
			elev/lift ratio	elev/lift equip. costs	Stability analysis	
H	Ferry	$59,000	1.0/0.0	$100,000	$5,000	**$164,000**
H	Dinner/excursion	$61,000	0.5/0.5	$65,000	$2,500	**$128,500**
H	Gaming	$19,000	0.0/0.0	$0	$0	**$19,000**
H	Cruise	$61,000	0.5/0.5	$65,000	$2,500	**$128,500**
H	Whalewatch/sightsee	$59,000	0.5/0.5	$65,000	$2,500	**$126,500**
H	Other	$61,000	0.5/0.5	$65,000	$2,500	**$128,500**
K	Ferry	$34,500	1.0/0.0	$100,000	$5,000	**$139,500**
K	Dinner/excursion	$34,500	0.5/0.5	$65,000	$2,500	**$102,000**
K	Gaming	$13,500	0.0/0.0	$0	$0	**$13,500**
K	Cruise	$34,500	0.5/0.5	$65,000	$2,500	**$102,000**
K	Whalewatch/sightsee	$34,500	0.0/0.0	$0	$0	**$34,500**
K	Commuter /shuttle	$19,000	00./0.0	$0	$0	**$19,000**
K	Fishing/dive	$34,000	0.0/0.0	$0	$0	**$34,000**
K	Other	$34,500	0.5/0.5	$65,000	$2,500	**$102,000**
T	Ferry	$20,000	0.5/0.5	$65,000	$2,500	**$91,000**
T	Dinner/excursion	$27,500	0.0/0.0	$0	$0	**$31,000**
T	Gaming	$27,500	0.0/0.0	$0	$0	**$31,000**
T	Cruise	$27,250	0.0/0.0	$0	$0	**$30,750**
T	Whalewatch/sightsee	$27,250	0.0/0.0	$0	$0	**$30,750**
T	Commuter /shuttle	$10,000	0.0/0.0	$0	$0	**$10,000**
T	Sailing	$27,250	0.0/0.0	$0	$0	**$27,500**
T	Other	$27,250	0.0/0.0	$0	$0	**$30,750**

- The scope of work, e.g. the number of accessible cabin doors or food bars, is varied with the size and service of the affected vessels; these access elements are representative only, not all-inclusive.
- T fishing vessels are not considered candidates for primary function alterations as specified for the purposes of these cost calculations.
- Elevator/lift ratios are not supportable by significant data at this time, but reflect field observations and the belief that lift technology for passenger vessels will improve and find wide application as a practical alternative to elevators.
- Large ferries, which tend towards car carrying arrangements, will most likely service vehicle decks with elevators; this retrofit has already been accomplished on several vessels. Those T ferries requiring multi-deck access will be more likely to utilize lifts, due to space and stability limitations.

Operating costs Fuel and maintenance costs are found in much the same manner as for new construction. There is the additional aspect of revenue losses since passenger accommodation area is lost to make way for elevators, accessible heads, and wheelchair tiedown spots.

Fuel costs are based solely upon the added component weight of elevators. The added area premium calculated for new construction does not pertain when backfitting on an existing vessel, and the net added weight of other components is assumed to be insignificant. Sample unit costs are shown in Table 5-14. The reader should note that these do not allow for speed reduction and that full power operation is assumed for the annual operating hours specified.

Unit annual maintenance costs may be found in Table 5-18, with the industry implementation maintenance costs. Detailed notes and spreadsheets for all costs are in Appendix D.

Table 5-14
Sample unit fuel cost for retrofit elevator installation

	Service	Δ (LT)	added wt/ Δ	horse-power	annual hrs	Annual fuel cost
H	Ferry	1500	0.0089	3000	3600	$3,375
H	Dinner/excursion	750	0.0179	2000	1200	$1,500
H	Gaming	2000	0.0067	2000	1800	$844
H	Cruise	1000	0.0134	2500	3600	$4,219
H	Whalewatch/sightsee	500	0.0268	2500	1800	$4,219
K	Ferry	250	0.0536	2000	3600	$13,500
K	Dinner/excursion	150	0.0893	2000	1200	$7,500
K	Gaming	150	0.0893	1500	1800	$8,438
K	Cruise	150	0.0893	2000	3600	$22,500
K	Whalewatch/sightsee	150	0.0893	2000	1800	$11,250
K	Fishing/dive	100	0.1339	2000	1800	$16,875
T	Ferry	150	0.0893	1500	3600	$16,875
T	Dinner/excursion	100	0.1339	1500	1200	$8,438
T	Gaming	100	0.1339	1000	1800	$8,438
T	Cruise	100	0.1339	1500	3600	$25,313
T	Whalewatch/sightsee	100	0.1339	2000	1800	$16,875

Note: Δ = displacement of loaded vessel

Lost revenue will be the result of alterations which take existing passenger space for access accommodations. The calculation starts with finding the areas needed for the new access features, i.e. elevators, accessible heads, and wheelchair tiedown spots. Lost passenger capacity results from simple division of the lost area by unit passenger areas. Lost revenue is then found by multiplying the trip frequency by representative fares and the lost capacity. The assumed full

capacity ratio (portion of trips at full capacity, when revenue losses will actually be incurred) is 0.4, corresponding approximately to a peak (summer) season plus holidays and some weekends.

Several calculations were needed for each vessel type because of two regulatory provisions for minimum per passenger areas, and since elevators, lifts, or neither will be needed for different individual vessels. The Coast Guard generally requires at least 10 ft^2 of deck space per passenger, but also allows for a minimum of 3.75 ft^2 per seat for high density craft. Space reductions clearly have different proportional effects on each category.

Table 5-15 shows the development of unit revenue losses, with four possible outcomes for each type of vessel. The term "NA" appears when the configuration shown is not applicable, based upon knowledge of the fleet, field visits, and, primarily, the specifications of the access solutions offered herein. Specifically, no T boat alterations in this model will have elevators. It is also assumed that no H vessels are "high density" and that all commuter/shuttle boats are.

It is assumed that elevators do not result in lost vehicle capacity on ferries. One domestic operator stated that a parking space had been lost due to retrofit, while a study for Transport Canada indicated no loss of space[17].

Further details on the area loss calculations appear in the notes in Appendix D.

5.3.2 Industry implementation cost

The total society cost for alterations to the existing vessels in the fleet, according to the model's schedule and access solutions, is $173.6 million, including $54.6 million for capital improvements (Table 5-16), $11.0 million for fuel (Tables 5-18), $7.3 million for maintenance (Table 5-19), and $100.7 million for lost revenues (Table 5-20). Industry costs are $191.8M, including amortized capital costs (Table 5-17).

Capital costs The industry implementation costs will be spread over a period of twenty years, as the alterations are modeled as a ten year phase-in, and the amortization runs out for ten additional years.

Operating cost-- fuel and maintenance All operating costs are calculated for a period of forty years, in which time the presently existing H vessel population is modeled to decay to zero. The K and T portions of the fleet likewise drop out in 33 and 25 years, respectively.

Operating cost-- lost revenue The industry implementation model is the same as described above for fuel and maintenance.

Table 5-15
Sample unit revenue costs for alterations

	Vessel service	Ft^2 loss, unisex heads	Ft^2 loss, elev.	Wheel-chair capacity	Fare	Daily trips	Days per week	Weeks per year	Annual loss w/elev, 10 ft^2/pax	Annual loss w/o elev, 10 ft^2/pax	Annual loss w/ elev, 3.75 ft^2/pax	Annual loss w/o elev, 3.75 ft^2/pax
H	Ferry	20	48	8	$5	4	6	50	$16,320	$4,800	NA	NA
H	Dinner/excursion	20	48	8	$25	1	6	50	$20,400	$6,000	NA	NA
H	Gaming	20	48	8	$25	6	6	50	$122,400	$36,000	NA	NA
H	Cruise	20	48	8	$500	1	1	50	$10,000	$0	NA	NA
H	Whalewatch/sightsee	20	48	8	$10	2	6	50	$16,320	$4,800	NA	NA
H	Other	20	48	8	$10	1	6	50	$8,160	$2,400	NA	NA
K	Ferry	10	48	6	$5	4	6	50	$13,920	$2,400	$40,457	$24,000
K	Dinner/excursion	10	48	6	$25	1	6	50	$17,400	$3,000	$50,571	$30,000
K	Gaming	10	48	6	$25	6	6	50	$104,400	$18,000	NA	NA
K	Cruise	10	48	6	$500	1	1	50	$10,000	$0	NA	NA
K	Whalewatch/sightsee	10	48	6	$10	2	6	50	$13,920	$2,400	$40,457	$24,000
K	Commuter /shuttle	0	0	4	$5	4	6	50	NA	NA	NA	$13,714
K	Fishing/dive	10	48	4	$25	1	6	50	$17,400	$3,000	$42,000	$21,429
K	Other	10	48	6	$10	1	6	50	$6,960	$1,200	$20,228	$12,000
T	Ferry	7.5	48	4	$5	4	6	50	$13,320	$1,800	$32,742	$167,286
T	Dinner/excursion	15	0	4	$25	1	6	50	NA	$4,500	NA	$141,429
T	Gaming	15	0	4	$25	6	6	50	NA	$27,000	NA	NA
T	Cruise	15	0	3	$500	1	1	50	NA	$0	NA	NA
T	Whalewatch/sightsee	15	0	3	$10	2	6	50	NA	$3,600	NA	$6,857
T	Commuter /shuttle	0	0	2	$5	4	6	50	NA	NA	NA	$19,286
T	Sailing	15	0	3	$25	1	6	50	$4,500	$4,500	NA	NA

Table 5-16
Industry implementation capital costs for vessel alterations
Societal costs

	Vessel type	Total annual cost	P.V. year 1	P.V. year 5	P.V. year 10	Total P.V.
H	Ferry	$997,425	$866,556	$685,472	$542,230	$6,796,471
H	Dinner/excursion	$89,300	$77,583	$61,371	$48,546	$608,492
H	Gaming	$79,800	$69,330	$54,842	$43,382	$543,759
H	Cruise	$11,163	$9,698	$7,671	$6,068	$76,061
H	Whalewatch/sightsee	$238,434	$207,150	$163,862	$129,620	$1,624,696
H	Other	$125,578	$109,101	$86,303	$68,268	$855,691
K	Ferry	$591,832	$514,179	$406,732	$321,737	$4,032,752
K	Dinner/excursion	$1,916,998	$1,665,474	$1,317,441	$1,042,137	$13,062,455
K	Gaming	$27,286	$23,706	$18,752	$14,834	$185,930
K	Cruise	$9,514	$8,265	$6,538	$5,172	$64,826
K	Whalewatch/sightsee	$91,373	$79,384	$62,795	$49,673	$622,615
K	Commuter /shuttle	$0	$0	$0	$0	$0
K	Fishing/dive	$208,533	$181,172	$143,313	$113,365	$1,420,950
K	Other	$261,625	$227,298	$179,800	$142,227	$1,782,717
T	Ferry	$346,320	$300,880	$238,006	$188,270	$2,359,830
T	Dinner/excursion	$306,900	$266,632	$210,915	$166,840	$2,091,222
T	Gaming	$0	$0	$0	$0	$0
T	Cruise	$49,815	$43,279	$34,235	$27,081	$339,440
T	Whalewatch/sightsee	$1,594,080	$1,384,925	$1,095,519	$866,590	$10,862,088
T	Commuter /shuttle	$264,600	$229,883	$181,844	$143,844	$1,802,989
T	Sailing	$176,580	$153,411	$121,353	$95,994	$1,203,219
T	Other	$625,455	$543,391	$429,839	$340,016	$4,261,861
	TOTAL	**$8,012,611**	**$6,961,297**	**$5,506,603**	**$4,355,895**	**$54,598,063**

Table 5-17

Industry implementation capital costs for vessel alterations

Industry costs, with amortization

	Vessel type	P.V. year 1	P.V. year 5	P.V. year 10	P.V. year 15	Total P.V.
H	Ferry	$128,560	$532,883	$843,055	$400,130	$9,322,334
H	Dinner/excursion	$11,510	$47,709	$75,479	$35,824	$834,634
H	Gaming	$10,286	$42,634	$67,449	$32,013	$745,843
H	Cruise	$1,439	$5,964	$9,435	$4,478	$104,329
H	Whalewatch/sightsee	$30,732	$127,386	$201,532	$95,651	$2,228,503
H	Other	$16,186	$67,091	$106,143	$50,377	$1,173,703
K	Ferry	$76,283	$316,192	$500,235	$237,421	$5,531,497
K	Dinner/excursion	$247,086	$1,024,174	$1,620,306	$769,028	$17,917,029
K	Gaming	$3,517	$14,578	$23,063	$10,946	$255,029
K	Cruise	$1,226	$5,083	$8,041	$3,817	$88,918
K	Whalewatch/sightsee	$11,777	$48,817	$77,231	$36,655	$854,006
K	Commuter/shuttle	$0	$0	$0	$0	$0
K	Fishing/dive	$26,878	$111,411	$176,259	$83,656	$1,949,036
K	Other	$33,721	$139,776	$221,134	$104,954	$2,445,252
T	Ferry	$56,853	$235,656	$372,823	$176,949	$4,122,604
T	Dinner/excursion	$39,557	$163,964	$259,401	$123,117	$2,868,410
T	Gaming	$0	$0	$0	$0	$0
T	Cruise	$6,421	$26,614	$42,105	$19,984	$465,591
T	Whalewatch/sightsee	$205,465	$851,652	$1,347,366	$639,485	$14,898,910
T	Commuter/shuttle	$34,105	$141,365	$223,648	$106,148	$2,473,058
T	Sailing	$22,760	$94,339	$149,251	$70,837	$1,650,387
T	Other	$80,616	$334,155	$528,654	$250,909	$5,845,753
	TOTAL	**$1,044,979**	**$4,331,442**	**$6,852,611**	**$3,252,377**	**$75,774,827**

Table 5-18

Industry implementation fuel costs for vessel alterations

Vessel type		Annual retrofits w/elev/lift	Elev/lift factor	P.V. year 1	P.V. year 10	P.V. year 20	P.V. year 30	P.V. year 40	Total fuel $
H	Ferry	5.58	1	$8,181	$107,293	$44,982	$14,283	$263	$1,688,984
H	Dinner/excursion	0.60	0.5	$195	$2,564	$1,075	$341	$6	$40,358
H	Gaming	3.15	0	$0	$0	$0	$0	$0	$0
H	Cruise	0.08	0.5	$69	$901	$378	$120	$2	$14,188
H	Whalewatch/sightsee	1.63	0.5	$1,495	$19,604	$8,219	$2,610	$48	$308,597
H	Other	0.84	0.5	$412	$5,408	$2,267	$720	$13	$85,130
K	Ferry	2.13	1	$12,507	$164,034	$57,479	$7,707		$2,298,731
K	Dinner/excursion	14.04	0.5	$22,877	$300,044	$105,138	$14,097		$4,204,742
K	Gaming	1.01	0	$0	$0	$0	$0		$0
K	Cruise	0.07	0.5	$341	$4,467	$1,565	$210		$62,602
K	Whalewatch/sightsee	1.32	0	$0	$0	$0	$0		$0
K	Commuter /shuttle	0.00	0	$0	$0	$0	$0		$0
K	Fishing/dive	3.07	0	$0	$0	$0	$0		$0
K	Other	1.92	0.5	$3,122	$40,949	$14,349	$1,924		$573,848
T	Ferry	3.28	0.5	$12,007	$157,479	$32,518			$1,766,607
T	Dinner/excursion	0.00	0	$0	$0	$0			$0
T	Gaming	0.00	0	$0	$0	$0			$0
T	Cruise	0.00	0	$0	$0	$0			$0
T	Whalewatch/sightsee	0.00	0	$0	$0	$0			$0
T	Commuter /shuttle	0.00	0	$0	$0	$0			$0
T	Sailing	0.00	0	$0	$0	$0			$0
T	Other	0.00	0	$0	$0	$0			$0
	TOTAL			**$61,207**	**$802,743**	**$267,969**	**42,012**	**$333**	**$11,043,789**

Table 5-19

Industry implementation maintenance costs for vessel alterations

Vessel type		Units per year w/ elev/lift	Unit annual cost	Units per year w/o elev/lift	Unit annual cost	P.V. year 1	P.V. year 10	P.V. year 20	P.V. year 30	P.V. year 40	Total type cost
H	Ferry	5.58	$2,000	1.40	$500	$9,830	$64,461	$27,025	$8,581	$158	$1,019,951
H	Dinner/excursion	0.60	$1,500	0.20	$500	$829	$5,436	$2,279	$724	$13	$86,017
H	Gaming	3.15	$2,000	1.05	$500	$5,658	$37,103	$15,555	$4,939	$91	$587,069
H	Cruise	0.08	$1,500	0.03	$500	$104	$680	$285	$90	$2	$10,752
H	Whalewatch/sightsee	1.63	$1,500	0.54	$500	$2,254	$14,780	$6,196	$1,968	$36	$233,860
H	Other	0.84	$1,500	0.28	$500	$1,166	$7,645	$3,205	$1,018	$19	$120,962
K	Ferry	2.13	$1,875	8.53	$375	$5,967	$39,130	$13,712	$1,839		$551,345
K	Dinner/excursion	14.04	$1,375	14.04	$375	$20,374	$133,607	$46,817	$6,277		$1,882,528
K	Gaming	1.01	$375	1.01	$375	$628	$4,120	$1,444	$194		$58,057
K	Cruise	0.07	$1,375	0.07	$375	$101	$663	$232	$31		$9,343
K	Whalewatch/sightsee	1.32	$375	1.32	$375	$823	$5,399	$1,892	$254		$76,075
K	Commuter /shuttle	0.00	$375	0.00	$375	$0	$0	$0	$0		$0
K	Fishing/dive	3.07	$375	3.07	$375	$1,907	$12,503	$4,381	$587		$176,174
K	Other	1.92	$1,375	1.92	$375	$2,781	$18,234	$6,389	$857		$256,921
T	Ferry	3.28	$1,250	6.08	$250	$4,656	$30,530	$6,304			$362,385
T	Dinner/excursion	0.00	$250	9.90	$250	$2,052	$13,455	$2,778			$159,705
T	Gaming	0.00	$250	0.00	$250	$0	$0	$0			$0
T	Cruise	0.00	$250	1.62	$250	$336	$2,202	$455			$26,134
T	Whalewatch/sightsee	0.00	$250	51.84	$250	$10,744	$70,454	$14,548			$836,272
T	Commuter /shuttle	0.00	$250	26.46	$250	$5,484	$35,961	$7,426			$426,847
T	Sailing	0.00	$250	6.48	$250	$1,343	$8,807	$1,819			$104,534
T	Other	0.00	$250	20.34	$250	$4,215	$27,644	$5,708			$328,121
	TOTAL					**$81,251**	**$532,815**	**$168,450**	**$27,359**	**$319**	**$7,313,051**

Table 5-20
Industry implementation lost revenue costs for vessel alterations

	Vessel type	Pop. factor 10 ft^2/pax	Pop. factor 3.75 ft^2/pax	Elev/lift factor	P.V. year 1	P.V. year 10	P.V. year 20	P.V. year 30	P.V. year 40	Total per type
H	Ferry	1.0	0.0	1.0	$75,493	$495,060	$207,549	$65,904	$1,213	$7,833,225
H	Dinner/excursion	1.0	0.0	0.5	$5,571	$36,532	$15,316	$4,863	$90	$578,037
H	Gaming	1.0	0.0	0.0	$31,336	$205,492	$86,150	$27,356	$503	$3,251,457
H	Cruise	1.0	0.0	0.5	$311	$2,039	$855	$271	$5	$32,257
H	Whalewatch/sightsee	1.0	0.0	0.5	$12,117	$79,457	$33,311	$10,578	$195	$1,257,230
H	Other	1.0	0.0	0.5	$3,134	$20,549	$8,615	$2,736	$50	$325,146
K	Ferry	0.5	0.5	1.0	$48,070	$315,228	$110,459	$14,811		$4,441,565
K	Dinner/excursion	0.5	0.5	0.5	$293,888	$1,927,218	$675,314	$90,550		$27,154,500
K	Gaming	1.0	0.0	0.0	$15,080	$98,891	$34,652	$4,646		$1,393,377
K	Cruise	1.0	0.0	0.5	$289	$1,894	$664	$89		$26,693
K	Whalewatch/sightsee	0.5	0.5	0.0	$14,491	$95,027	$33,298	$4,465		$1,338,924
K	Commuter /shuttle	0.0	1.0	0.0	$0	$0	$0	$0		$0
K	Fishing/dive	0.5	0.5	0.0	$31,052	$203,628	$71,353	$9,567		$2,869,122
K	Other	0.5	0.5	0.5	$16,044	$105,208	$36,866	$4,943		$1,482,380
T	Ferry	0.8	0.3	0.5	$38,353	$251,504	$51,933			$2,985,273
T	Dinner/excursion	0.8	0.3	0.0	$76,062	$498,790	$102,996			$5,920,483
T	Gaming	1.0	0.0	0.0	$0	$0	$0			$0
T	Cruise	1.0	0.0	0.0	$0	$0	$0			$0
T	Whalewatch/sightsee	0.8	0.3	0.0	$281,796	$1,847,919	$381,579			$21,934,224
T	Commuter /shuttle	0.0	1.0	0.0	$150,414	$986,362	$203,675			$11,707,810
T	Sailing	1.0	0.0	0.0	$24,174	$158,522	$32,733			$1,881,612
T	Other	0.8	0.3	0.0	$55,283	$362,526	$74,858			$4,303,068
	TOTAL				**$1,172,957**	**$7,691,846**	**$2,162,176**	**$240,779**	**$2,056**	**$100,716,384**

5.4 TRAINING COSTS

Passenger vessel crew training for vessels in the industry is needed to assure proper assistance to passengers with disabilities, including passage from the dock to the vessel. Estimates have varied from zero to the cost for one day training per year for all crew. One half day of training per year is assumed for all passenger vessel crews, regardless of the vessels' accessibility status.

Industry manpower data are not readily available for this calculation, and a rough estimate only is possible. Therefore, it is assumed that an average of three crew per vessel are affected, a total of 17,310 personnel. At an assumed average labor rate of $250/day, the annual cost will be $2,163,750. Present value for the forty year period considered herein is $33.2 million.

5.5 FLEET COST SUMMARY

Table 5-21 (society cost) and 5-22 (business cost) show the categorized summaries of costs among the three Coast Guard subchapter passenger vessel categories. Table 5-23 is a summary calculation of "actual" costs, i.e. the total of the cost stream with no present value discounting.

Table 5-21
Industry-wide fleet access implementation costs ($ millions)
Societal cost

Vessel type		Capital	Fuel	Maintenance	Revenue	Total
H	New construction	$11.1	$2.6	$2.0	NA	$15.7
K	New construction	$27.8	$22.3	$6.5	NA	$56.6
T	New construction	$74.8	$33.6	$9.2	NA	$117.6
Total	**New construction**	**$113.7**	**$58.5**	**$17.7**	**$0**	**$189.9**
H	Alteration	$10.5	$2.1	$2.1	$13.3	$28.0
K	Alteration	$21.2	$7.1	$3.0	$38.7	$70.0
T	Alteration	$22.9	$1.8	$2.2	$48.7	$75.6
Total	**Alteration**	**$54.6**	**$11.0**	**$7.3**	**$100.7**	**$173.6**
TOTAL	**FLEET**	**$168.3**	**$69.5**	**$25.0**	**$100.7**	**$363.5**
TOTAL	**Plus training**					**$396.7**

Table 5-22

Industry-wide fleet access implementation costs ($ millions)

Business cost

Vessel type		Capital	Fuel	Maintenance	Revenue	Total
H	New construction	$13.5	$2.6	$2.0	NA	**$18.1**
K	New construction	$34.2	$22.3	$6.5	NA	**$63.0**
T	New construction	$92.6	$33.6	$9.2	NA	**$135.4**
Sub Total	**New construction**	**$140.3**	**$58.5**	**$17.7**	**$0**	**$216.5**
H	Alteration	$14.4	$2.1	$2.1	$13.3	**$31.9**
K	Alteration	$29.0	$7.1	$3.0	$38.7	**$77.9**
T	Alteration	$32.4	$1.8	$2.2	$48.7	**$82.0**
Sub Total	**Alteration**	**$75.8**	**$11.0**	**$7.3**	**$100.7**	**$194.8**
TOTAL	**FLEET**	**$216.1**	**$69.5**	**$25.0**	**$100.7**	**$411.3**
TOTAL	**Plus training**					**$444.5**

Table 5-23

Fleet sector actual costs (1996 $millions)

Vessel type		Capital	Fuel	Maintenance	Revenue	Total
H	New construction	$27.6	$8.9	$7.1	$0	**$43.6**
K	New construction	$58.2	$74.4	$22.7	$0	**$155.3**
T	New construction	$142.9	$110.4	$31.1	$0	**$284.4**
Sub Total	**New construction**	**$228.7**	**$193.7**	**$60.9**	**$0**	**$483.3**
H	Alteration	$15.4	$4.8	$4.8	$30.9	**$55.9**
K	Alteration	$31.1	$13.4	$5.9	$75.8	**$126.2**
T	Alteration	$34.6	$3.4	$4.3	$94.4	**$136.7**
Sub Total	**Alteration**	**$81.1**	**$21.6**	**$15.0**	**$201.1**	**$318.8**
TOTAL	**FLEET**	**$309.8**	**$215.3**	**$75.9**	**$201.1**	**$802.1**
TOTAL	**Plus training**	**$86.6**				**$888.9**

6. SHORE TO VESSEL TRANSITION ACCESS

6.1 APPROACH

The unit costs for providing access at dock and pier facilities are calculated and the industry implementation cost for ADA compliance determined in a six step process, as presented in paragraph 3.2.1. The access requirements for this segment of the industry are driven mainly by the needs of mobility-impaired persons, in particular specified path of travel geometries for wheelchairs.

This chapter presents dock and pier access solutions. Chapter 7 presents the unit incremental costs and industry implementation costs. Introductory comments on each step of the process follow:

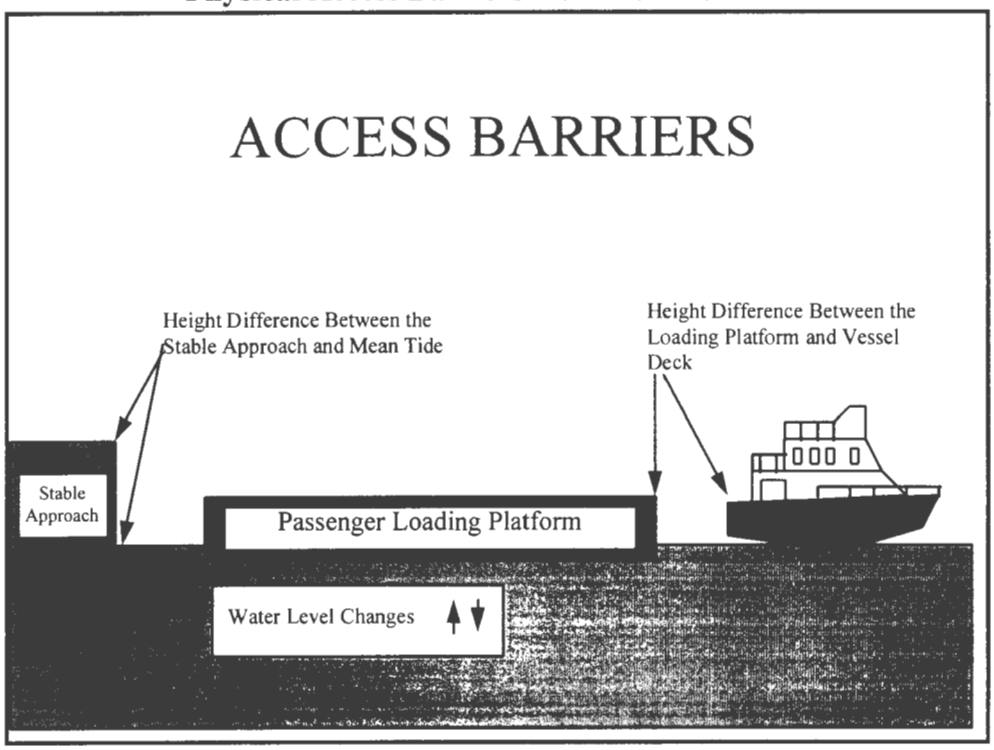
- ***Physical barriers to access from land to vessel (Section 6.2)***-- Up to three pathway elements must be considered in the construction of access solutions: the stable approach (land or fixed structure such as a pier), passenger loading platform (dock), and the vessel deck.
- ***Constraints on solutions (Section 6.3)***-- The unique dynamic nature of the marine environment imposes cost, reliability, and operations constraints upon the design of access solutions. These must be integrated into the solutions.
- ***Classification of marine facilities (Section 6.4)***-- The classification matrix will model the facility population by vessel type serviced and hydrographic features.
- ***Proposed access solutions (Section 6.5)***-- The set of practicable and cost-effective solutions for the population of marine facilities is based upon identified barriers and constraints.
- ***Incremental costs of proposed access solutions (Section 7.1)***-- Incremental costs, relative to providing non-compliant access, are calculated for each proposed solution.
- ***Industry implementation cost (Section 7.2)***-- Industry implementation costs are based on the proposed solutions, the estimated number of affected facilities, and logic linking the solutions to the modeled facility population. The population is modeled on limited data; a range of industry costs is, therefore, projected.

6.2 PHYSICAL BARRIERS TO ACCESS FROM LAND TO VESSEL

Access from shore to vessel involves transit along three path-of-travel elements: stable approach, passenger loading platform, and vessel deck (Figure 6-1). The access barriers result from the intervening differences in height among those elements, whose descriptions follow:

- ***Stable approach***-- The start point of the path of travel, land and/or a fixed pier.
- ***Passenger loading platform***-- The intermediate component along the path of travel, i.e. a floating dock. This is the most common configuration, but access is sometimes provided directly from the stable approach to the vessel deck.
- ***Vessel deck***-- The end of the shore facility portion of the path of travel.

Figure 6-1
Physical Access Barriers from Dock to Vessel



The accommodations to overcome the barriers will satisfy a set of "nominal marine conditions", which include tidal or non-tidal height limits of ten and twenty feet, respectively, and the assumption that severe weather is not causing excessive motions. The approach to categorizing shore facilities sorts on this assumed hydrographic condition (yes or no). Combinations of the physical access barriers along the path of travel determine the designs of the proposed access solutions. Description of the barriers follows:

- ***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, 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 twice daily, with normal ranges from little more than a foot to over twenty feet. Non-tidal (inland) facilities experience water level changes as the result of rain, snowmelt, dam releases, etc., which tend to occur in predictable patterns over time. The changes are less frequent than at tidal facilities, but can be more severe, with normal ranges often in excess of 20 feet. Extreme weather conditions can add considerably to the range 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 with loading and weather conditions.

6.3 MARINE DESIGN REQUIREMENTS FOR ACCESS SOLUTIONS

The following are the unique design constraints imposed by the marine environment for providing access from shore facilities to vessels:

- ***Dynamic nature of the marine environment***-- Shore facilities are exposed to a dynamic marine environment, with the impact of waves, wind, tides, current, and weather. The functional design of access features must account for the resulting loads and motions.
- ***Changes in height differences***-- Access solutions in the marine environment differ from those on land in that height differences change, over both short and long time frames. Changing height differences drive a unique set of solutions for accessibility.
- ***Lift and stability requirements of floating structures***-- Excluding fixed piers, access structures are floating components subject to the same static and dynamic effects as vessels. The design of access solutions for docks must take into account lift (weight), heel and trim due to shifting of weight, and the dynamic effects of wind and waves.
- ***Exposure to harsh weather conditions***-- While any outdoor system for accessibility must be designed and built to withstand the impacts of weather, marine facilities are especially impacted by their environment, i.e. the effects of water, salt and air on durability and reliability.

6.4 CLASSIFICATION OF MARINE FACILITIES

Development of access solutions requires a system for facility classification. The following attributes define shore facilities and result in sixteen facility types as shown in Table 6-1 below:

- ***Normal range of water height***--The normal range of water height can vary from less than one foot to in excess of 25 feet. Industry's experience has of course been that access with greater height changes is the more difficult. The evidence is that height changes of more than ten feet for tidal facilities and twenty feet for non-tidal facilities are logical breakpoints for characterization, based upon the Army Corps of Engineers Port Series, showing 90-95% of port facilities below that threshold.
- ***Available water sheet***-- Space limitations are frequently a factor in how easily a facility can be made accessible. Available watersheet, the area over the water available for docks and piers and vessel maneuvering, is often a critical matter and is defined by issues of property ownership and navigable waterways. The breakpoint of 40,000 ft^2 was suggested during the Massachusetts negotiated regulation for waterborne transportation access because it provides area for a 100' vessel to turn, a large-scale full access solution, and dock space.
- ***Scheduled versus unscheduled service***-- From a user perspective, there is generally a greater presumption that scheduled service will be accessible. Although ADA does not

specifically make any references to scheduled or unscheduled service, there are several analogous concepts in ADA and other rulemakings.

- ***Type of vessel using facility***-- The type and size of vessels using a facility relate directly to passenger volumes and the size of a facility to accommodate them. Facility size and passenger volumes are key factors for determining access requirements. As in Chapters 4 and 5, vessel size roughly corresponds to Coast Guard subchapter classifications H/K (large) and T (small).

Table 6-1 describes the facilities by service and hydrographic characteristics. Each category is scored with "+" and "-" for tidal height, available watersheet, schedule, and vessel size. "+" scores indicate the need and practicality of full access, while "-" scores indicate less intensive use or greater site-related difficulties. The results are then expressed on a scale from 0 to 4, corresponding to the number of "+" marks received.

This categorization is used in the calculation of industry implementation costs, specifically in Section 7.2 which establishes the linkage between the shore facility population and the fleet.

Table 6-1
Marine Facilities Matrix

		Service Characteristics			
		Scheduled (+) H/K (+)	**Scheduled (+) T (-)**	**Unscheduled (-) H/K (+)**	**Unscheduled (-) T (-)**
P h y s i c a l **F e a t u r e s**	Water height < 10'/ 20' (+) (Note 1), water sheet > 40K ft^2 (+)	++++ 4	+++- 3	++-+ 3	++-- 2
	Water height < 10'/ 20' (+), water sheet < 40K ft^2 (-)	+-++ 3	+-+- 2	+--+ 2	+--- 1
	Water height > 10'/ 20' (-), water sheet > 40K ft^2 (+)	-+++ 3	-++- 2	-+-+ 2	-+-- 1
	Water height > 10'/ 20' (-), water sheet < 40K ft^2 (-)	--++ 2	--+- 1	---+ 1	---- 0

Note 1: Water height limits shown for tidal/non-tidal facilities.

6.5 PROPOSED ACCESS SOLUTIONS

6.5.1 Criteria

The process for identifying design constraints and developing facility classification criteria drives the development of practicable access solutions. A limited number of solutions are advanced for the purpose of calculating unit costs. These solutions are not all inclusive but provide a reasonable spectrum for modeling industry costs. Given the variety of facilities now in service and the possibilities for new engineering approaches, it is expected that accessibility solutions will vary widely.

The following four criteria inform the design of proposed shore-to-vessel access solutions:

- ***Broadest possible applicability***-- Access solutions apply to a broad cross section of shore facilities. A limited number are chosen to simplify the process of developing industry-wide costs.
- ***ADAAG specifications***-- All solutions will satisfy ADAAG ramp specifications for slip-resistant surfaces, handrails, gaps, clearance, and live loads. Non-compliance with ADA slope requirements for transition plates at either end of the gangway would be allowable if properly identified for potential users. Depending on the facility classification, exemptions to ADA slope and length regulations could be acceptable (discussion in Chapter 7).
- ***Unassisted access***-- Solutions should provide unassisted access to the vessel.
- ***Reasonable cost***-- Low installation cost will mean faster compliance. The proposed access solutions defined for this report will not be universally adopted as new engineering approaches will emerge; low cost solutions will, however, be the most likely outcome.
- ***Low maintenance***-- An access system that is not properly maintained will not provide access for very long.

6.5.2 Proposed Solutions

Four components are selected as the basis of unit cost calculations and the cost roll-out.

> ***COMPONENT 1: Either a 60'-80' accessible gangway (1) or a "Double entry" ramp (1a) and twin 30' accessible gangways (1b) from stable approach to passenger loading platform. Double entry means that there are two start points on the land at different heights; one of the start points will require a fixed ramp.***
> ***COMPONENT 2: 120' fixed ramp system (2a) and associated floating platform (2b).***
> ***COMPONENT 3: 12' accessible boarding gangway.***

Selected combinations of these components make up five solutions which have been found to be feasible for application to all of 59 terminal facilities visited. Solutions 1 through 4, shown in Figures 6-2 through 6-5, are for the "high access" facilities, that is, those rated "3" or "4" in

Figure 6-2

"High Access" solution with Components 1a, 1b, 2a, 2b, and 3

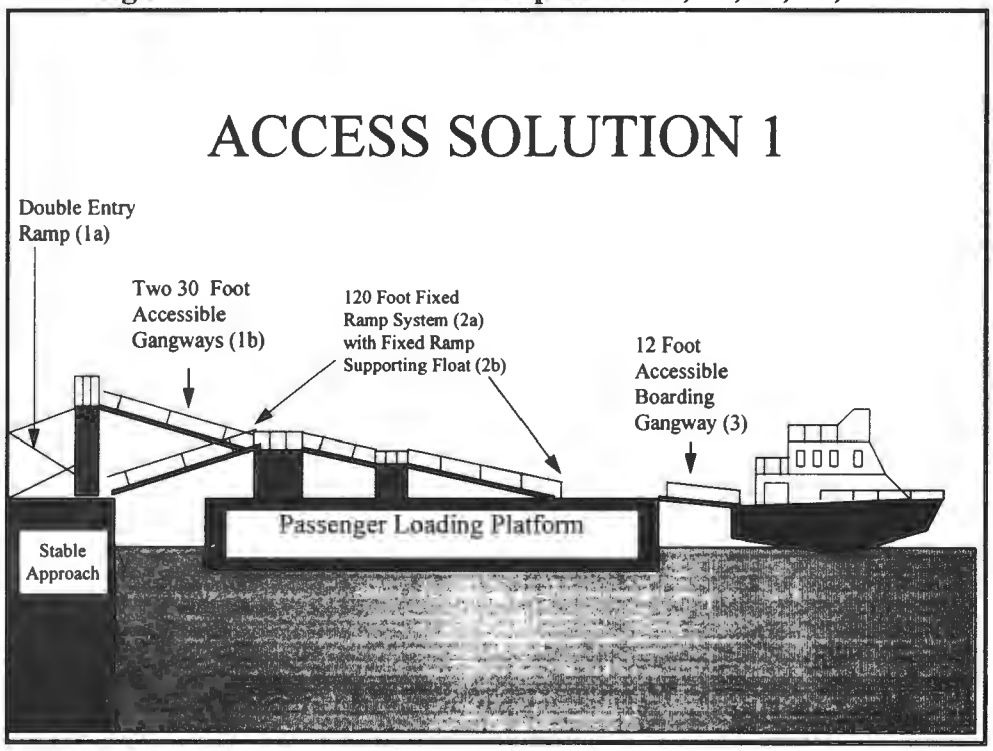


Figure 6-3

High Access solution with Components 1, 2a, 2b, and 3

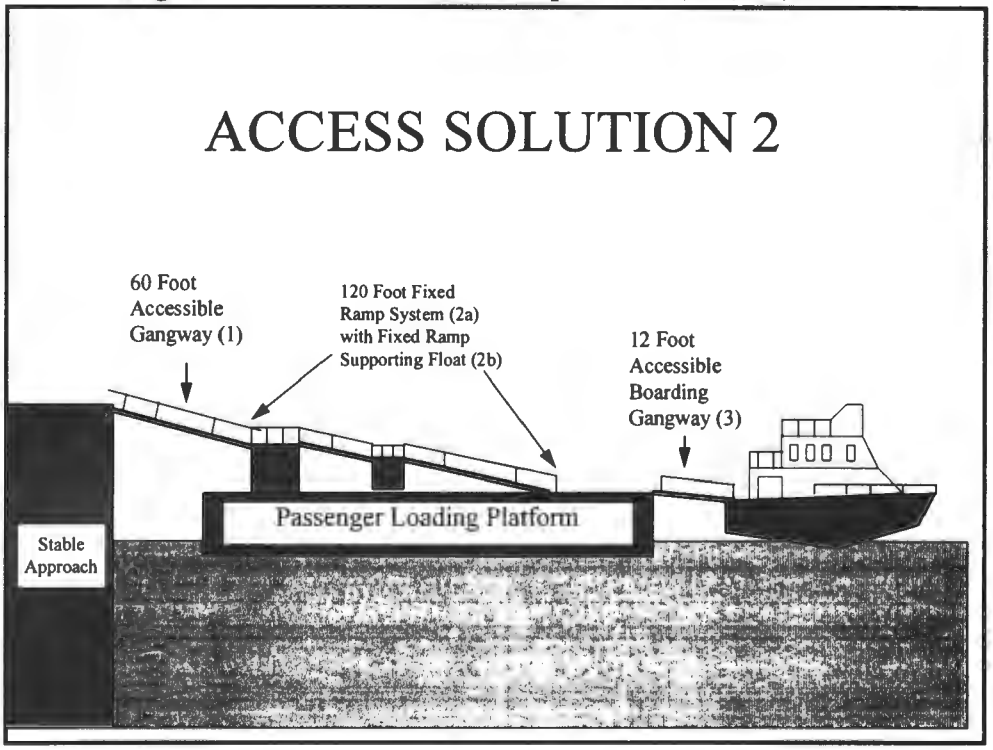


Figure 6-4
High Access solution with Components 1a, 1b, and 3

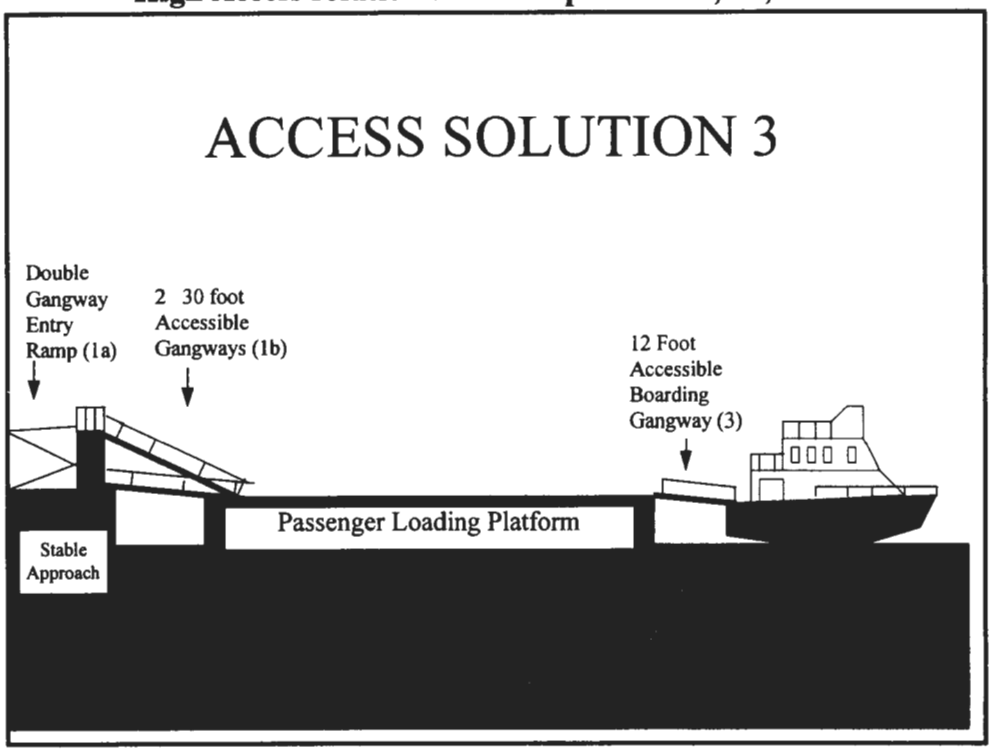


Figure 6-5
High or Low Access solution with Components 1 and 3

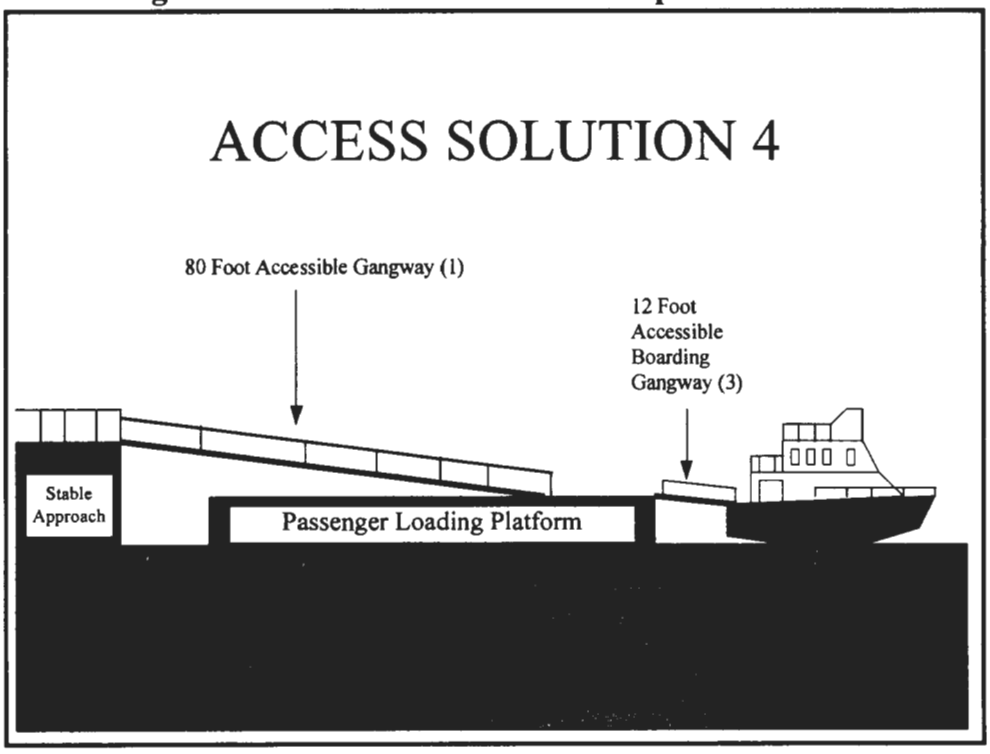


Figure 6-6
"Low Access" solution with Components 1 and 3

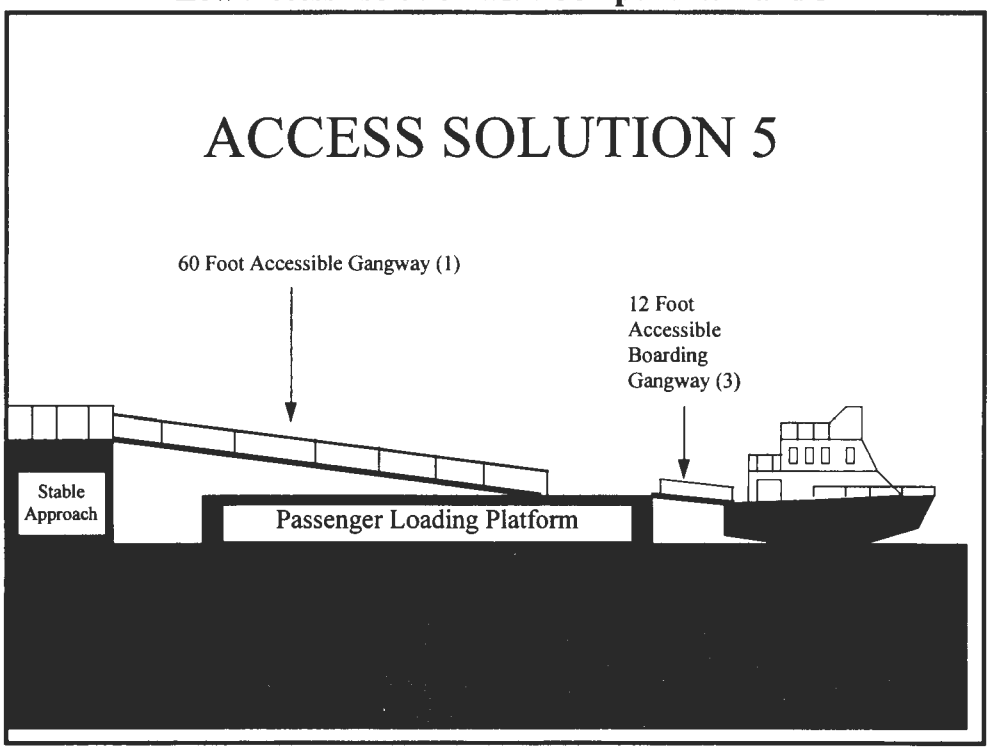


Table 6-1, based upon intensity of use and hydrographic characteristics. Solutions 4 and 5 (Figures 6-5 and 6-6) are lower impact designs for those facilities with lower access profiles, that is, rated from "0" to "2". The range of water heights at affected facilities implies that low cost solutions will often provide full access for category "3" and "4" facilities. Likewise, Solutions #4 and 5 may often provide full access at category "0-2" facilities.

All of the high access solutions may be varied to suit greater height differences for the small percentage of such facilities. Higher unit costs for those facilities are included in the full implementation calculation in Chapter 7.

Note that Solutions 4 and 5 are variations on the simplest possible design, including Components 1 and 3. The ramp from land to float is either 80' or 60' long. Solution #4 may be either a "High" or "Low" access design, depending on the local hydrography. It is used for both situations in the industry cost calculations.

6.5.3 Safety concerns

Costs for the proposed solutions will be developed with all pertinent safety features and ADAAG specifications in mind. These safety issues may not be readily apparent in examining the proposed solutions, but they were considered in every solution examined:

- ***Information on travel path***- The path of travel at a marine facility is likely to differ from what someone would encounter on land. As a result, it is critical that information on these differences be made available to all users.
- ***Guardrails***-- Because of the inherent dangers of accidentally leaving the path of travel at a marine facility, guardrails are critical to insuring passenger safety.
- ***Edge Treatments/Detectable Warnings***-- Tactile edge treatments and detectable warnings for the sight-impaired are also critical to insuring passenger safety.
- ***Changes in slopes, heights, materials, etc.***-- The path of travel from land to vessel is likely to have frequent changes, particularly slopes. For user safety, it is important to identify these at the proper time.
- ***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.
- ***Assistance***- - Assistance by crew for all passengers in the marine environment is standard practice due to its dynamic nature. This positive tradition in the industry will be a part of the growing need for access for persons with disabilities.

7. SHORE TO VESSEL TRANSITION ACCESS COSTS

The industry cost calculations have the following three steps:

- Development of unit costs for the access components
- Calculation of unit access solution costs (Scenarios 1-6)
- Cost of industry implementation based upon finding the number, or range of numbers, of terminals affected nationally

The first two steps are straightforward, given the availability of component costs data and the access solutions advanced in Chapter 6. The industry cost is limited by available shore facility data, and are of necessity presented as a range of cost scenarios based upon different data extrapolations. The extrapolations result from varied inputs for numbers of terminals, tied to the vessel population, and the distributions of unit access solution costs within the terminal population.

7.1 UNIT INCREMENTAL COSTS

The incremental, or premium, costs of providing access for each solution are calculated, that is, the additional costs of fully accessible systems relative to existing industry standards. The incremental cost elements for all components in the proposed solutions are:

- Extra gangway width
- Extra gangway length
- Extra handrails/guardrails
- Non-slip surface
- ADA compliant approach
- Signage
- Strengthening to ADA required weight limits

Cost units begin at the component level and add together to give unit scenario costs. The access scenario premiums are the differences between the scenario costs and those estimated for non-compliant construction.

7.1.1 Unit component costs

Table 7-1 shows sample unit costs developed for the access components. They do not include costs for current industry construction practices. Detailed supporting data and notes are in Appendix E.

Table 7-1
Component unit costs

Access component	Height	Length	Cost
1. 60' accessible gangway	5'	60'	$15,900
1. 80' accessible gangway	7'	80'	$21,200
1. 100' accessible gangway	8'	100'	$26,500
1a. Double gangway entry ramp.	5'	60'	$30,000
1a. Double gangway entry ramp.	8'	100'	$50,000
1b. Two 30', accessible gangways.	5'	(2) X 30'	$10,500
2a. 120' fixed ramp system.	10'	120'	$31,000
2b. Supporting float for 120' fixed ramp	NA	NA	$70,000
2a. 180' fixed ramp system.	15'	180'	$46,500
2b. Supporting float for 180' fixed ramp	NA	NA	$105,000
3. 12' accessible boarding gangway	1'	12'	$2,100

Note: Height and length refer to height of barrier and 12:1 length to overcome.

7.1.2 Unit solution costs

The component cost units are added to find the unit cost for each access solution in Table 7-2. Access barrier height differences vary over a wide range for each access solution; however, uniform representative heights and lengths were chosen for each solution. These are reflected in the access solutions and costs.

One baseline non-accessible configuration is used in order to determine the access premium for all solutions. It consists of a standard 50 foot gangway and a set of portable stairs to the vessel's deck edge. The gangway cost was based on standard, currently available equipment. No costs were assigned to the stairs, nor for the baseline float, which is assumed to be required for any solution. The baseline cost is $5,300.

Table 7-2 includes notional costs developed for solutions for high tidal/non-tidal water height changes, identified as "High 1/2/3/4/5". The water heights given in Table 7-2 are representative of a range; the "high" solutions therefore do not solve for the most extreme situations. Longer ramps and gangways for each solution raise the component costs. The baseline cost for non-accessible solutions in these situations is $10,000.

Detailed scenario unit cost calculations are found in Appendix E.

Table 7-2
Solution unit costs

Component	Height	1	1a	1b	2a	2b	3	Total	Net cost
Solution 1	10'	$0	$30,000	$10,500	$31,000	$70,000	$2,100	$143,600	$138,300
Solution 2	10'	$15,900	$0	$0	$31,000	$70,000	$2,100	$119,000	$113,700
Solution 3	8'	$0	$30,000	$10,500	$0	$0	$2,100	$42,600	$37,300
Solution 4	7'	$21,200	$0	$0	$0	$0	$2,100	$23,300	$18,000
Solution 5	5'	$15,900	$0	$0	$0	$0	$2,100	$18,000	$12,700

High 1	15'	$0	$50,000	$15,900	$46,500	$105,000	$2,100	$219,500	$209,500
High 2	15'	$21,200	$0	$0	$46,500	$105,000	$2,100	$174,800	$164,800
High 3	10'	$0	$50,000	$15,900	$0	$0	$2,100	$68,000	$58,000
High 4	10'	$26,500	$0	$0	$0	$0	$2,100	$28,600	$18,600
High 5	7'	$21,200	$0	$0	$0	$0	$2,100	$23,300	$13,300

7.2 INDUSTRY ROLL-OUT COSTS

The industry roll-out cost calculation includes existing facilities only and does not account for new construction trends. The difficulties of data collection, discussed below, make accurate projections of replacement rate of existing facilities and the construction rate of new facilities impossible. Therefore, the cost of implementation for existing facilities only will follow that of new construction and retrofits for vessels, i.e. a 40-year phase-in.

The shore facility industry cost calculation consists of the following steps:

- ***Analysis of available data, including validation by site survey information***
- ***Development of facility baseline data base by linking to vessel population (Section 4.3)***
- ***Linking access solutions to facility data base***
- ***Industry costs found as a range defined by upper and lower facility/vessel ratios and three distributions of access solutions to the population***

7.2.1 Data analysis

Only two sources for shore facility data were found, both from U.S. Government agencies. Descriptions of the available data follow:

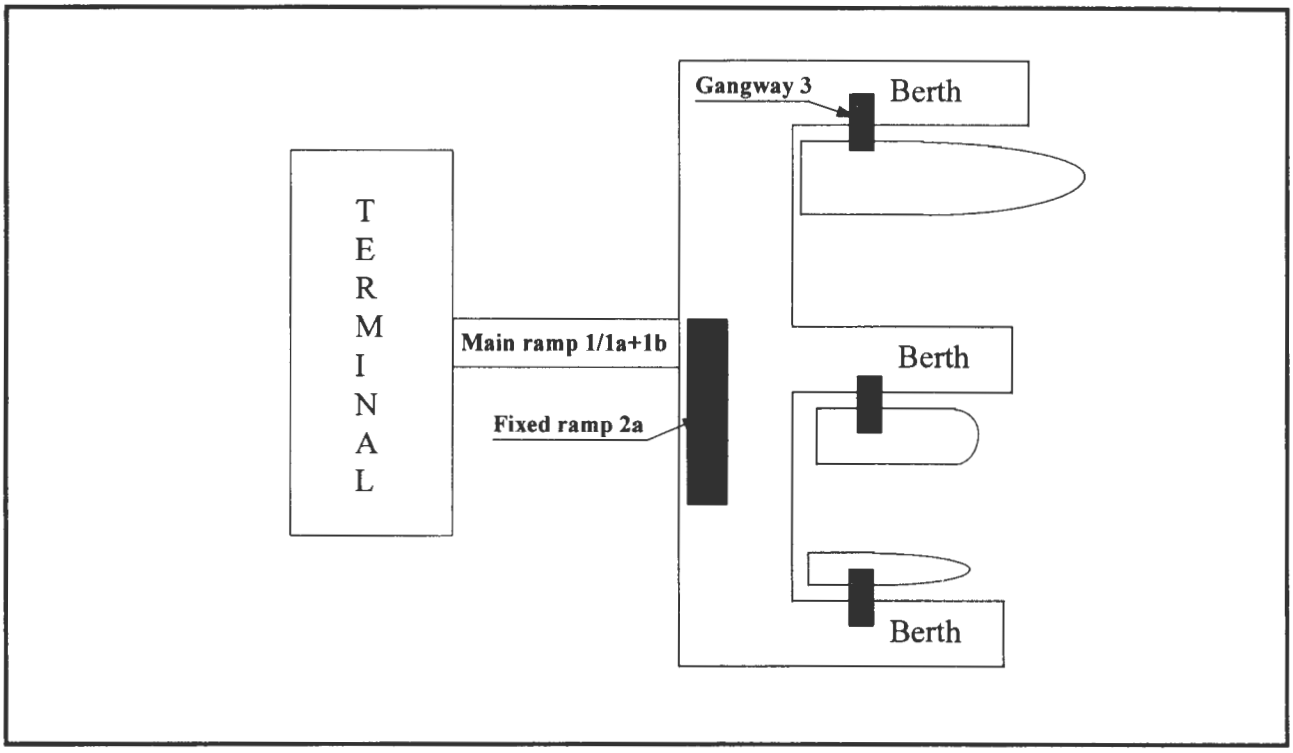
- ***Army Corps of Engineer Port Series***-- The reports in the Port Series cover the principal United States coastal, Great Lakes and inland ports. There are 59 separate reports, which are updated on a regular basis. Each report contains a general description of the port area

and a listing of port and harbor facilities. The general port description includes the tidal range of the port.

The port and harbor facility list includes all wharves, piers and docks in the port by category of use. The usage categories include separate listing for vehicular ferries and passenger ferries. There is a separate description of each pier, wharf and dock which includes physical dimensions, owner and operator.

- ***Federal Transit Administration National Waterborne Passenger Transportation Data Base***-- This data base (abbreviated to NWPTDB) identifies 168 separate ferry systems operating in the United States. Each system is profiled separately. The profile contains information on the ferry system location, number of routes, and vessels operated. The NWPTDB covers those ferry lines and associated facilities that responded to the original questionnaire. The passenger fleet data development in para. 4.3.3 indicates that this survey gives excellent coverage of the national ferry fleet and its shore facilities.
- ***Field data***-- The practicability of the six access scenarios was confirmed by trips to a representative range of shore facilities in New England, San Francisco Bay, Chicago, Cincinnati, New York City, Oregon, and Cape May, New Jersey. The number of vessels at each facility was also observed for the purpose of calculating facility/vessel ratios. Figure 7-1 is an example of a multi-berth facility servicing multiple vessels. Detailed site visit results are in Appendix E (Figure E-1).

Figure 7-1
Multi-vessel facility
(Component #s indicated)



The Army Corps data base is far from comprehensive; it covers only large fixed facilities in the principal port areas. For these purposes, it is inadequate as a national model and no correlation can be drawn to our field data since so many smaller ports and facilities were visited. This data base does, however, give an excellent indication of the distribution of coastal and inland water height ranges (see Appendix E).

It shows that, except for Alaska, some parts of Maine, and some river sites, all normal ranges are less than the threshold values of ten and twenty feet. Seven sites with water height ranges in excess of the thresholds were visited (about 12% of the total), including six in the Cincinnati, Ohio/Covington, Kentucky area. This ratio is too high based on Army Corps data and is adjusted to 5% of the total population. The industry cost calculation, therefore, reflects higher unit costs for that portion of facilities.

Therefore national facility data will be characterized as follows:

- ***Ferry terminals***-- The number of ferry facilities is drawn directly from NWPTDB, a total of 357. Based upon field observations, all facilities are assumed to be in scheduled service ("+"), less than 10'/20' tidal range ("+"), and non-restricted water sheet ("+"). Distribution between H/K and T service is proportional to the fleet distribution, that is 219 H/K facilities ("++++") and 138 T facilities ("+++-"). All are therefore in Categories 4 and 3 (Table 6-1).
- ***Non-ferry terminals***-- This population is developed from field observations and extrapolation of facility/vessel ratios using developed fleet data. The distribution of vessel types, by Coast Guard subchapter, among the observed facilities is extrapolated to the entire existing fleet. Two ratios are applied in order to get a range of cost impacts since the confidence in the data is low.

  The global ratio of 0.43 and a local (Boston) study ratio of 0.33 resulted from the field work. The Boston number is distorted by the presence of a single terminal serving eight passenger vessels. The global ratio could be influenced by a disproportionate number of facilities in large and medium sized cities relative to small port areas. A high end ratio symmetric to the low end number is probably reasonable. Facility-to-vessel ratios of 0.33 and 0.55 are, therefore, used to bound the range of industry implementation costs. The population characterization is summarized in Table 7-3.

  The terminals with high water level changes are folded into the general population by a weighting factor of 1.5, based upon the unit scenario costs in Table 7-2. The costs for Scenarios 4, 5, and 6 are little changed, but are 50% higher for #1, 2, and 3, the high access solutions for intensive use terminals. The affected terminals, i.e. all H/K and scheduled service T facilities, are therefore accounted at 7.5% instead of 5%, by multiplying the total category numbers by 1.025.

Table 7-3
Shore terminal population
Access Categories shown parenthetically

Terminal type and facility-vessel ratio	H/K sched. ++	T sched. +-	H/K un-sched. -+	T un-sched. --
Ferry ++	224 (4)	142 (3)	NA	NA
Other (0.33) x ++	209 (4)	989 (3)	10 (3)	168 (2)
Other (0.33) x +-	27 (3)	345 (2)	0 (2)	61 (1)
Other (0.55) x ++	348 (4)	1648 (3)	16 (3)	281 (2)
Other (0.55) x +-	45 (3)	576 (2)	0 (2)	102 (1)

7.2.2 Population/solution linkage

Six industry cost scenarios establish the range of industry expense for shore facility upgrade. Two facility/vessel ratios, established in 7.2.1, are crossed with three access solution distributions. High access facility categories are linked with the high access solutions, i.e. Categories 4 and 3 are solved by Solutions 1, 2, 3, and 4. Low access facility categories 2, 1, and 0 are addressed by Solutions #4 and 5.

The available data do not support any particular distribution of access solutions to the facility population; therefore three distributions are chosen to show a range of costs with different proportions of high and low cost solutions. Table 7-4 describes the linkages and distributions. Note that Solutions #1 and 2 are most costly and that #3, 4, and 5 are much cheaper solutions.

Table 7-4
Access Solution Linkages

	S O L U T I O N S					
	High access				Low access	
	1 ($138K)	2 ($114K)	3 ($37K)	4 ($18K)	4 ($18K)	5($13K)
Distrib. 1	10%	10%	40%	40%	50%	50%
Distrib. 2	25%	25%	25%	25%	50%	50%
Distrib. 3	40%	40%	10%	10%	50%	50%

The industry implementation cost is calculated separately for ferries; the facility/vessel ratio is not varied since the facility population is well documented. Ferry operations are, by the study's definitions, all high access terminals. However, many T ferry facilities consist of simple roll-on/roll-off arrangements for short runs, including those for ferry barges. Three ferry facility industry-wide costs only are calculated, for the cost scenarios in Table 7-4. Only Solutions 1-4 apply, with the caveat that 25% of T ferry facilities need no access features.

Tables 7-5 and 7-6 summarize the results of the industry cost calculations. Table 7-5 is the societal cost, that is, the present value of capital outlays over a 40-year replacement and construction period, with no amortization costs. Table 7-6 shows the present value of business costs, which include capital costs amortized at 7.9% over ten years, resulting in a cost stream of 50 years.

The "raw total" values come from the detailed industry implementation cost sheets, presented in Appendix E (pp. E-9 and E-10). These actual costs in 1996 dollars are estimated to range from $79.5 million to $263.8 million.

Table 7-5
Industry-wide terminal access implementation costs ($millions)
Societal costs

	Raw Total	Raw annual	PV 1	PV 5	PV 10	PV 20	PV 30	PV 40	PV Total
Ferry low	$14.94	$0.37	$0.32	$0.27	$0.21	$0.13	$0.08	$0.05	**$6.00**
Ferry medium	$24.95	$0.62	$0.54	$0.45	$0.36	$0.22	$0.14	$0.09	**$10.02**
Ferry high	$34.97	$0.87	$0.76	$0.63	$0.50	$0.31	$0.20	$0.12	**$14.04**
R=0.33; low	$64.64	$1.62	$1.40	$1.16	$0.92	$0.58	$0.36	$0.23	**$25.96**
R=0.33; med.	$99.87	$2.50	$2.17	$1.80	$1.42	$0.89	$0.56	$0.35	**$40.10**
R=0.33; high	$139.48	$3.49	$3.03	$2.51	$1.99	$1.24	$0.78	$0.49	**$56.00**
R=0.55; low	$107.74	$2.69	$2.34	$1.94	$1.53	$0.96	$0.60	$0.38	**$43.26**
R=0.55; med.	$167.46	$4.19	$3.64	$3.02	$2.39	$1.49	$0.93	$0.58	**$67.24**
R=0.55; high	$228.81	$5.72	$4.97	$4.12	$3.26	$2.04	$1.28	$0.80	**$91.87**

The costs in Table 7-5 and 7-6 may be apportioned along the lines of vessel size by Coast Guard Subchapter. The apportionment is asshown in Table 7-7, per industry implementation spreadsheets, pp. E-9 and E-10 in Appendix E:

- ***Ferry terminals***-- H/K account for 67% of the total cost and T for 33% of the total.
- ***Non-ferry terminals***-- H/K accounts for 17-19% of the total and T for 81-83%.

Table 7-6
Industry-wide terminal access implementation costs ($millions)
Business costs, amortized

	Raw Total	Raw annual	PV 5	PV 10	PV 20	PV 30	PV 40	PV 50	PV Total
Ferry low	$14.94	$0.37	$0.20	$0.32	$0.20	$0.12	$0.08	$0.00	**$7.33**
Ferry medium	$24.95	$0.62	$0.33	$0.53	$0.33	$0.21	$0.13	$0.01	**$12.25**
Ferry high	$34.97	$0.87	$0.47	$0.74	$0.46	$0.29	$0.18	$0.01	**$17.16**
R=0.33; low	$64.64	$1.62	$0.86	$1.37	$0.85	$0.53	$0.33	$0.02	**$31.73**
R=0.33; med.	$99.87	$2.50	$1.33	$2.11	$1.32	$0.83	$0.52	$0.03	**$49.02**
R=0.33; high	$139.48	$3.49	$1.86	$2.95	$1.84	$1.15	$0.72	$0.05	**$68.46**
R=0.55; low	$107.74	$2.69	$1.44	$2.28	$1.42	$0.89	$0.56	$0.03	**$52.88**
R=0.55; med.	$167.46	$4.19	$2.24	$3.54	$2.21	$1.39	$0.87	$0.05	**$82.19**
R=0.55; high	$228.81	$5.72	$3.06	$4.83	$3.03	$1.89	$1.18	$0.07	**$112.30**

Table 7-7
Terminal access cost summary, 1996 present value ($millions)

Vessel type/ cost distribution	Facility/ vessel ratio (R)	Society costs			Business costs		
		H/K facilities	T facilities	Total	H/K facilities	T facilities	Total
Ferry low	0.91	$4.07	$1.93	$6.00	$4.97	$2.36	$7.33
Ferry medium	0.91	$6.79	$3.23	$10.02	$8.30	$3.95	$12.25
Ferry high	0.91	$9.52	$4.52	$14.04	$11.63	$5.53	$17.16
Non-ferry, low	0.33	$4.46	$21.49	$25.96	$5.45	$26.27	$31.73
Non-ferry, med.	0.33	$7.45	$32.64	$40.10	$9.11	$39.90	$49.02
Non-ferry, high	0.33	$10.44	$45.56	$56.00	$12.77	$55.69	$68.46
Non-ferry, low	0.55	$7.44	$35.82	$43.26	$9.09	$43.79	$52.88
Non-ferry, med.	0.55	$12.43	$54.81	$67.24	$15.19	$67.00	$82.19
Non-ferry, high	0.55	$17.41	$74.46	$91.87	$21.28	$91.02	$112.30

8. COST SCENARIOS

This chapter is a brief examination of the impact of access requirements on individual businesses; five examples, mostly representative of small concerns, are provided. They are the following:

1. An operator of two Subchapter K dinner/excursion boats who will retrofit one in 2005, replace the other in 2010, and refurbish the dock in 2010 (Scenario 1).
2. A T ferry operator who will retrofit one vessel in 2000, replace another in 2010, and replace his dock in 2005 (Scenario 2).
3. A T commuter boat operator who will replace the vessel in 2005 and the dock in 2010 (Scenario 4).
4. An operator of two T fishing boats who will replace them in 2005 and 2010 and rebuild the dock in 2005 (Scenario 4).
5. An operator of two T whalewatcher and excursion boats who will retrofit the whalewatcher in 2005, replace the excursion boat in 2010, and refurbish the dock in 2005 (Scenario 5).

Table 8-1 summarizes the costs that would be incurred by the sample businesses. Capital costs are given first in 1995 dollars and then amortized ten years from the build year and present valued to 1995. Operating expenses for a thirty year period from the build year are present valued to 1995.

Table 8-1
Operator scenario costs

	Boat 1				Boat 2				Dock			TOTAL
		Capital $		Oper. $		Capital $		Oper. $		Capital $		
	Description	Raw '95 $	10-yr. APV	30-yr. PV	Description	Raw '95 $	10-yr. APV	30-yr. PV	Description	Raw '95 $	10-yr. APV	
1	Alteration 2005	$102,000	$73,832	$352,226	Newbuild 2010	$88,250	$50,530	$72,950	Replace 2010	$138,300	$79,188	**$628,725**
2	Alteration 2000	$87,500	$80,067	$422,877	Newbuild 2010	$89,500	$51,246	$150,469	Replace 2005	$113,700	$82,300	**$786,959**
3	Newbuild 2005	$12,000	$8,686	$4,834	NA	$0	$0	$0	Replace 2010	$12,700	$7,272	**$20,791**
4	Newbuild 2005	$19,500	$14,115	$1,731	Newbuild 2010	$19,500	$11,165	$1,283	Replace 2005	$12,700	$9,193	**$37,487**
5	Alteration 2005	$27,250	$19,725	$214,254	Newbuild 2010	$69,750	$39,937	$74,767	Replace 2005	$12,700	$9,193	**$357,876**

PV = present value
APV = amortized, present value

9. STABILITY CALCULATIONS

Elevators installed for the purpose of providing multi-deck access for persons with disabilities are the single access feature which may significantly impact the stability of a passenger vessel. The weight (in excess of two long tons) and the high location imply basic design issues for some vessels beyond the economic considerations of direct cost and deck space losses. A sampling of five passenger vessels is the object of a brief analysis to see how the addition of elevators affects stability.

9.1 ASSUMPTIONS AND CONDITIONS

The analysis proceeds on two sets of data: 1) the signature of the vessel and the particulars of the elevator retrofit; and 2) the Coast Guard's statutory stability parameters for passenger vessels. The following address the first point:

- The samples chosen are existing domestic passenger vessels, known to satisfy all stability regulations in their present condition, i.e. with no elevators[19].
- Elevator is assumed to serve all passenger accommodation decks.
- Elevator is placed in the most favorable position stability wise, amidships and on the centerline.
- The elevator's center of gravity is assumed with the car in its topmost position .

Stability requirements are the following:

- Intact stability
  - Coast Guard weather criterion, 46 CFR §170.170, specifying that vessels sustain heeling moments due to transverse wind loads on exposed surfaces. The unit area wind load varies with the service area of the vessel, e.g. exposed, partially protected, and protected waters. The latter generally correspond to open ocean, areas within 20 miles of safe refuge, and lakes, rivers, and harbors, respectively.
  - Coast Guard passenger heeling moment criterion, 46 CFR §171.050, specifying that vessels sustain heeling moments due to passengers crowding to one side.
- Damage stability
  - Coast Guard adopted version of the International Convention for the Safety of Life at Sea rules for passenger vessel damage stability, 46 CFR §171.080. These specify, for given damage situations, minimum range of positive stability, minimum righting energy, maximum heel angle, and minimum righting arm relative to heeling moments induced by wind and passenger crowding. Positive range and righting arm are indexed to operating areas, similar to the weather criterion.

9.2 APPLICATION

Elevator access was modeled as for retrofit to existing vessels, due to constraints of available data. The models did not include extra deck space as would be likely for a new design. The following provisions were part of the analysis:

- All vessels are assumed to operate in "partially protected" waters. Instances of failure to comply with the weather criterion resulted in a second iteration at the more benign "protected" standard.
- Weather criterion compliance is checked for four conditions: departure, fully loaded, with and without the elevator; and arrival, with stores and liquids "burned out", with and without the elevator. Wind heeling moments are per the calculations of ref. 19.
- Required metacentric heights for passenger crowding in the intact conditions are calculated directly from the Coast Guard formula and compared directly to found values in the critical condition: arrival, with elevator. At arrival, the vessel's center of gravity is highest and its stability is consequently the least robust.
- Damage stability is checked for the critical condition only: arrival, with installed elevator. Passenger crowding heel moment is the critical requirement[19] and is the only criterion checked.

9.3 RESULTS

The analysis shows a compliance with stability regulations among the vessels sampled, except for the 91 foot excursion boat. In the four cases which pass the criteria, the addition of an elevator lessens the margins of compliance somewhat, but in most cases the residual margin is ample. Detailed results of the analysis appear in Appendix F.

9.3.1 Intact stability weather criterion

The modified, and more stringent, version of the Coast Guard weather criterion was employed, i.e., allowing no more than half the heel angle needed to submerge the deck edge. Four of the vessels passed easily, and the 91 foot excursion boat passed barely (see Table 9-1). In the latter case, the addition of an elevator would cause much greater heeling under wind loads and probably result in significant passenger discomfort.

Table 9-1
Compliance with 46 CFR §171.170

Vessel	Wind load area (ft^2)	Maximum allowed ∠	Resulting ∠
80' shuttle boat	1175	9.67^0	2.76^0
91' excursion (ex-crew) boat	1388	12.75^0	10.72^0
105' dinner boat	2803	6.81^0	1.91^0
192' dinner boat	4314	6.16^0	3.40^0
274' paddle wheeler	9827	5.33^0	0.66^0

9.3.2 Intact stability passenger crowding criterion

This calculation requires a minimum metacentric height, found formulaically and depending upon passenger capacity, beam of the vessel, and vessel displacement. Table 9-2 shows the results, in all cases for the "arrival, with elevator" condition. The 91 foot excursion boat fails by a narrow margin, although it passes in the "departure, with elevator" condition.

Table 9-2
Compliance with 46 CFR §171.050

Vessel	Passenger capacity	Req'd. GM_t (ft)	Attained GM_t (ft)
80' shuttle boat	200	2.21	7.90
91' excursion (ex-crew) boat	250	2.91	**2.69**
105' dinner boat	600	3.35	16.50
192' dinner boat	600	2.04	11.32
274' paddle wheeler	1200	1.90	42.76

9.3.3 Damage stability

The Coast Guard standard requires each vessel to survive certain "extents of damage" which may occur over its entire length, under the influence of several external forces such as wind loading and passenger crowding. The result for each craft is multiple damage cases, each involving one or more watertight compartments below the main deck.

All sample vessels except the 91 foot excursion boat comply with the requirement in the arrival with elevator condition. In five of its eight damage cases, the 91 footer fails to sustain the required passenger crowding loads. Quick examination of the results indicates that this vessel would also fail the less stringent "protected waters" criterion.

9.4 Discussion

The results show a clear correlation of success with size, the only failure being one of the two smallest sample vessels. The size trend can also be observed by examination of the changes in safety margins when the elevator is added; the relative change is smaller with progressively larger size.

It is probable that designers of new T boats, or conversions as in the case of the 91 foot excursion boat, will have weigh carefully the options of stair lifts and elevators. Stair lifts minimize weight and engineering impacts, but will likely require extra stair wells and particular attention from crew members. Elevators of course add substantial weight and maintenance burdens, but offer convenience for the passengers with a minimum of crew involvement.

10. ADDITIONAL OBSERVATIONS

10.1 BENEFITS

The implementation of ADA in the passenger vessel industry suggests three possible benefits. This study can only address them qualitatively since available data does not allow for a valid quantitative estimation of the benefits.

It should be recognized that these potential benefits represent a narrow view of access opportunities, neglecting the much wider monetary and societal benefits of greater inclusion of persons with disabilities in employment, commerce, and leisure activities. It is likely that "universal design" concepts will evolve to successfully accommodate an aging population, people with disabilities, and users of all shapes and sizes. This bright future is beyond the scope of this study.

10.1.1 Increased business from persons with disabilities

It is probable that improved access will result in more patronage of the passenger vessel trade by customers with disabilities. Measurement of the benefit would require data on: 1) annual industry revenues; 2) present use levels of marine passenger service by persons with disabilities; and 3) revenue increment data from other industries and transport modes due to access improvements. With these data, revenue enhancements could be estimated with reasonable certainty on the expected increased frequency of visits by persons with disabilities. Information on items #2 and 3 is only available in anecdotal form.

10.1.2 Insurance benefits

The marine environment is unfamiliar territory for many of the millions of passengers who board each year. Moisture, motion, spatial limitations, and tripping/climbing obstacles can make for a hazardous environment on the dock and vessel. There is evidence that the majority of insurance claims by passengers against carriers is for "slip, trip, and fall" incidents. A major marine insurance broker reports that 40% and 22% of all claims are for mishaps on the decks and on ramps/ladders, respectively.

While it is possible that access improvements will make the industry safer for able passengers and reduce such claims, such a benefit may be offset by claims increases from passengers with disabilities using newly accessible facilities.

A quantitative estimate of this benefit would require: 1) claim data from marine insurance companies; and 2) data from other industries and transportation modes showing improved safety and reduced incidence of injury. These data are not presently available.

10.1.3 Employee health benefits

Improved access for wheelchairs may result in fewer job-related injuries for operator personnel since crew assistance for the lifting and moving of wheelchairs is reduced or eliminated. The Casco Bay Island Transit District has reported that fewer and less costly employee injury claims have resulted from a thorough health and safety program which includes job function analysis, employee training, ADA hiring practices, and capital improvements[18]. The report cited access features on vessels in the fleet as a key factor in reducing high stress lift situations on board.

10.2 IMPLEMENTATION ISSUES

The research for this project has identified an array of questions specific to the passenger vessel industry. Some involve application of the myriad provisions of ADA to the marine sector (a number of assumptions have been made for the access solutions proposed herein); other issues are simply beyond the scope of the cost study. The following points will need clarification:

- Definition of the ADA notion of "alterations" for the marine industry, for vessels and pier/dock facilities, referring to current ADA definitions for vehicles and facilities.
- Application of the many other provisions of ADA and ACAA to the marine industry, e.g., exceptions such as "one-car-per-train" and "equivalent facilitation", (see 9.2.1).
- Investigation of trigger mechanisms. How does construction of or alteration to accessible "parts" affect the whole marine operation, e.g. is the dock part of the accessible path of travel to a new or upgraded vessel?
- Investigation of emergency egress and evacuation situations for people with disabilities. The study has made assumptions relative to the cost impact of lifesaving appliances (none) and leaves completely aside the issue of crew manning for the evacuation of large numbers of persons with disabilities.
- Provision of "event" related access features by vessels in certain services, e.g. gambling machines for motor impaired people on gaming boats or narrative reading cards for the hearing-impaired on tour boats.

10.2.1 Application of ADA precedents

The following are brief descriptions of ADA and other regulatory provisions as they have been applied to transportation modes and how they might be pertinent for marine access. A broader and more detailed discussion is provided in Appendix G.

- **Air Carriers Access Act (ACAA)**-- The Act is significant for marine passenger service because it 1) recognized situations in which carriers and loading facilities are differently owned, requiring provision of access by all stakeholders, and 2) permitted different access treatments for different sizes of airplanes.
- **Railroad access**-- Precedents in this mode are probably analogous to marine public transport assets such as ferries, but not excursion and other leisure vessels. One level of access on two-level commuter and dining cars is acceptable, as is "one car per train" access.

- **Undue burden**-- Transportation providers may not claim undue burden relief when acquiring new or remanufactured vehicles.
- **Elevator exemption**-- Some private entities are exempted if the building is less than 3 stories or 3000 ft^2 per story. Transportation facilities, among others, cannot be exempted, indicating the importance placed by Congress on transportation access. There is an analogy, if not exact, to public accommodation passenger vessels, depending on the cost and technical issues acknowledged by the regulation.
- **New construction**-- Access must be provided unless it is technically infeasible, for which the standards are very high (cost is generally not a factor). The solutions proposed herein generally follow this guideline, i.e., they assume feasibility of providing access. There is flexibility for installing elevators, depending on size and service of the vessel.
- **Alterations**-- Alterations must generally meet the new construction standards "to the maximum extent feasible", based on technical, not cost, considerations. ATBCB and DOJ have consistently ruled that adding elevators is not required. No vessel alteration requires more than proposed solution "Access 2", and that only for large public accommodation vessels, only in cases where needed to provide full services. Technical feasibility of access accommodations, especially elevators, will be more problematic than for new construction.
- **Small vehicles**-- Surface vehicles carrying less than 16 people are not required to have lifts or ramped access. For this reason, we have excepted water taxis and crew boats (forms of public transport) from the study.
- **Fundamental nature**-- ADA states that accessible accommodations are not required in cases where they would alter the "fundamental nature" of the business or activity. An example in the marine environment would be handrails around a dock where boats tie up. Other such exceptions are not contemplated in this study, but may indeed be argued by some operators after implementation.

10.3 ADDITIONAL DATA NEEDS

The approach suggested herein is the product of study of the industry and its pertinent safety regulations, the requirements of ADA, and the availability and reliability of data. Industry data was gathered both for the vessel population and shore facility population, with mixed results. Future refinements of the cost study, if desired, would require the acquisition and analysis of better, more complete data.

10.3.1 Vessel population

There is a clear picture of the present disposition of the passenger fleet regulated by the Coast Guard. Historical data have two deficiencies: 1) a gap between 1965 and 1987 when little sorted data of any kind exists; and 2) the period of time before 1965 when good global fleet data were compiled, but not sorted in any useful way to reflect vessel sizes and services. Coast Guard and Army Corps data comprise a good basis for the fleet's last five years, but retrieving better historical data is probably not possible. The statement of data needs will, therefore, be limited to more feasible aims. These are:

- Enhancements of service life expectations. A rigorous data gathering effort involving owners, designers, and the insurance industry could establish a better foundation for the assumptions needed to conduct the industry cost calculation.
- A survey of non-Coast Guard regulated vessels, i.e. those on non-navigable waters regulated by state marine agencies and other non-inspected vessels such as those carrying six or fewer passengers.

10.3.2 Dock and pier population

Available data are by no means complete. The link between vessel and shore populations was made based upon a very limited sampling. Extensive field work would be needed for a better grasp of this linkage, especially given the wide variety of operations and physical configurations.

11. CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

The completed and planned work on the passenger vessel access cost study can be summed up as follows:

- This study has significantly advanced the knowledge in the area of waterborne access for persons with disabilities. More work is needed to improve the industry's understanding of access needs and to form the basis of informed decision making at the Department of Transportation.
- Much of the data necessary to complete a detailed cost and benefit analysis was not available. A good snapshot of the current fleet has been developed, without, however, a strong historical basis on which to analyze long term industry trends. Shore facility data is quite weak; a snapshot was developed by site visits, linkage to the fleet data set, and validation by the limited data in the Army Corps Port Series.
- Unit costs include both the generic elements of ADAAG specifications and the unique aspects of marine transportation. The solution sets are limited to feasibly handle the cost analysis. They provide realistic outcomes but cannot anticipate all access designs.
- Onboard access requirements should provide for flexible solutions in a fleet that is diverse in terms of size, service and design, operating in a unique environment with a unique set of safety issues.
- There should be allowance for innovative solutions by industry, particularly for mobility access from land to the vessel, where large height barriers must be overcome, and for mobility on the vessels, both between decks and in doors and passageways on the decks.
- Operating and revenue costs comprise more than half the total cost of fleet access. About 85% of these are projected revenue losses caused by loss of deck space from alterations of existing vessels; this amount is sensitive to many factors such as design of access features and frequency of full capacity sailings.
- Revenue losses due to alterations of existing vessels would be during peak operating capacity times. This may substantially affect profits for some operators who make most of their money during peak seasons.
- Fleet capital expenses are based on a rather rigid application of the proposed full access solution set. The fleet-wide cost of some features , such as elevators, may be overstated since innovative designs and operating practices may reduce the need for such installations. Other costs which are more difficult to ascertain for a large population, such as upgraded auxiliary power plants, are not included. The results are unit and fleet costs which are a valid first approximation, useful for the purposes of decision making by the Department.
- Unit costs for operators of small passenger vessels (T boats) are lower, but the burden may nonetheless be more onerous for those small businesses. The fleetwide cost for T boats is the highest because of the preponderantly large size of that fleet sector.

- Costs of access across the docks and piers were difficult to estimate because of weak industry data. A limited set of five solutions, which were found to be sufficient for all of a wide variety of facilities visited, yield a useful estimate of unit costs. The industry implementation cost is a range estimate since data were insufficient to characterize the size or the nature of the population.
- The needs of access over the docks and piers can be satisfied in most cases by the set of five solutions developed for the study, which include no mechanical aids or devices. It is likely that such devices will appear as technology addresses industry's needs for improved access.

11.2 Recommendations

This study has advanced the knowledge of watercraft access but also served to identify several areas where more work is needed to fully understand implementation of ADA. They are the following:

- **Integration of access features with safety design as required by the Coast Guard.** More research involving industry, access advocates, and the Coast Guard will lead to a comprehensive and detailed treatment of access on passenger vessels. Particular attention must be given to alternative elevator design, practicability of lifts, head design (particularly for state rooms), the details of sill/ramp design, several ADAAG/Coast Guard (Title 46 CFR) harmonization issues, and generally how to craft the standards for the variety of vessel types affected.
- **Investigation of unusual vessel types**. The Department's decision making must include passenger vessels not specifically covered herein, including passenger sailing vessels and the emerging new class of passenger submarines. Additional work may be needed to determine the potential impact on vessels beyond the scope of this study, such as state regulated craft, small boats carrying less than six passengers, and cargo vessels carrying passengers for hire.
- **Cruise ships**. The legal issue of extra-territorial jurisdiction of the United States in the matter of internationally flagged cruise ships operating from U.S. shores has so far prevented field work in that industry. Future research on the provision and impact of access may be needed if a legal understanding is achieved with the cruise lines.
- **Dock and pier access**. Further investigation to improve knowledge of mobility solutions and to build a more reliable industry data base would lead to more accurate cost estimates and a better technical basis on which to build access requirements.
- **New technology**. Both government and industry must be aware of the possibilities offered by innovative solutions to access problems in the marine environment. A technology assessment would identify promising new approaches, e.g., in lift equipment and evacuation and lifesaving appliances.
- **Documentation**. Two documents would be very helpful for Government and industry: a "best practice" guide for onboard access features and a training manual for emergency situations.

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APPENDIX A

COAST GUARD MSIS DATA OUTPUT AND MARINE SAFETY OFFICES' FLEET SURVEY RESPONSES

FIGURE A-1

COAST GUARD MARINE SAFETY OFFICES DATA

MSO	POC	TEL.	"H" boat	Ferry	Cruise	Dinner	Excur. sights.	Gaming	Pass. barge	"T"	T-L	T-L ferry	T-L din/X	T-L sightsee.	T-L Cruise	T-L taxi	T-L gaming	T-L fishing/dive	T-S	Fishing/ dive	Exc./ whale/ sightC	Cruise	Dinner	Ferry	Shuttles H2O taxi	Other	Sail vessel
Baltimore	LT Mike Jendrosek	410-962-5125	0							233	19	1	18						214	180					20	12	2
		FAX 0930																									
Boston	LT Darrell Verfaillie	223-3020	0							172	15	0	15				0		157	43	36			1	22	55	
	ENS Derek Dostie																										
Chicago	LCDR R. Hassler	708-789-5830	6	1				5		79	21	0	19				2	0	58	10	36			1	0	11	
		FAX x5843																									
Cleveland	CWO Pestka	216-552-4405								3	1		1						2	0	0		0	0	2	0	0
all GLAKES	FAX 216-659-3559																										
Long Beach	LCDR Rod Walker	310-980-4482	0	0	0			0		300	40	0	40				0		260	75	40		0	0	25	120	0
		FAX x4415																									
Miami	CDR Scott Hartley	305-536-5693	1					1		300	24	2	20				2		276	261	0				15		
Mobile	CDR Jim Person	205-441-5203	1					1		196	6	1	5						190	155	33			2	0		0
		FAX x6169																									
New Orleans	LT David Murk	504-589-6273	34	12		2	3	9	8	54	4	1	1	2	0	0	0	0	50	3	16	0	29	2	0	0	0
		FAX 4216																									
New York	LT Susan Klein	212-668-3361	34	21		1	12			473	126	43	25	15		8	0	35	347	176	22	14	15	24	96		16
	Liam Slain x4971	FAX x3362																									
Philadelphia	CDR Glen Anderson	215-271-4850	5	5	0					150	9	6	3						141	122	10				0	9	
Pittsburgh	CWO John Wisinski	412-644-5808	2	0	0	2		0		14	5	1	4				0	0	9	0	7			0	2	0	0
Portland, Ore.	LTJG D. McClellan	503-240-9340	0	0	0	0	0	0		257	6	1	1	3	1				251	140	102			3	5	1	
St. Louis	LT M Kelly	314-539-3091	11	0	0	0		11		130	38	6	25				7	0	92	6	43		0	8	35		
		FAX x2659																									
SF Bay	LT Curtis Gray	510-437-3119	1	0	1			0		275	35	15	15				0	5	240	150			35	35	10		10
	Michael Lengettes	FAX x3072																									
Tampa	Captain WH Fells	813-228-2191	2	0	0			2		208	26	3	18				4	1	182	81	101			0	0	0	0
		FAX x2399																									28
Wilmington	CDR Richardson	910-343-4879	9	9	0	0		0		58	10	1	3					6	48	22	10		8	6	1	0	1
NC		FAX x4423																									
TOTAL			106	48	1	5	15	29	8	2902	385	81	213	20	1	8	15	47	2517	1424	456	14	87	82	233	208	57

MSIS

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(1 row affected)
ALL PASSENGER VESSELS
age

age	
NULL	96
1	73
2	167
3	132
4	164
5	205
6	221
7	229
8	204
9	200
10	192
11	155
12	130
13	156
14	222
15	193
16	225
17	218
18	179
19	162
20	114
21	135
22	132
23	121
24	95
25	107
26	110
27	99
28	98
29	71
30	80
31	79
32	72
33	60
34	55
35	52
36	58
37	39
38	49
39	38
40	44
41	35
42	31
43	27
44	18
45	24
46	18
47	20
48	32
49	19
50	43
51	34
52	14
53	15
54	21
55	8
56	11
57	7
58	7
59	5
60	3
61	5
62	3
63	6
64	7
65	8
66	4
67	5
68	7
69	10
70	6
71	6
72	3
73	4
74	2
75	1
77	4
78	4
79	2
81	1
82	2
83	1
84	2
85	1
87	2
89	2
90	1
93	2
95	1
96	1
sum	
	5726

(91 rows affected)

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(1 row affected)
ALL PASSENGER VESSELS - (VALID STATUS)
age

age	
NULL	62
1	52
2	112
3	89
4	127
5	138
6	150
7	162
8	156
9	154

(2)

```
+-------------------------------------SQL-------------------------------------+
|  /   Run Query   Load Query   Save Query   Edit                           P |
|-----------------------------------------------------------------------------|
|                                                                             |
| SELECT  service, "# Vsls" = COUNT(vin), age                                 |
| FROM US_TPASS_FLT94                                                         |
| WHERE reg_gt >= 100 OR subchap = "H"                                        |
| GROUP BY service, age                                                       |
| COMPUTE SUM(COUNT(vin))                                                     |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
+-----------------------------------------------------------------------------+
```

service	# Vsls	age
PASSENGER	10	1
PASSENGER	14	2
PASSENGER	6	3
PASSENGER	5	4
PASSENGER	5	5
PASSENGER	4	6
PASSENGER	2	7
PASSENGER	2	8
PASSENGER	4	9
PASSENGER	4	10
PASSENGER	3	11
PASSENGER	2	12
PASSENGER	4	13
PASSENGER	5	14
PASSENGER	4	15
PASSENGER	3	16
PASSENGER	5	17
PASSENGER	5	18
PASSENGER	3	19
PASSENGER	1	20
PASSENGER	5	21
PASSENGER	4	22
PASSENGER	4	23
PASSENGER	1	24
PASSENGER	3	25
PASSENGER	1	26
PASSENGER	3	27
PASSENGER	5	28
PASSENGER	6	30
PASSENGER	3	31
PASSENGER	3	32
PASSENGER	1	34
PASSENGER	2	35
PASSENGER	5	36
PASSENGER	3	37
PASSENGER	5	38
PASSENGER	3	39
PASSENGER	1	41
PASSENGER	2	42
PASSENGER	3	44
PASSENGER	3	45
PASSENGER	1	46
PASSENGER	2	48
PASSENGER	1	49
PASSENGER	2	51
PASSENGER	4	53
PASSENGER	3	59
PASSENGER	2	61
PASSENGER	1	62
PASSENGER	2	63
PASSENGER	1	64
PASSENGER	2	65
PASSENGER	4	68
PASSENGER	2	69
PASSENGER	2	71
PASSENGER	1	81
PASSENGER	1	82

service	# Vsls	age
PASSENGER	1	95
PASSENGER BARGE	1	2
PASSENGER BARGE	1	4
PASSENGER BARGE	1	8
PASSENGER BARGE	1	9
PASSENGER BARGE	1	15
PASSENGER BARGE	2	21
PASSENGER BARGE	1	25
PASSENGER BARGE	1	28
PASSENGER BARGE	1	29
PASSENGER BARGE	1	30
PASSENGER BARGE	1	31
PASSENGER BARGE	2	32
PASSENGER BARGE	1	35
PASSENGER BARGE	1	44
	SUM	
	205	

*** END OF QUERY RESULTS ***

APPENDIX B

ENGINEERING AND COST CALCULATIONS FOR SAMPLE VESSELS

IMPLEMENTATION OF ADA REQUIREMENTS ON PASSENGER VESSELS

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April 1995

ADA PASSENGER VESSEL IMPACT STUDY

This is a brief description of the anticipated requirements and their associated cost, space and weight factors which must be considered in the design, construction, or retrofit of vessels for the use of disabled persons. To a certain extent, some of the proposed changes are already incorporated into some of today's vessels to provide passenger comfort, ambiance and safety. However, to retrofit existing vessels to comply with the additional re- quirements of the ADA, if enacted, could entail extensive modifications.

The regulations covering the space and access requirements for the American Disabilities Act are listed in 49 CFR Part 37. These requirements for land based facilities were used as a basis for this study and may or may not be universally accepted for implementation.

The applicable U.S. Coast Guard regulations and requirements are in 49 CFR Section 171.124 to 177.30.

Human Factors

Mobility Impaired Passenger Enhancements

Tiedowns and floor space - Per ADA, the number of wheelchair spaces needed is 1 for 4-25 persons, 2 for 26-50, 4 for 51-300, 6 for 301-500, and 6 plus 1 more for each additional 100 passengers. Tiedowns at all these locations are advisable for underway operation. The floor space required for the wheel chair is 30" x 48" or about 2.67 times greater than a standard seat (18" X 30" [USCG] which equals 3.75 square feet). On retrofits, seats will probably be lost. The number of wheelchair slots required multiplied by the area differential will give the number of seats lost. Other criteria are sometimes used by USCG to determine passenger maximums, either 30" of rail space or 10 square feet of deck space per passenger. However, as these requirements exceed ADA guidelines, there will be no penalty.

Passageway width - The U.S. Coast Guard requires 24" for aisles less than 15' long and 30" for those over 15' long. The normal industry passageway is 30-36". ADA guidelines are 32" minimum. Therefore, an increase of 6.25% is required. Wheelchair turnaround area is a minimum 60" x 60". Average passageway area is 28.2% of total deck area. On new construction this can be accommodated by design with minimal cost or weight increase.

Accessible head(s) - The standard head is approximately 3' X 4' which equals 12 square feet. The minimum ADA accessible head is 56" x 60" or 24 square feet. Additional space of about 6 square feet is required for door opening and maneuvering the wheelchair. The combination of these two requirements equals 30 square feet, an increase of 250%. ADA regulations require one unisex head per deck (floor). Grab rails are also required. The fastening of these rails must be very secure which adds to the cost. "Hands free" fixtures must also be added.

Doors - Per USCG standard weathertight doors need only be 28" in width. In addition, there must be a coaming of 3" if the door leads to the inside the vessel's hull. However, the coaming need only be high enough to accommodate the seal (typically 1") if the above does not apply. ADA specifies 32" wide doors. A ramp over the coaming would impact the door's sealing and dogging arrangements. On the exterior of the door, grating must be used so as not to defeat the purpose of the coaming. "Hands free" operation, 5 pound opening force and a 3 - 5 second closing delay may also be in- corporated.

Embarkation Access - The ramp attachment to the vessel may require some modification to the sills at exterior doors to bypass the door's coaming. Within the cabin, the ramp requirements would not usually be insurmountable as a 3" sill would only require a 30" ramp.

Bar Height - The standard serving bar height is about 40". A serving area at a height of about 30" would be useful for wheelchair users. This also works well for children. New construction vessels are often built this way, but retrofits would require special modifications. Since most snack bars are quite small and carefully designed, this could be a problem.

Elevators

Size - An ADA accessible elevator plus the structure and operating equipment is 51" x 68" (ADA minimum). As a staircase is required by USCG anyway, there would be a net loss of space. In addition, an elevator, like a stairway, requires a vertical, fire proof casing through all decks and a fire door at each deck level.

Weight - A standard, two deck, elevator weighs about 27,000 pounds. The car weight is about 4,000 pounds including 4 passengers.

Power Requirements - Electrical requirements for the elevator would be about 15-30 horsepower depending on elevator size and number of decks served. Depending on the individual vessel this may or may not require a larger generator and distribution system.

Cost - The standard elevator price is approximately $50,000 for 2 decks, $72,000 for 3 decks, and $95,000 for 4 decks, plus installation of about 50 % of purchase price for new installations and 100% for retrofits.

Stairlifts - Stairlifts have been used but have a capacity of about 300 pounds. this will not provide service for battery powered wheelchairs of weights of 400-450 pounds including the operator. Cost is about $15,000-20,000 installed [Golden Gate Bridge District].

Dockside Lifts - Dockside lifts similar to construction elevators are sometimes used to handle wheelchair users.

Visually Impaired Passengers

Handrails - Touch sensitive treatment is sometimes added to handrails to signify the approach of the end of the rail. Cost is estimated at $50 per end.

Steps - Touch sensitive treatment, tactile strips, is sometimes added to the areas at the start and end of each stairwell and embarkation points. Cost is estimated at $200 per location.

Signage/Alarms - Braille signage or audible messages should duplicate each public notice or warning. The cost would vary according to the means of the warning and size and decks of vessel. Special attention needs to be given for emergency situations as well as food service, telephone and restroom locations.

Hearing Impaired Passengers

Visual Messages/Alarms- Visible messages or alarms need to duplicate all emergency and warning situations.

Vessel Considerations

Stability

The increased weight above the waterline affects the vessel's stability in proportion to her size and hull form. In all cases, the increase in vessel weight would require a reanalysis of the vessel's stability with the Coast Guard. For a 1-5% weight increase, the calculations would cost about $1,500; for any greater weight increase, the analysis would cost $ 6,000 or more depending on complexity.

Speed Loss / Propulsion Increase

Engine Power - The increased weight of the elevator and larger generator will require more power to achieve the same vessel speed. In new construction, the vessel size will be increased to provide more floor space (as opposed to decreasing the number of seats). This increased size and weight also will require more power. Alternatively, for retrofits, in cases of small increases,

the same plant can sometimes be loaded more heavily. This will result in increased maintenance costs.

Gears, Shafting and Propulsors - Larger gears, shafting, propellers, jets, etc. may be required for the increase in power. The larger power requirements may also necessitate the installation of shaft brakes and other more complex control mechanisms.

Annual Fuel Cost- Regardless of whether the existing machinery is retained (and run at a higher power output) or new machinery installed, the fuel requirements will generally increase unless more fuel efficient machinery is retrofitted.

Piers, Floats and Shoreside Access Ramps

More gradual slopes require more length. The cost of this escalates per the following:

Industry Norm

6:1 slope at 5 feet elevation requires 30 feet of run

Cost factor 1.00

ADA Minimum (for retrofits)

8:1 slope for 3" rise maximum

Cost factor 1.33 X

ADA Preferred

10:1 slope for 3" rise maximum (or 6" for retrofits)- used for ramp side transitions.

Cost factor 1.5 X

12:1 slope for 30" rise maximum. A 5 foot elevation change would require two 30 foot ramps plus a 5 foot long landing for a total installed length of 65 feet.

Cost factor 2.0 X

For example, a 10' tide range would require 120' of ramps plus 5' landings every 30' resulting in a total installed length of 135'.

Width - Standard width is 36 inches

36", cost factor 1.00

48", cost factor 1.25 X

60", cost factor 1.50 X

72", cost factor 2.00 X

Handrails - Touch sensitive treatment on ends would cost $50 per end per side. In addition, they have specific sizes and standoff dimensions.

Overhanging or protruding hazards - Must be railed off or reduced in size.

2" Curbing - Would add 5% to the cost of the ramps.

Wheelchair corners - Would increase the ramp width to at least 5'. Pier space may require a "Z" shaped ramp with level
turning pads which could bring the cost to 2.50 X.

Hoist/positioning machinery - Industry standard is for the vessel's crew to lift and position the access ramp. A longer, wider (and heavier) ramp would require the additional cost of a mechanical hoist and positioning system.
Float- A longer ramp will require positioning the float further away from the pier, usually requiring longer, bigger piles. Alternatively, a "U" or "Z" shaped ramp will require a larger float and mooring system due to deeper water.

References:

American Disabilities Act
36 CFR Chapter XI

US Coast Guard Regulations
49 CFR Section 171.124 to 177.30

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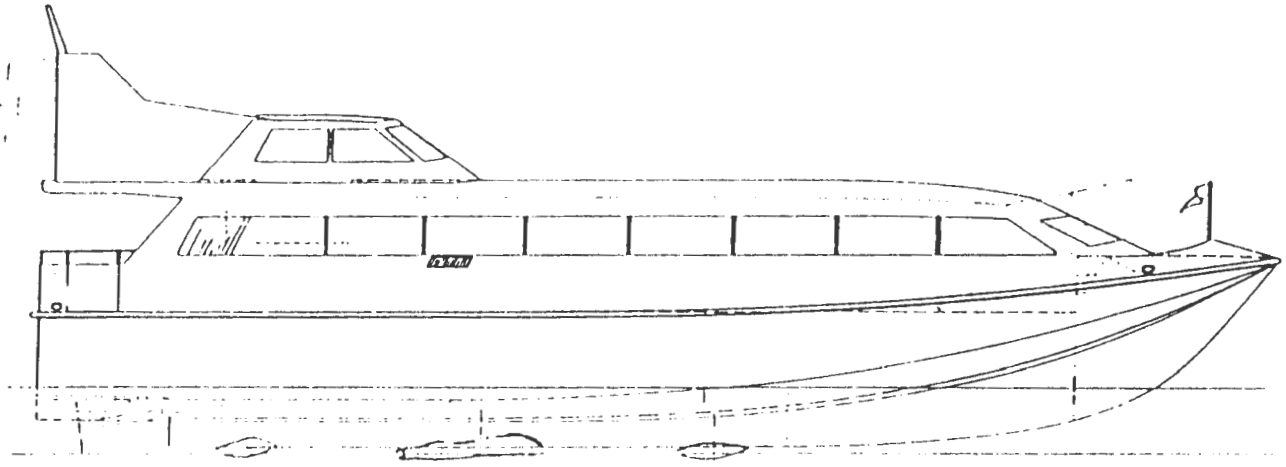
VOLPE VESSEL STUDY - ADA IMPACT

Vessel	Operator	New or Retrofit	Cost of New Construction Standard	Cost of ADA Modifications	Cost of New Construction w/ ADA	Elevator Service No. of Decks	Speed Loss (knots)	Increased Annual Operating Cost	Annual Lost Revenue
Dinner Boat									
Small 65-120' x 150 Passengers									
HARBOR BAY EXPRESS II ALAMEDA	Harbor Bay Maritime	New	$1,533,000	$68,209	$1,601,209	none	0.2	$3,100	$15,400
Large 175-200' x 600+ Passengers									
CALIFORNIA HORNBLOWER	Hornblower Dining Yachts	New	$3,777,000	$247,426	$4,024,426	3 decks	0.15	$15,500	$482,560
High speed Ferry									
Fast Commuter 65-120' x 200 Passengers									
BAY BREEZE w/o elevator	City of Alameda	New	$3,323,000	$169,310	$3,492,310	none	0.2	$11,067	$31,000
BAY BREEZE w/ elevator		Retrofit	$3,323,000	$363,049	$3,686,049	2 decks	2.0	$69,400	$40,600
Conventional 100-150' x 500 Passengers									
BAY CLIPPER	Crowley R&W Fleet	Retrofit	$3,400,000	$243,058	$3,643,058	2 decks	2.0	$61,000	$57,000
Fishing Charter / Whale Watcher 60-100' x 150 Passengers									
COBRA	Private	Retrofit	$2,700,000	$139,790	$2,839,790	on dock	0.4	$9,010	$52,000

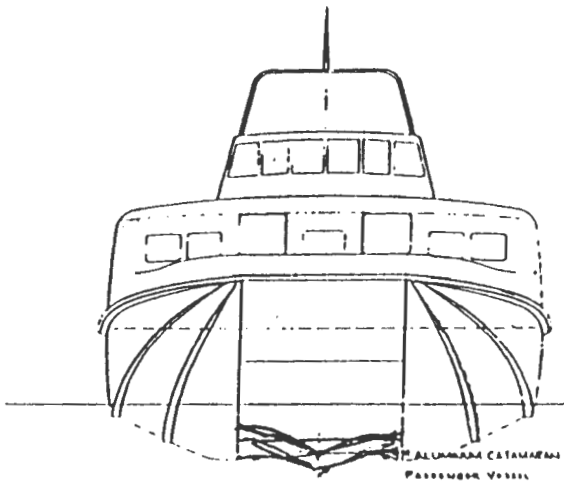
Piers			Cost of New Construction Standard ($K)	Cost of New Construction per ADA ($K)	Cost Differential for ADA	Ramp Slope Extg/ADA	Gangway Width (ft)	Platform & Boarding Ramp Width (ft)
Small								
Pier 33	Crowley	San Francisco, California	$172	$372	$200	1:8/1:12	6	8
Medium								
Pier 39A	Hornblower	San Francisco, California	$171	$215	$44	1:12.5	6	8
Large								
Pier 1/2	S.F. Ferry	San Francisco, California	$411	$615	$203	1:8/1:16	8	8 and 6

	SAN FRANCISCO BAY PASSENGER VESSEL ADA STUDY								
VESSEL PARTICULARS									
Vessel HARBOR BAY EXPRESS II 65' L 24' B 7.3' D			Power(bhp)	2,000	Speed (kts)	30/40	Passengers	149	
1995 Fair Market Value (w/o ADA)		**$1,533,000**	1995 Replacement Cost (w/ADA)			**$1,585,950**			
		Pass.Area	Pass.Area	Total	Total		Number	Number	
	Passenger	Inside	Outside	Pass.Area	Deck Area		Seats	Seats	
	Accommodations	(sq.ft)	(sq.ft)	(sq.ft)	(sq.ft)		Inside	Outside	
	Main Deck	739	156	895	1,206		149	0	
	Total Areas	739	156	895	1,206				
							Total Seats	149	
	Fair market value / passenger				$10,289				
	Fair market value / sq ft passenger space				$1,713				
	Fair market value / sq ft total space				$1,271				
SPACE & COST OF ADA MODIFICATIONS					Area (sq.ft)	Cost ($)	Notes		
	Wheelchair space (no.spaces x 2.67x3.75)				40		4 spaces		
	Accessible unisex head(s) (no.decks x 30)				0		2 ADA heads extg		
	Passageway access (.282x total deck areax.0625)				0		extg meets ADA		
	Embark/ disembark access				-		no penality		
	Elevator (no. decks x 24)				-		1 deck-none required		
	Total modications required space				40				
	Cost / sq ft x modifications space					$50,800			
WEIGHT & COST OF ADA MODIFICATIONS					Weight (lb)	Cost ($)			
	Vessel lightship + fuel				62,000	lbs			
	Passengers (pass x 165 lbs)				24,585	lbs			
	Total vessel displacement				86,585	lbs			
	Fair market value / lightship weight				$24.73	/lb			
	Lightship weight/total deck area				51.41	lbs/sq ft			
	Floor space added weight				2,059	lbs			
	Elevator (no.decks > weight)				-				
	Generator upgrade (no. decks for elevator > kw/ lb)				-				
	Total modifications weight addition				2,059	lbs			
	Modification weight x cost/lb					$50,919			
	Average cost of mods (space + weight / 2)			($50,900 + $50,919/2)		**$50,909**			
DIRECT COST OF ADA MODIFICATIONS						Cost ($)			
	Elevator (no. decks > cost)					$0	not req'd		
	Signage/alarms (no. decks x $ 3,500)					$3,500	meets ADA		
	Visual aids (no. decks x $ 3,000)					$3,000	same		
	Food service mods ($,000 per counter)					$2,000			
	Wider door w/ assist($ 5,000 per installation)					-	meets ADA		
	Unisex head ($ 5,800 on main deck/ $ 15,000 on upper deck)					$5,800	same		
	Wheelchair tiedowns (no. spaces x $ 250)					$1,000			
	Embarkation sill ramp ($ 1,000/door)					$2,000	1 each p/s		
	Total direct costs					**$17,300**			
DIRECT COST OF VESSEL MODIFICATIONS						Capital Cost	Yearly Cost	Lost Speed	
0.40%	Weight gain							Lost Revenu	
0.40%	Increased maintenance cost						$650		
0.40%	Speed loss (assume 1.5 kts per 16,500 lbs)							**.2 knots**	
0.40%	Fuel useage increase (assume 3500 hr/yr x hp x 1.2/24bsfc x 2200hp x $.70/gal)						$2,450		
	Lost revenue cost ($3 x 4 x 50 x 6 x .4 x lost space / 3.75)							$15,400	
	Total direct costs of ADA mods					$17,300			
	Average cost of mods space and weight					$50,909			
Total Costs						$68,209	**$3,100**	**$15,400**	



PARTICULARS

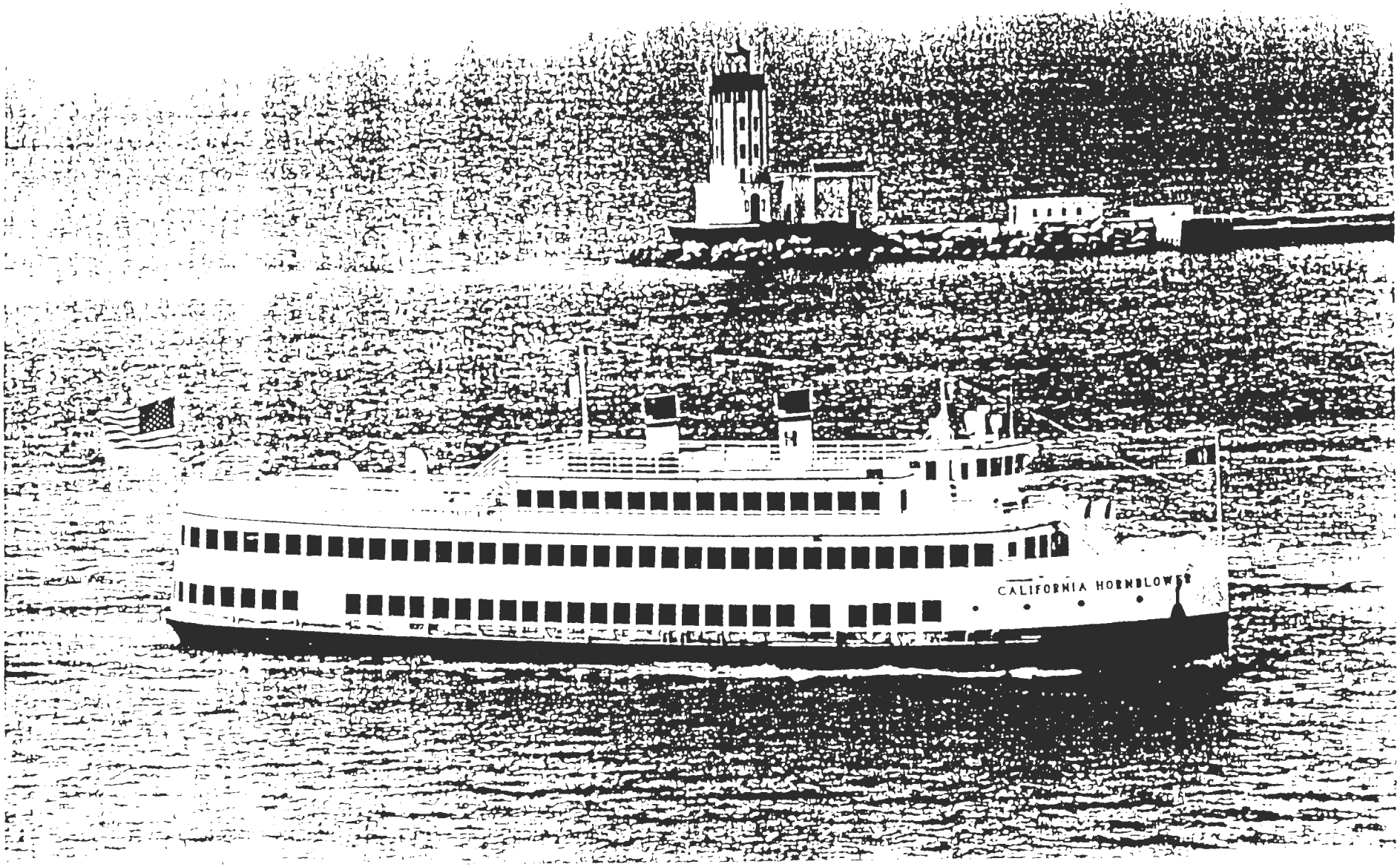
LENGTH OA HULL		o.a. 104'
BEAM MAX		24' 0"
DRAFT FULL LOAD		5' 6"
PASSENGER CAPACITY		149 PERSONS
MAIN ENGINES	(2) MAN DIESEL	1000 H.P. EACH
GENERATORS	N1	19 KW
AIR COND.	(1) Exhaust Aired	17000 BTU EACH
FUEL CAPACITY		N1 ' GAL TOTAL
FRESH WATER		750 GAL
HOLDING TANK		150 GAL



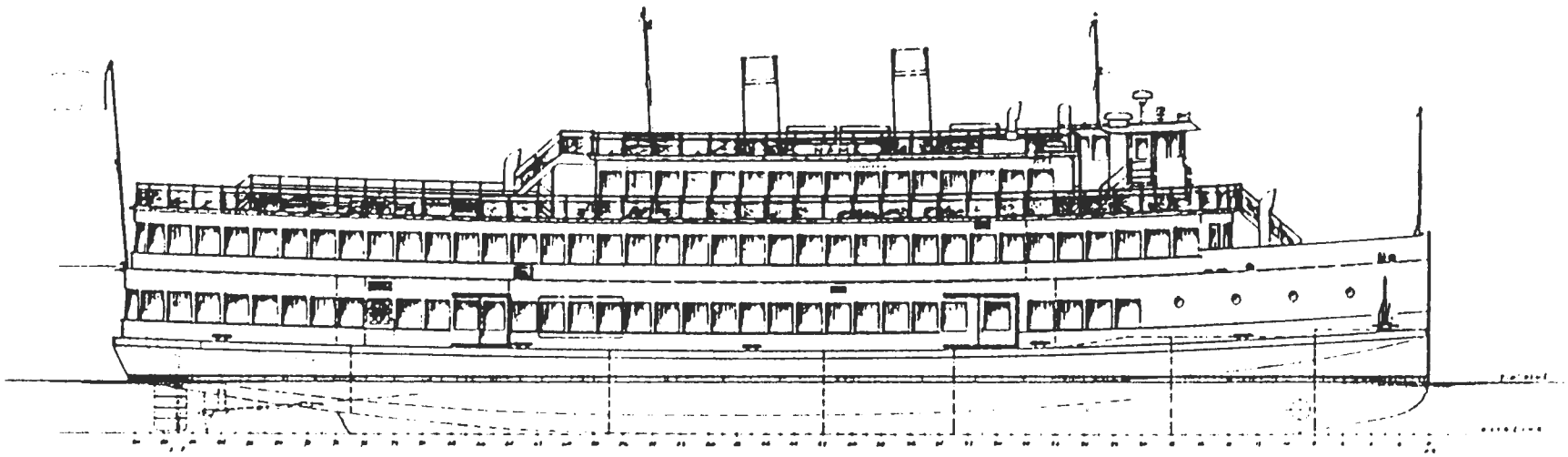
ALUMINUM CATAMARAN
PASSENGER VESSEL
OUTBOARD PROFILE
AND
ARRANGEMENT PLAN

HARBOR BAY EXPRESS

	SAN FRANCISCO BAY PASSENGER VESSEL ADA STUDY							
VESSEL PARTICULARS								
Vessel CALIF. HORNBLOWER 183.3' L 40.5' B 11.0' D			Power(bhp)	1,020	Speed (kts)	10	Passengers	1,000
1995 Fair Market Value (w/o ADA)		**$3,777,000**	1995 Replacement Cost (w/ADA)			**$4,049,150**		
		Pass.Area	Pass.Area	Total	Total		Number	Number
	Passenger	Inside	Outside	Pass.Area	Deck Area		Seats	Seats
	Accommodations	(sq.ft)	(sq.ft)	(sq.ft)	(sq.ft)		Inside	Outside
	Main Deck	1,916	0	1,916	3,456		38	0
	Upper Deck	2,760	0	2,760	3,424		24	6
	Sun Deck	1,464	2,140	3,604	4,680		0	36
	Total Areas	6,140	2,140	8,280	11,560			
							Total Seats	104
	Fair market value / passenger				$3,777			
	Fair market value / sq ft passenger space				$456			
	Fair market value / sq ft total space				$327			
SPACE & COST OF ADA MODIFICATIONS					Area (sq.ft)	Cost ($)	Notes	
	Wheelchair space (no.spaces x 2.67x3.75)				100		10 spaces	
	Accessible unisex head(s) (no.decks x 30)				60		1 on upper &sun dk	
	Passageway access (.282x total deck areax.0625)				-		no fixed chairs/tables	
	Embark/ disembark access				-		p/s main dk ramp extg	
	Elevator (no. decks x 24)				72		3 decks	
	Total modications required space				232			
	Cost / sq ft x modifications space					$75,800		
WEIGHT & COST OF ADA MODIFICATIONS					Weight (lb)	Cost ($)		
	Vessel lightship + fuel				1,275,320	lbs		
	Passengers (pass x 165 lbs)				165,000	lbs		
	Total vessel displacement				1,440,320	lbs		
	Fair market value / lightship weight				$2.96	/lb		
	Lightship weight/total deck area				110.32	lbs/sq ft		
	Floor space added weight				25,600	lbs		
	Elevator (no.decks > weight)				30,000	lbs	3 decks	
	Generator upgrade (no. decks for elevator > kw/ lb)				600	lbs		
	Total modifications weight addition				56,200	lbs	(wt less elevator)	
	Modification weight x cost/lb					$77,552		
	Average cost of mods (space + weight / 2)			($75,800 + $77,552/2)		**$76,676**		
DIRECT COST OF ADA MODIFICATIONS						Cost ($)		
	Elevator (no. decks x material cost + 50% to install new construction)					$108,000	3 decks	
	Signage/alarms (3 decks x $ 3,500 x 1.5 for large boat)					$15,250	same	
	Visual aids (no. decks x $ 3,000)					$9,000	same	
	Food service mods ($2,000 per counter)					$6,000	same	
	Wider door w/ assist ($ 5,000 per installation)					-	meets ADA	
	Unisex head ($ 5,800 on main deck/ $ 15,000 on upper deck)					$30,000	1 ea. on upper & sun dk	
	Wheelchair tiedowns (no. spaces x $ 250)					$2,500	10 spaces	
	Embarkation sill ramp ($ 1,500/door)					-	meets ADA	
	Total direct costs					**$170,750**		
DIRECT COST OF VESSEL MODIFICATIONS						Capital Cost	Yearly Cost	Lost Speed
								Lost Revenue
	Auxiliary power increase	15 KW				$4,000		
5%	Increased maintenance cost						$10,000	
4%	Propulsion increase (4% x 20% mach part of fair market value)					$30,200		
1.50%	Speed loss (assume 1.5 kts per 16,500 lbs)							**.15 knots**
4.40%	Fuel useage increase (assume 3500 hr/yr x hp x 1.2/24bsfc x 2200hp x $.70/gal)						$5,500	
	Lost revenue cost ($75 x 5 x 52 x .40 x lost deck area / 3.75 sq.ft)							
	(fare x days x weeks x trips x % full trips x area)							$482,560
	Total direct costs of ADA mods					$170,750		
	Total Vessel Space Weight Average cost					$76,676		
Total Costs						$247,426	**$16,500**	**$482,560**

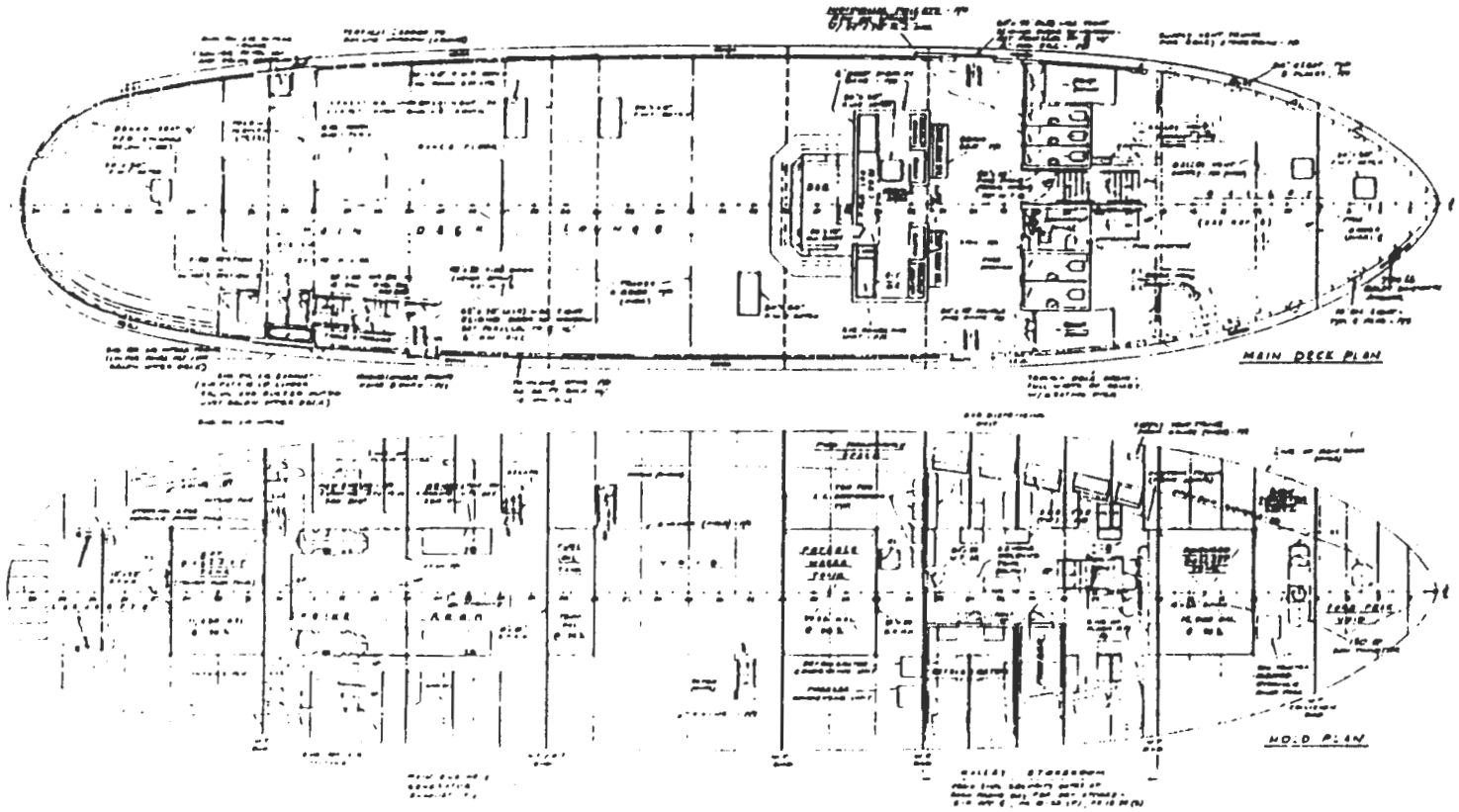

CALIFORNIA HORNBLOWER

M.V. CALIFORNIA HORNBLOWER



OUTBOARD PROFILE

M.V. CALIFORNIA HORNBLOWER



DECK ARRANGEMENTS

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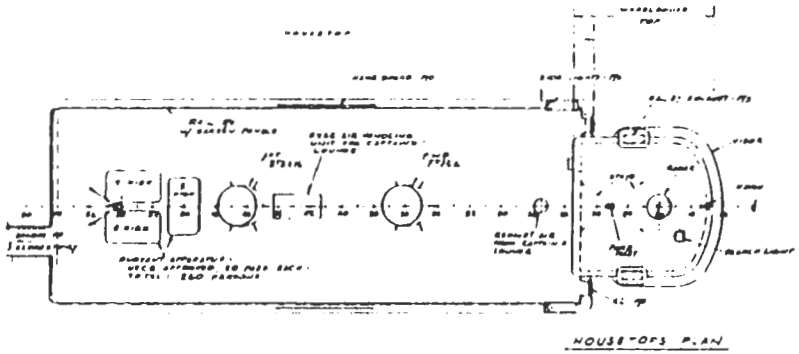
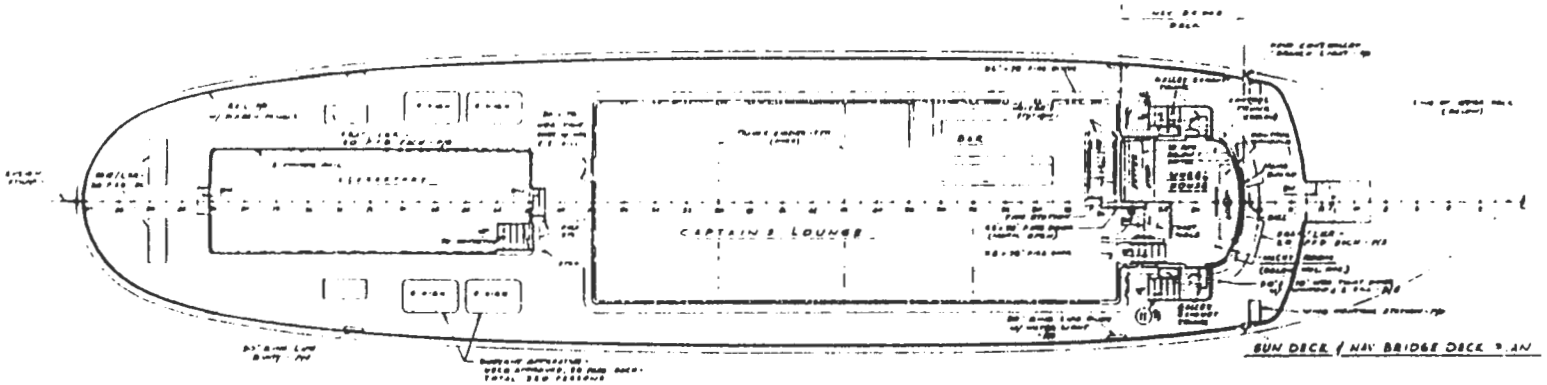
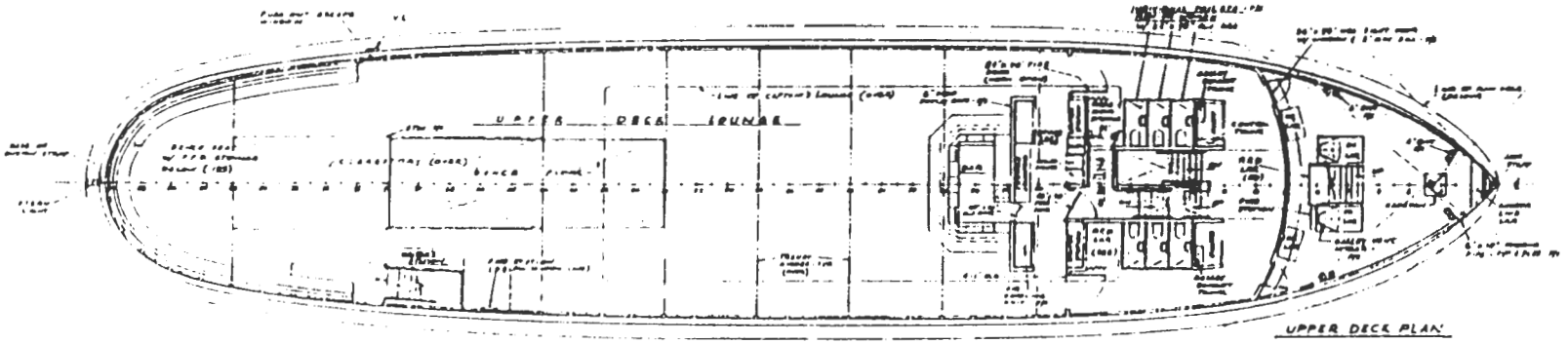
M.V. CALIFORNIA HORNBLOWER



HOUSETOPS PLAN



SUN DECK / NAV. BRIDGE DECK PLAN



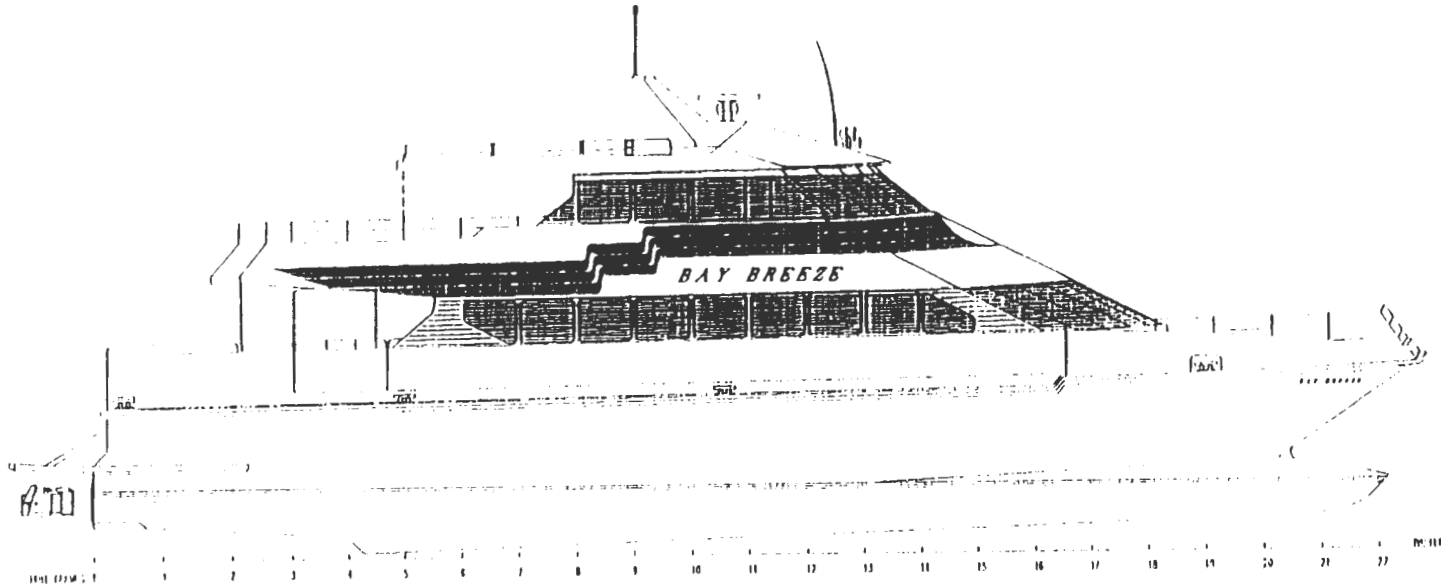
UPPER DECK PLAN

DECK ARRANGEMENTS

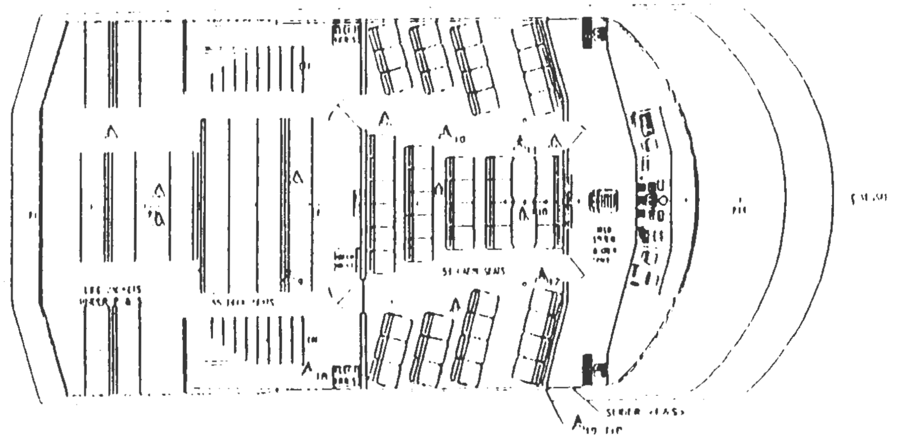
inccom6

	SAN FRANCISCO BAY PASSENGER VESSEL ADA STUDY							
VESSEL PARTICULARS								
Vessel BAY BREEZE w/o elevator 97.0' L 28.5' B 8.8' D			Power(bhp)	2,200	Speed (kts)	26	Passengers	250
1995 Fair Market Value (w/o ADA)		$3,323,000	1995 Replacement Cost (w/ADA)			$3,468,085		
		Pass.Area	Pass.Area	Total	Total		Number	Number
	Passenger	Inside	Outside	Pass.Area	Deck Area		Seats	Seats
	Accommodations	(sq.ft)	(sq.ft)	(sq.ft)	(sq.ft)		Inside	Outside
	Main Deck	2,277	330	2,607	3,856		164	2
	Upper Deck	374	750	1,124	2,529		41	43
	Total Areas	2,651	1,080	3,731	6,385			
							Total Seats	250
	Fair market value / passenger				$13,292			
	Fair market value / sq ft passenger space				$891			
	Fair market value / sq ft total space				$520			
SPACE & COST OF ADA MODIFICATIONS					Area (sq.ft)	Cost ($)	Notes	
	Wheelchair space (no.spaces x 2.67x3.75)				60		has 6 spaces	
	Accessible unisex head(s) (no.decks x 30)				30		1 extg on main dk	
	Passageway access (.282x total deck areax.0625)				65		ok as is	
	Embark/ disembark access				minor		no penality	
	Elevator (no. decks x 24)				-		assumed not req'd	
	Total modications required space				155	sq ft		
	Cost / sq ft x modifications space ($520/ x 155)					$80,600		
WEIGHT & COST OF ADA MODIFICATIONS					Weight (lb)	Cost ($)		
	Vessel lightship + fuel				140,000	lbs		
	Passengers (pass x 165 lbs)				41,250	lbs		
	Total vessel displacement				181,250	lbs		
	Fair market value / lightship weight				$23.74	$/lb		
	Lightship weight/total deck area				21.93	lb/sq ft		
	Floor space added weight				3,400	lbs	ok as is	
	Elevator (no.decks > weight)				-		assumed not req'd	
	Generator upgrade (no. decks for elevator > kw/ lb)				0		ok as is	
	Total modifications weight addition				3,400	lbs		
	Modification weight x cost/lb					$80,750		
	Average cost of mods (space + weight / 2)			**(80600 + $80,750/2)**		**$80,675**		
DIRECT COST OF ADA MODIFICATIONS						Cost ($)		
	Elevator (no. decks > cost)					-	assumed not req'd	
	Signage/alarms (no. decks x $ 3,500)					$7,000	on 2 decks	
	Visual aids (no. decks x $ 3,000)					$6,000	same	
	Food service mods ($ 2,000 per counter)					$2,000	on main dk	
	Wider door w/ assist ($ 5,000 per installation)					-	meets ADA	
	Unisex head ($ 5,800 on main deck/ $ 15,000 on upper deck)					$5,800		
	Wheelchair tiedowns (6 spaces x $ 250)					$1,500	extg	
	Embarkation sill ramp ($ 2,000/door)					$4,000	main dk p/s	
	Total direct costs					**$26,300**		
DIRECT COST OF VESSEL MODIFICATIONS						Capital Cost	Yearly Cost	Lost Speed
								Lost Revenue
3%	Increased maintenance cost						$6,000	
	Propulsion increase (new machinery & design @ 3% fair market value)					$62,335		
.8%	Speed loss (assume 1.5 kts per 16,500 lbs)							.2 knots
.8%	Fuel useage increase (assume 3500 hr/yr x hp x 1.2/24bsfc x 2200hp x $.70/gal)						$5,067	
	Lost revenue cost ($3 x 2 x 52 x 6 x .40 x lost deck area / 3.75 sq.ft)							$31,000
	Total direct costs of ADA mods					$26,300		
	Total Vessel Space Weight Average cost					$80,675		
Total Costs						$169,310	**$11,067**	**$31,000**

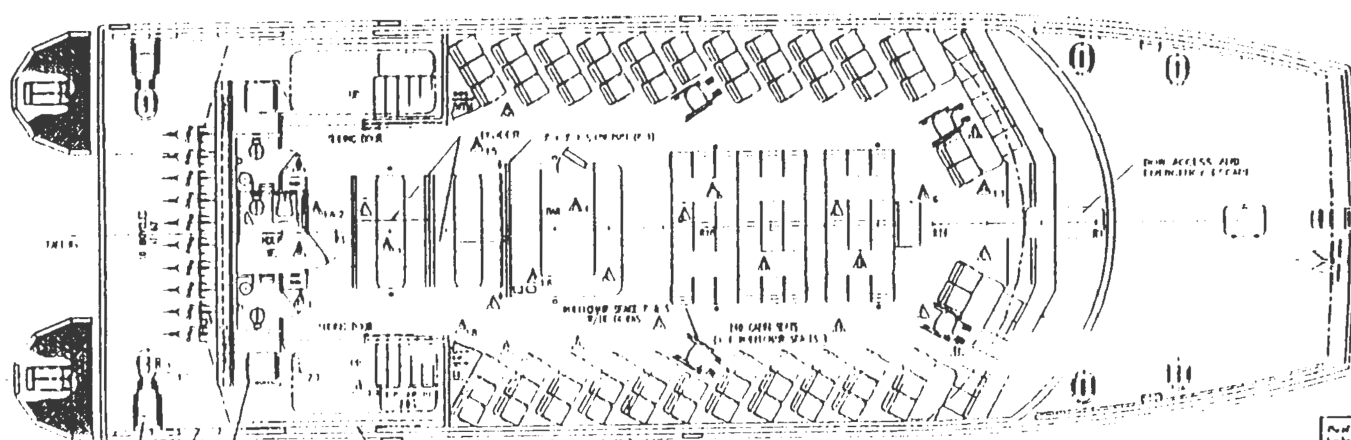
	SAN FRANCISCO BAY PASSENGER VESSEL ADA STUDY							
VESSEL PARTICULARS								
Vessel BAY BREEZE w/ elevator 97.0' L 28.5' B 8.8' D			Power(bhp)	2,200	Speed (kts)	26	Passengers	250
1995 Fair Market Value (w/o ADA)		**$3,323,000**	1995 Replacement Cost (w/ADA)			**$3,701,401**		
		Pass.Area	Pass.Area	Total	Total		Number	Number
	Passenger	Inside	Outside	Pass.Area	Deck Area		Seats	Seats
	Accommodations	(sq.ft)	(sq.ft)	(sq.ft)	(sq.ft)		Inside	Outside
	Main Deck	2,277	330	2,607	3,856		164	2
	Upper Deck	374	750	1,124	2,529		41	43
	Total Areas	2,651	1,080	3,731	6,385			
							Total Seats	250
	Fair market value / passenger				$13,292			
	Fair market value / sq ft passenger space				$891			
	Fair market value / sq ft total space				$520			
SPACE & COST OF ADA MODIFICATIONS					Area (sq.ft)	Cost ($)	Notes	
	Wheelchair space (6spaces x 2.67x3.75)				60	sq ft	has 6 spaces	
	Accessible unisex head(s) (2decks x 30)				30	sq ft	1 extg on main dk	
	Passageway access (.282x total deck areax.0625)				65	sq ft	ok as is	
	Embark/ disembark access				minor		no penality	
	Elevator (no. decks x 24)				48	sq ft	2 deck service	
	Total modications required space				203	sq ft		
	Cost / sq ft x modifications space		($520 x 203			$105,560		
WEIGHT & COST OF ADA MODIFICATIONS					Weight (lb)	Cost ($)		
	Vessel lightship + fuel				140,000	lbs		
	Passengers (pass x 165 lbs)				41,250	lbs		
	Total vessel displacement				181,250	lbs		
	Fair market value / lightship weight				$23.74	/lb		
	Lightship weight/total deck area				21.93	lbs/sq ft		
	Floor space added weight		(203 x 21.93)		4,500	lbs		
	Elevator (no.decks > weight)				28,000	lbs	2 deck service	
	Generator upgrade (no. decks for elevator > kw/ lb)				450	lbs		
	Total modifications weight addition				32,950	lbs	(4950# plus elevators)	
	Modification weight x cost/lb					$117,563		
	Average cost of mods (space + weight / 2)			**($105560+117563/2)**		**$111,536**		
DIRECT COST OF ADA MODIFICATIONS						Cost ($)		
	Elevator (no. decks x material cost + 50% to install new construction)					$75,000	2 deck service	
	Signage/alarms (2 decks x $ 3,500)					$7,000	on 2 decks	
	Visual aids (2 decks x $ 3,000)					$6,000	same	
	Food service mods ($ 2,000 per counter)					$2,000	on main dk	
	Wider door w/ assist ($ 5,000 per installation)					-	meets ADA	
	Unisex head ($ 5,800 on main deck/ $ 15,000 on upper deck)					$5,800	same	
	Wheelchair tiedowns (6 spaces x $ 250)					$1,500	extg	
	Embarkation sill ramp ($ 2,000/door)					$4,000	main dk p/s	
	Total direct costs					**$101,300**		
DIRECT COST OF VESSEL MODIFICATIONS						Capital Cost	Yearly Cost	Lost Speed
								Lost Revenue
	Auxiliary power increase	15 KW				$4,000		
5%	Increased maintenance cost						$10,000	
22%	Propulsion increase (22% x 20% mach part of fair market value)					$146,212		
7.70%	Speed loss (assume 1.5 kts per 16,500 lbs)							2 knots
22.00%	Fuel useage increase (assume 3500 hr/yr x hp x 1.2/24bsfc x 2200hp x $.70/gal)						$59,400	
	Lost revenue cost ($3 x 2 x 52 x 6 x .40 x lost deck area / 3.75 sq.ft)							$40,600
	(fare x days x weeks x trips x % full trips x area)							
	Total direct costs of ADA mods					$101,300		
	Total Vessel Space Weight Average cost					$111,536		
Total Costs						$363,049	**$69,400**	**$40,600**



PROFILE



PLAN DECK 2



PLAN DECK 1

GENERAL PARTICULARS

LENGTH OVERALL	[illegible]
LENGTH WATERLINE	[illegible]
BEAM OVERALL (INCL. SPONSONS)	[illegible]
BEAM OF HULL	[illegible]
DRAFT	[illegible]
PASSENGERS	219 (SEATS)
	4 (W/CHAIRS)

REVISIONS

SYM	DESCRIPTION	APPR	DATE
A	1 INCREASED [illegible] HEAD SIZE & REARRANGED 2 ROTATE BOOTHS 180 3 CHANGE [illegible] 4 INCREASE BAR COUNTER [illegible] 5 MOVE 3 SETS OF BOOTHS FORWARD 6 ADD SEATS 7 RELOCATE [illegible] (P-S) 8 ADD LOCKERS (P-S) 9 MOVE [illegible] SEATS FWD & RE-ARRANGE 10 ADD 1 SEAT ACROSS 11 ADD [illegible] 12 ROTATE SEATS 180 13 REMOVE TABLES 14 [illegible] 15 ADD [illegible] TO BOOTHS 16 ADD [illegible] STATIONS 17 MOVE ALL HATCHES [illegible] (P-S) 18 REMOVE [illegible] 19 ADD HIGH-BACK SEATS [illegible] 20 ADD ACCESS DOORS (P-S)		[illegible]
B	[illegible]		[illegible]
C	[illegible]		[illegible]
D	[illegible]		[illegible]
E	[illegible]		[illegible]
F	[illegible]		[illegible]
G	[illegible]		[illegible]

	SAN FRANCISCO BAY PASSENGER VESSEL ADA STUDY							
VESSEL PARTICULARS								
Vessel BAY CLIPPER 127.3' L 34.5' B 10.6' D			Power(bhp)	2,270	Speed (kts)	15	Passengers	693
1995 Fair Market Value (w/o ADA)		**$3,400,000**	1995 Replacement Cost (w/ADA)			**$3,566,250**		
		Pass.Area	Pass.Area	Total	Total		Number	Number
	Passenger	Inside	Outside	Pass.Area	Deck Area		Seats	Seats
	Accommodations	(sq.ft)	(sq.ft)	(sq.ft)	(sq.ft)		Inside	Outside
	Main Deck	2,307	0	2,307	2,752		300	0
	Upper Deck	1,443	994	2,437	2,529		150	120
	Housetop	0	880	880	880		0	123
	Total Areas	3,750	1,874	5,624	6,161			
							Total Seats	693
	Fair market value / passenger				$4,906			
	Fair market value / sq ft passenger space				$605			
	Fair market value / sq ft total space				$552			
SPACE & COST OF ADA MODIFICATIONS					Area (sq.ft)	Cost ($)	Notes	
	Wheelchair space (no.spaces x 2.67x3.75)				70	sq ft	7 spaces	
	Accessible unisex head(s) (no.decks x 30)				30	sq ft	1 on upper dk added	
	Passageway access (.282x total deck areax.0625)				-		ok as is	
	Embark/ disembark access				-		extg	
	Elevator (no. decks x 24)				48	sq ft	2 deck service	
	Total modications required space				148	sq ft		
	Cost / sq ft x modifications space		($552 x 148)			$81,700	(for new construction)	
WEIGHT & COST OF ADA MODIFICATIONS					Weight (lb)	Cost ($)		
	Vessel lightship + fuel				160,875	lbs		
	Passengers (pass x 165 lbs)				114,345	lbs		
	Total vessel displacement				275,220	lbs		
	Fair market value / lightship weight				$21.13	/ lb		
	Lightship weight/total deck area				26.11	lbs/sq ft		
	Floor space added weight				3,900	lbs		
	Elevator (no.decks > weight)				28,000	lbs	2 deck service	
	Generator upgrade (no. decks for elevator > kw/ lb)				450	lbs		
	Total modifications weight addition				32,350	lbs	(4350# plus elevator)	
	Modification weight x cost/lb					$91,916		
	Average cost of mods (space + weight / 2)			($81,700 +$91,916/2)		$86,808	see note *1 below	
DIRECT COST OF ADA MODIFICATIONS						Cost ($)		
	Elevator (no. decks x material cost + 100% to install retrofit)					$100,000	2 deck service	
	Signage/alarms (3 decks x $ 3,500)					$10,500	on 3 decks	
	Visual aids (no. decks x $ 3,000)					$9,000	same	
	Food service mods ($2,000 per counter)					$4,000	on 2 decks	
	Wider door w/ assist ($ 5,000 per installation)					-	meets ADA	
	Unisex head ($ 5,800 on main deck/ $ 15,000 on upper deck)					$15,000	1 on upper dk	
	Wheelchair tiedowns (7 spaces x $ 250)					$1,750		
	Embarkation sill ramp					-	extg main dk p/s	
	Total direct costs					**$140,250**		
DIRECT COST OF VESSEL MODIFICATIONS						Capital Cost	Yearly Cost	Lost Speed
20%	Auxilary power KW upgrade (assumed)					$10,000	$1,000	Lost Revenue
12.50%	Increased maintenance cost						$25,000	
*1	Propulsion increase	see note 1						
	Stability analysis (% weight increase > cost)					$6,000		
13.50%	Speed loss (assume 1.5 kts per 16,500 lbs)							**2.0 knots**
12.50%	Fuel useage increase (assume 3500 hr/yr x hp x 1.2/24 x hp x $.70/gal)						$34,760	
	Lost revenue cost ($3 x 4 x 50 x 6 x .40 x lost deck area / 3.75 sq.ft)							$57,000
	(fare x days x weeks x trips x % full trips x area)							
	Total direct costs					**$156,250**	**$61,000**	**$57,000**
	Total vessel space/weight average cost					**$86,808**		
	Total costs					**$243,058**		
*1 Cost of space and weight mods not applicable for retrofit project								
*2 This vessel would require a complete repower for any more speed.								
A speed loss of 12.5% is used which increases fuel consumption a similar amount								


RED & WHITE FLEET
scenic ferry ride to Sa

	SAN FRANCISCO BAY PASSENGER VESSEL ADA STUDY							
VESSEL PARTICULARS								
Vessel COBRA	96' L 22' B 8.5' D		Power(bhp)	3,600	Speed (kts)	30	Passengers	120
1995 Fair Market Value (w/o ADA)		**$2,700,000**	1995 Replacement Cost (w/ADA)			**$2,763,300**		
		Pass.Area	Pass.Area	Total	Total		Number	Number
	Passenger	Inside	Outside	Pass.Area	Deck Area		Seats	Seats
	Accommodations	(sq.ft)	(sq.ft)	(sq.ft)	(sq.ft)		Inside	Outside
	Second Deck	164	0	164	445		31	0
	Main Deck	228	922	1,150	1,314		30	0
	Total Areas	392	922	1,314	1,759			
							Total Seats	61
	Fair market value / passenger				$22,500			
	Fair market value / sq ft passenger space				$2,055			
	Fair market value / sq ft total space				$1,535			
SPACE & COST OF ADA MODIFICATIONS					Area (sq.ft)	Cost ($)	Notes	
	Wheelchair space (no.spaces x 2.67x3.75)				20		4 req'd, 2 outside ok as is	
	Accessible unisex head(s) (no.decks x 30)				30		1 on main dk	
	Passageway access (.282x total deck areax.0625)				-		main dk ok as is	
	Embark/ disembark access				-		manlift on dock	
	Elevator (no. decks x 24)				-		none, main dk only	
	Total modications required space				50			
	Cost / sq ft x modifications space					$76,700	see note *1 below	
WEIGHT & COST OF ADA MODIFICATIONS					Weight (lb)	Cost ($)		
	Vessel lightship + fuel				169,900	lbs		
	Passengers (pass x 165 lbs)				19,800	lbs		
	Total vessel displacement				189,700	lbs		
	Fair market value / lightship weight				$15.89	/lb		
	Lightship weight/total deck area				96.59	lbs/sq ft		
	Floor space added weight				4,800	lbs		
	Elevator (no.decks > weight)				-		none, main dk only	
	Generator upgrade (no. decks for elevator > kw/ lb)				-		same	
	Total modifications weight addition				4,800	lbs		
	Modification weight x cost/lb					$76,280		
	Average cost of mods (space + weight / 2)			($76,700 + $76,280/2)		$76,490	see note *1 below	
DIRECT COST OF ADA MODIFICATIONS						Cost ($)		
	Elevator (no. decks > cost)					$25,000	manlift on dock	
	Signage/alarms (no. decks x $ 3,500)					$7,000	on 2 decks	
	Visual aids (no. decks x $ 3,000)					$6,000	same	
	Food service mods ($ 2,000 per counter)					$2,000	on 1 decks	
	Wider door w/ assist($ 5,000 per installation)					$5,000	1 door on main dk	
	Unisex head ($ 5,800 on main deck/ $ 15,000 on upper deck)					$5,800	1 on main dk	
	Wheelchair tiedowns (no. spaces x $ 250)					$1,000		
	Embarkation sill ramp (12" coaming) + gate at side rail					$10,000		
	Total direct costs					**$61,800**		
DIRECT COST OF VESSEL MODIFICATIONS						Total Cost	Yearly Cost	Lost Speed
	Auxilary power KW upgrade (assumed)							Lost Revenue
3%	Increased maintenance cost						$5,000	
	Propulsion increase (new machinery & design @ 3% fair market value)							-
	Stability analysis (% weight increase > cost)					$1,500		
1%	Speed loss (assume 1.4 kts per 19,000 lbs)							**.4 knots**
1%	Fuel useage increase (assume 3500 hr/yr x hp x 1.2/24 x hp x $.70/gal)						$4,410	
	Lost revenue cost ($50 x 3 x 52 x .50 x lost deck area / 3.75 sq.ft)							$52,000
	Total direct costs					**$63,300**	**$9,010**	**$52,000**
	Total vessel space weight average					$76,490		
						$139,790		
	Note 1* Cost of space and mods not applicable for retrofit projects							

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APPENDIX C

UNIT FLEET COSTS FROM FIELD WORK AND LITERATURE

APPENDIX C
ACCESSIBILITY COST DATA FROM THE FIELD AND LITERATURE

NEW CONSTRUCTION

Elevators/lifts

NORTHERN STAR and SOUTHERN STAR, gaming boats
Elevators $50,000 each
M/V MAQUOIT, Casco Bay ferry
One elevator approx. $50,000
U.S. Park Service attraction vessel
New custom built lift, installed $45,000
Woods Hole Steamship Authority M/V MARTHA'S VINEYARD
Elevator, two decks $61,960 installed

ALTERATIONS

Elevators/lifts

Woods Hole Steamship Authority NANTUCKET
Elevator retrofit approx. $100,000

Transport Canada study
Elevator retrofit on ferry $150,000 Canadian

Casco Bay 65' ferries
Lifts estimated at about $20,000 each

Heads

Casco Bay 65' ferries
Estimated at about $25,000 each
Red and White Line BAY CLIPPER
$18,305 (men's) and $21,996 (women's)

APPENDIX D

DETAILED COST SPREADSHEETS AND NOTES-- FLEET

NEW CONSTRUCTION

General

Costs for access associated with new construction vessels are projected 40 years forward from the time of assumed implementation of the regulations, 1998. At assumed population decay rates, the last of the longest-lived vessels (Subchapter H) would then be retired and replaced.

Design of new vessels is assumed to include all access accommodations described in Chapter 4. Space optimization of many accommodations such as accessible heads and and passageways may be expected, particularly on larger vessels. No revenue losses due to area reductions are included; rather, the capital cost of extra area for inclusion of access accommodations are found. Costs of component such as elevators and signage/alarm systems are found directly and the weight premium calculated.

Operating costs for new vessels coming into service from 1998 are also calculated until the year 2038. They include increments for fuel cost (due to extra weight) and maintenance for access accommodations such as elevators. While revenue losses can be expected for alterations because of lost passenger space, this is assumed not to be the case for new construction, as discussed above.

Unit Capital Costs

The fleet is characterized by Coast Guard Subchapter and service type; each category will be represented by a typical vessel or blend of vessels. The capital costs are:

- **The construction premium for the added weight and area required for access accommodations**. Spreadsheet "sked/factors" shows the available data and the blend chosen for each vessel category.
- **The direct cost of ADA modifications**. Components' direct cost, including installation, are scheduled in accordance with Tables 4-4 and 4-5. Some components, such as accessible heads and food service bars, are assumed to have no extra cost relative to non-accessible components. Installation premiums for such components as elevators and alarms are assumed to be 50% less than for retrofits.

Space/weight premium

New construction costs can be effected by requirements for added space and weight, as ADA accommodations do. The sample vessel study indicates that the most consistent

basis is cost per weight, where weight includes that of actual components (i.e. elevator) and the weight associated with added space.

For these purposes, only the elevator is calculated to add "component" weight from among the required access accommodations. Added weight due to space requirements is found as follows:

- Accessible heads add 1) 10 ft^2 each for H/K and T fishing boats, and 2) 15 ft^2 each for all other T boats. ADAAG indicates that a single accessible lavatory requires about 30 ft^2. The differential fleet-wide reflects a lower premium due to the use of multiple heads, especially on larger vessels.
- Each tiedown spot adds net 3 ft^2 for high density craft only, i.e. 10 ft^2 for the spot minus 7 ft^2 deck space (Table 4-6).
- Elevators add 24 ft^2 per deck serviced.

Direct costs

Food service bars

New construction costs are much lower than retrofit. Marginal cost of $500 covers extra costs for acquiring bi-level bar.

Signage/alarms

Unit costs are: $6,500/deck (per Walther study) for H vessels; $5,000/deck for K; and $3,500/deck for T boats. While the bulk of the cost is in wiring/controls, etc. for visual/audio alarms, the variance in numbers of alarms, message boards, tactile strips, handrail end treatments, etc. Signage and alarms are assumed for all decks of affected vessels since this requirement is not related to wheelchair access, providing for sight- and hearing-impaired people who may go anywhere onboard.

Accessible heads

UHI indicates that 67% of ferry routes are less than 30 minutes, the Coast Guard threshold for required rest rooms on board. The detailed arrangements data are not available for the ferry fleet. It is assumed that any K or H ferry will be constructed with heads on board, especially since many run on several routes, short and long. 50 % of the T ferries, those most likely to be dedicated to short runs, are assumed to be constructed without heads.

Fleet Capital Costs

10-year amortization at 7.9%.

Present value at 4.8%.

H fleet outlays to year 40, amort. to year 50.
K fleet outlays to year 30, amort. to year 40.
T fleet outlays to year 25, amort. to year 35.

Operating Costs

These costs are increased for fuel and maintenance. The population of new vessels increases by the assumed annual increments to 100% and then remains constant. New "H" vessels grow in number until the end of the 40 years; Ks and Ts grow for 30 and 25 years, respectively, after which their numbers are assumed constant until 2038.

Fuel Costs

For each vessel type, two unit annual cost increments are found: with and without an elevator. The added weight components are the following:

- **Elevator**: standard weights per Walther study
  2 decks-- 27,000 pounds
  3 decks-- 30,000 pounds
- **Other accommodations**: weights of passage, head, food service and other accommodations are negligible relative to non-accessible components. Stair lifts are not included as significant added weight The additional area requirements result in added weights, which have been calculated as weight to unit area ratios for several sample vessels. These ratios are multiplied by the incremental access areas to find the added weight in a new construction vessel.
- The sum of the foregoing two weights is for a vessel with elevator. The weight associated with area for "other accommodations" is added for vessels without elevators, including those vessels with lifts.

It is assumed that ADA considerations do not affect an owner's requirements for a newbuilding. Rather than calculate a loss in speed, we figure on higher fuel consumption to meet the specified speed requirement.

Hours of operation

Different vessel types may be expected to operate engines for different amounts of time annually. Daily hours are multiplied by 6 days per week and 50 weeks per year to arrive at the annual figure. Since consistent year-round operation may only be realistic for public transport vessels, particularly large ferries, the fuel consumption numbers for many public accommodation vessels will be representative of idealized conditions and, therefor, high.

The assumed hours are:

Vessel type	Daily hours	Annual hours
Ferry	12	3600
Dinner/excursion	4	1200
Gaming	6	1800
Cruise	12	3600
Whalewatch/sightsee	6	1800
Commuter	12	3600
Fishing/dive	4	1200
Sail	1	300
Other	4	1200

Fuel costs are assumed for half the first year newbuilds in year 1, and all affected vessels thereafter. The new fleet phase-in is 40 years for H vessels, 30 for K vessels, and 25 for T boats. For Ks and Ts, 100% of the fleet is assumed to operate after phase-in periods to 40 years.

Maintenance

Full maintenance costs each year including year 1.

Actual costs

Costs in 1996 dollars (no present value or amortization) are given in the spreadsheets and totalled in the Executive Summary. Capital costs are simply the annual fleet costs multiplied by the phase-in periods (40/30/25 years) for the three subchapters. Operating costs (fuel and maintenance) are found for each class by multiplying the average number for vessels in service times the 40 year implementation period. For H vessels, this is (40 X annual incremental cost X 40years/2) = 800 X annual incremental cost. For K vessels, it is ((30 X annual incremental cost X 30 years/2) + (30 X annual incremental cost X remaining 10 years)) = 750 X annual incremental cost. ForT boats, it is ((25 X annual incremental cost X 25 years/2) + (25 X annual incremental cost X remaining 15 years)) = 687 X annual incremental cost.

NOTES ON VESSEL ALTERATIONS COSTS

Unit capital costs for vessel alterations

Costs are found for a major alteration to the vessel's "primary function area", which is assumed to be the trigger for the proposed access requirements of Tables 4-4 and 4-5. The unit and rollout costs do not take account of the ADA's 20% ceiling which applies to shoreside alterations.

Tiedowns

Unit cost = $250 per Walther study.
Number per ship in accordance with ADAAG parking lot requirements:

Subchapter H vessels: 8 tiedowns=average of 700 passenger capacity.
Subchapter K vessels: 6 or 4 tiedowns depending on vessel type
6::301-500 capacity
4::51-300 capacity
Subchapter T vessels: 2-4 tiedowns depending on type (2 for 26-50 passengers)

Accessible heads

Unit cost = $15,000 per operator interviews (Walther study has lower numbers reflective of new construction).

Subchapter H vessels: (2) accessible heads for the largest vessels.
Subchapter K and T vessels: (1) accessible head assumed on largest deck with access.

UHI indicates that 67% of ferry routes are less than 30 minutes, the Coast Guard threshold for required rest rooms on board. The detailed arrangements data are not available for the ferry fleet. It is assumed that any K or H ferry will be constructed with heads on board, especially since many run on several routes, short and long. 50 % of the T ferries, those most likely to be dedicated to short runs, are assumed to be without heads.

Embarkation mods.

Mods. to gunwale and deck edge for accessible gangway interface.
Unit cost = $1000 per Walther study.

Subchapter H vessels: (2) embarkation points assumed, either for port and starboard entry or two on one side.
Subchapter K and T vessels; (1) embarkation point only should suffice, since these are smaller vessels in a retrofit situation.

Passage

For retrofit, passage needs are assumed to be limited to doorway modifications for access to vessel interiors. Corridor/aisle widths are commonly in excess of 32" and are not widened for retrofit costing purposes. For smaller (T) vessels, this assumption means that the main "primary function area" will have adequate access without major passage widening to every part of the boat.

It is assumed however that doorways leading to interior areas will require widening and sill treatments.

Unit cost = $5000/door per Walther study

Subchapter H vessels: (2) doorways assumed, either for port and starboard entry or two on one side.
Subchapter K and T vessels: (1) doorway modification.

Signage/alarms

Unit costs are: $6,500/deck (per Walther study) for H vessels; $5,000/deck for K; and $3,500/deck for T boats. While the bulk of the cost is in wiring/controls, etc. for visual/audio alarms, the variance in numbers of alarms, message boards, tactile strips, handrail end treatments, etc. will result in a range of costs for different sizes and services.

Food service counter modifications

Subchapter H vessels: (2) food bars assumed, since service will likely be on at least two decks..
Subchapter K and T vessels: (1) accessible food bar should suffice for smaller vessels in a retrofit situation.

Unit cost = $2000/bar per Walther study.

Elevators and lifts

Access to no more than two decks is assumed in any case for retrofit. Lifts have been found feasible in field visits to some operators and will probably be used as a low cost and low impact alternative to elevators in many cases.

"Elev/lift notes" on the unit costs spreadsheet are the following:

- Elev. 2 dks-- all such retrofitted vessels will have elevators. Affected ferries will likely have vehicle decks, for which stair lifts are not generally feasible.
- 2dk, elev/lift-- for these vessel types, either option may be available. It is assumed that 50% will use each solution, and the cost is therefor averaged.

- 2 dk. lift-- smaller vessel types are assumed to be retrofitted with stair lifts.
- NA-- Not applicable. "H" and "K" gaming boats all have multi-deck access as built. Commuter/shuttle vessels are small public transport assets with no need for multi-deck access.

Unit costs are:

Elevator: $50,000 for 2-deck system plus 100% multiplier for retrofit installation, per Walther study and field/literature notes.

Lift: 2-deck system is assumed to cost $30,000, installed, based upon field interviews with operators.

Fuel

Annual unit costs Added weight results in added fuel costs. Weight of elevators only is considered significant for this purpose. Area requirements for access accommodations do not result in added weight for retrofit. Other items are replacement equipment or light weight with negligible impact. If a stair lift is used, that weight is ignored also.

Fuel consumption equation: Major manufacturers of marine engines recommended the following equation to calculate fuel costs from weight added to a vessel:

(Δ wt./vessel displacement) X (#hrs. of operation annually) X (ship HP) X (1.2/24 bsfc) X $0.70/gal. = delta annual cost

Δ wt. = 30,000 pounds for an elevators, assumed to be for 2-deck service only.

Vessel characteristics Notional displacements for each Subchapter/type group were found from sample vessels in the Walther study and the 22 T/K/H vessels used in the Volpe Center damage stability study. Notional horsepower ratings for main placts were similarly derived.

NOTE: Unit fuel costs associated with added elevator weights are shown for some vessels for which elevator installations are not anticipated.

Vessel maintenance

Unit costs

Elevators/lifts Elevator maintenance costs reported by operators range from $1,000-$4,000/ year per unit, the more expensive being for service contracts paid for by large operators such as gaming boats. A low end number ($1,500/year) is chosen because many smaller operators will probably find cheaper service and/or maintain the units themselves. This value is assumed for all vessels since only one is assumed in all cases.

Likewise, the lifts are assumed to cost an annual $500 for maintenance and this value is uniform for all vessels.

Other accommodations Maintenance for other access items will be minimal. Alarm systems and additional structural features such as sill treatments are assumed to cost from $250/yr to $500/yr depending on vessel size (H = $500; K = $375; T = $250).

Schedule

Full expenses for effected vessels the first year. Otherwise, phase-in for the first ten years and population decay for the following twenty years is the same as for the capital costs and fuel calculations.

Revenue losses

General

ADA access modifications can result in the loss of passenger accommodation space. For the cases of alterations, we assume that lost areas are due to elevator and accessible head retrofits, and, in some cases, the area required for wheelchairs. As stated elsewhere, the widening of existing aisles and corridors is not included.

Revenue area parameters

Coast Guard allows two passenger-area calculations: 1) 10ft^2 of accommodation deck space per passenger; or 2) 3.75 ft^2 per passenger seat. The latter is usually used on smaller, high density carriers such as small ferries and commuter boats. Table 4-6 of the Interim Report shows per passenger areas well in excess of 10 ft^2 for most vessels, excepting a shuttle boat, two small dinner boats, and two high-density ferries. The densest boats are grouped at about 7.0 ft^2/passenger.

Unit capacity is assumed to be 10 ft^2/passenger for all H vessels, and K and T gaming, cruise, and sailing vessels. Note that the required "sitting" space of 10 ft^2/wheelchair does not impact capacity for these vessels.

Accessible unisex heads are estimated at 30 ft^2 each. Net area loss will vary depending on how existing heads are replaced, e.g. eliminate one or two "standard" single-sex heads at 12 ft^2 each, or modify large existing multiple heads. The worst case is a loss of 18 ft^2, while 0 to 6 ft^2 may be more common, especially for larger vessels. Blended numbers chosen are as follows: 1) H and K vessels-- 10 ft^2/head; and 2) T boats-- 15 ft^2/head.

7.0 ft^2/passenger is used for all size commuter boats and for portions of all other classes of K and T vessels as shown in the spreadsheet. The area loss due to wheelchair "sitting" space is 10 ft^2

For cruise vessels, it is assumed that one berth is lost only in the case of adding an elevator.

Calculation of revenue loss

Notional revenue factors for each class are given for the following: fare, trips per day, days per week, weeks per year, and full capacity ratio. The latter accounts for the fact that lost area only costs revenue when a vessel operates at full capacity-- not all of the time. Cruise boats are assumed to operate on a weekly basis.

Vessel population is sorted as follows: 1) per capita area requirement (10 or 3.75 ft^2); and 2) elevator/lift requirements. "Population factors" for per capita areas are educated guesses on the portions of each vessel type so designed (factors always total to 1.0). The fleet distribution for elevators is as described in the body of the report.

The "vessel elevator factor" measures the portions of vessel types opting for elevators or stair lifts. The annual number of alterations with elevators is further divided by this factor; 1.0 means all get elevators and 0.0 means all get lifts.

Single vessel cost scenarios

Annual unit costs are projected for single vessel types. The 30-year total is for an alteration in the first out year, 25-year total for alteration in year 5, and 20-year total for alteration in year 10.

Actual costs

Costs in 1996 dollars (no present value or amortization) are given in the spreadsheets and totalled in the Executive Summary. Capital costs are simply the annual fleet costs multiplied by the phase-in period (10 years). Operating costs (fuel, maintenance, and revenue) are found for each subchapter class by calculating the "ramp-up" costs during the 10 year phase-in for the average number of affected vessels, plus the "ramp-down" costs for remaining service years for the average number of affected vessels. The calculations are as follows:

H-- Cost = (10 X annual incremental cost X 10 years/2) + (10 X annual incremental cost X 30 years/2) = 200 X annual incremental cost.
K-- Cost = (10 X annual incremental cost X 10 years/2) + (10 X annual incremental cost X 20 years/2) = 150 X annual incremental cost.
T-- Cost = (10 X annual incremental cost X 10 years/2) + (10 X annual incremental cost X 15 years/2) = 125 X annual incremental cost.

TABLE D-1
UNIT FUEL COSTS (NEWBUILDINGS)

UNIT VESSEL COST				year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	year 11	year 12	year 13
		H	Ferry	$3,323	$3,171	$3,026	$2,887	$2,755	$2,629	$2,508	$2,393	$2,284	$2,179	$2,079	$1,984	$1,893
		H	Dinner/excursion	$1,477	$1,409	$1,345	$1,283	$1,224	$1,168	$1,115	$1,064	$1,015	$969	$924	$882	$841
		H	Gaming	$831	$793	$756	$722	$689	$657	$627	$598	$571	$545	$520	$496	$473
		H	Cruise	$4,154	$3,964	$3,782	$3,609	$3,444	$3,286	$3,135	$2,992	$2,855	$2,724	$2,599	$2,480	$2,367
		H	Whalewatcher/sightseeing	$4,154	$3,964	$3,782	$3,609	$3,444	$3,286	$3,135	$2,992	$2,855	$2,724	$2,599	$2,480	$2,367
		H	Other	$2,215	$2,114	$2,017	$1,925	$1,837	$1,752	$1,672	$1,596	$1,523	$1,453	$1,386	$1,323	$1,262
		K	Ferry	$11,973	$11,425	$10,901	$10,402	$9,926	$9,471	$9,037	$8,623	$8,228	$7,852	$7,492	$7,149	$6,821
		K	Dinner/excursion	$6,652	$6,347	$6,056	$5,779	$5,514	$5,262	$5,021	$4,791	$4,571	$4,362	$4,162	$3,972	$3,790
		K	Gaming	$7,428	$7,088	$6,763	$6,454	$6,158	$5,876	$5,607	$5,350	$5,105	$4,871	$4,648	$4,435	$4,232
		K	Cruise	$19,808	$18,901	$18,036	$17,209	$16,421	$15,669	$14,951	$14,267	$13,613	$12,990	$12,395	$11,827	$11,285
		K	Whalewatcher/sightseeing	$9,978	$9,521	$9,084	$8,668	$8,271	$7,893	$7,531	$7,186	$6,857	$6,543	$6,243	$5,957	$5,684
		K	Commuter /shuttle	$586	$560	$534	$509	$486	$464	$443	$422	$403	$385	$367	$350	$334
		K	Fishing/dive	$14,930	$14,246	$13,593	$12,971	$12,377	$11,810	$11,269	$10,753	$10,260	$9,790	$9,342	$8,914	$8,506
		K	Other	$6,652	$6,347	$6,056	$5,779	$5,514	$5,262	$5,021	$4,791	$4,571	$4,362	$4,162	$3,972	$3,790
		T	Ferry	$14,698	$14,024	$13,382	$12,769	$12,184	$11,626	$11,094	$10,586	$10,101	$9,638	$9,197	$8,775	$8,374
		T	Dinner/excursion	$7,440	$7,100	$6,774	$6,464	$6,168	$5,886	$5,616	$5,359	$5,113	$4,879	$4,656	$4,442	$4,239
		T	Gaming	$7,367	$7,030	$6,708	$6,400	$6,107	$5,828	$5,561	$5,306	$5,063	$4,831	$4,610	$4,399	$4,197
		T	Cruise	$22,101	$21,089	$20,123	$19,201	$18,322	$17,483	$16,682	$15,918	$15,189	$14,493	$13,829	$13,196	$12,592
		T	Whalewatcher/sightseeing	$14,844	$14,164	$13,516	$12,896	$12,306	$11,742	$11,204	$10,691	$10,202	$9,734	$9,288	$8,863	$8,457
		T	Commuter /shuttle	$147	$140	$133	$127	$122	$116	$111	$106	$101	$96	$92	$88	$84
		T	Sailing	$15	$15	$14	$13	$13	$12	$12	$11	$10	$10	$10	$9	$9
		T	Fishing	$130	$124	$119	$113	$108	$103	$98	$94	$90	$85	$82	$78	$74
		T	Other	$7,422	$7,082	$6,758	$6,448	$6,153	$5,871	$5,602	$5,346	$5,101	$4,867	$4,644	$4,432	$4,229

TABLE D-1
UNIT FUEL COSTS (NEWBUILDINGS)

year	year	year	year	year	year	year	year	year	year	year	year	year	year	year	year
14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
$1,807	$1,724	$1,645	$1,570	$1,498	$1,429	$1,364	$1,301	$1,242	$1,185	$1,130	$1,079	$1,029	$982	$937	$894
$803	$766	$731	$698	$666	$635	$606	$578	$552	$527	$502	$479	$457	$436	$416	$397
$452	$431	$411	$392	$374	$357	$341	$325	$310	$296	$283	$270	$257	$246	$234	$224
$2,258	$2,155	$2,056	$1,962	$1,872	$1,786	$1,704	$1,626	$1,552	$1,481	$1,413	$1,348	$1,287	$1,228	$1,171	$1,118
$2,258	$2,155	$2,056	$1,962	$1,872	$1,786	$1,704	$1,626	$1,552	$1,481	$1,413	$1,348	$1,287	$1,228	$1,171	$1,118
$1,204	$1,149	$1,097	$1,046	$998	$953	$909	$867	$828	$790	$754	$719	$686	$655	$625	$596
$6,509	$6,211	$5,926	$5,655	$5,396	$5,149	$4,913	$4,688	$4,473	$4,268	$4,073	$3,886	$3,708	$3,538	$3,376	$3,222
$3,616	$3,450	$3,292	$3,142	$2,998	$2,860	$2,729	$2,604	$2,485	$2,371	$2,263	$2,159	$2,060	$1,966	$1,876	$1,790
$4,038	$3,853	$3,677	$3,508	$3,348	$3,194	$3,048	$2,908	$2,775	$2,648	$2,527	$2,411	$2,301	$2,195	$2,095	$1,999
$10,768	$10,275	$9,805	$9,356	$8,927	$8,518	$8,128	$7,756	$7,401	$7,062	$6,738	$6,430	$6,135	$5,854	$5,586	$5,330
$5,424	$5,176	$4,939	$4,712	$4,497	$4,291	$4,094	$3,907	$3,728	$3,557	$3,394	$3,239	$3,090	$2,949	$2,814	$2,685
$319	$304	$290	$277	$264	$252	$241	$230	$219	$209	$199	$190	$182	$173	$165	$158
$8,116	$7,744	$7,390	$7,051	$6,728	$6,420	$6,126	$5,846	$5,578	$5,322	$5,079	$4,846	$4,624	$4,412	$4,210	$4,017
$3,616	$3,450	$3,292	$3,142	$2,998	$2,860	$2,729	$2,604	$2,485	$2,371	$2,263	$2,159	$2,060	$1,966	$1,876	$1,790
$7,990	$7,624	$7,275	$6,942	$6,624	$6,320	$6,031	$5,755	$5,491	$5,240	$5,000	$4,771	$4,552	$4,344	$4,145	$3,955
$4,045	$3,860	$3,683	$3,514	$3,353	$3,200	$3,053	$2,913	$2,780	$2,652	$2,531	$2,415	$2,304	$2,199	$2,098	$2,002
$4,005	$3,822	$3,647	$3,479	$3,320	$3,168	$3,023	$2,884	$2,752	$2,626	$2,506	$2,391	$2,282	$2,177	$2,078	$1,982
$12,015	$11,465	$10,940	$10,438	$9,960	$9,504	$9,069	$8,653	$8,257	$7,879	$7,518	$7,174	$6,845	$6,532	$6,233	$5,947
$8,070	$7,700	$7,347	$7,011	$6,690	$6,383	$6,091	$5,812	$5,546	$5,292	$5,049	$4,818	$4,598	$4,387	$4,186	$3,994
$80	$76	$73	$69	$66	$63	$60	$57	$55	$52	$50	$48	$45	$43	$41	$39
$8	$8	$8	$7	$7	$7	$6	$6	$6	$5	$5	$5	$5	$5	$4	$4
$71	$68	$65	$62	$59	$56	$53	$51	$49	$46	$44	$42	$40	$39	$37	$35
$4,035	$3,850	$3,674	$3,505	$3,345	$3,192	$3,046	$2,906	$2,773	$2,646	$2,525	$2,409	$2,299	$2,193	$2,093	$1,997

TABLE D-1
UNIT FUEL COSTS (NEWBUILDINGS)

year 30	year 31	year 32	year 33	year 34	year 35	year 36	year 37	year 38	year 39	year 40	40-year cost 1998-2038	35-year cost 2003-2038	30-year cost 2008-2038	25-year cost 2013-2038	20-year cost 2018-2038
$853	$814	$777	$741	$707	$675	$644	$615	$586	$560	$534	$61,432	$46,270	$34,277	$24,790	$17,285
$379	$362	$345	$329	$314	$300	$286	$273	$261	$249	$237	$27,303	$20,565	$15,234	$11,018	$7,682
$213	$204	$194	$185	$177	$169	$161	$154	$147	$140	$133	$15,358	$11,568	$8,569	$6,197	$4,321
$1,067	$1,018	$971	$927	$884	$844	$805	$768	$733	$699	$667	$76,790	$57,838	$42,846	$30,987	$21,607
$1,067	$1,018	$971	$927	$884	$844	$805	$768	$733	$699	$667	$76,790	$57,838	$42,846	$30,987	$21,607
$569	$543	$518	$494	$472	$450	$429	$410	$391	$373	$356	$40,955	$30,847	$22,851	$16,527	$11,523
$3,074	$2,933	$2,799	$2,671	$2,548	$2,432	$2,320	$2,214	$2,113	$2,016	$1,924	$221,337	$166,710	$123,498	$89,316	$62,278
$1,708	$1,630	$1,555	$1,484	$1,416	$1,351	$1,289	$1,230	$1,174	$1,120	$1,069	$122,965	$92,616	$68,610	$49,620	$34,599
$1,907	$1,820	$1,737	$1,657	$1,581	$1,509	$1,440	$1,374	$1,311	$1,251	$1,193	$137,319	$103,428	$76,619	$55,413	$38,638
$5,086	$4,853	$4,631	$4,419	$4,216	$4,023	$3,839	$3,663	$3,495	$3,335	$3,182	$366,184	$275,808	$204,318	$147,767	$103,034
$2,562	$2,444	$2,333	$2,226	$2,124	$2,026	$1,934	$1,845	$1,761	$1,680	$1,603	$184,447	$138,925	$102,915	$74,430	$51,898
$151	$144	$137	$131	$125	$119	$114	$108	$103	$99	$94	$10,841	$8,165	$6,049	$4,375	$3,050
$3,833	$3,658	$3,490	$3,330	$3,178	$3,032	$2,893	$2,761	$2,634	$2,514	$2,399	$275,993	$207,877	$153,995	$111,372	$77,656
$1,708	$1,630	$1,555	$1,484	$1,416	$1,351	$1,289	$1,230	$1,174	$1,120	$1,069	$122,965	$92,616	$68,610	$49,620	$34,599
$3,774	$3,601	$3,436	$3,279	$3,128	$2,985	$2,848	$2,718	$2,593	$2,475	$2,361	$271,702	$204,645	$151,600	$109,640	$76,449
$1,910	$1,823	$1,739	$1,660	$1,584	$1,511	$1,442	$1,376	$1,313	$1,253	$1,195	$137,545	$103,598	$76,745	$55,504	$38,701
$1,892	$1,805	$1,722	$1,643	$1,568	$1,496	$1,428	$1,362	$1,300	$1,240	$1,184	$136,190	$102,577	$75,989	$54,957	$38,320
$5,675	$5,415	$5,167	$4,930	$4,704	$4,489	$4,283	$4,087	$3,900	$3,721	$3,551	$408,569	$307,732	$227,967	$164,871	$114,959
$3,811	$3,637	$3,470	$3,311	$3,160	$3,015	$2,877	$2,745	$2,619	$2,499	$2,385	$274,412	$206,686	$153,112	$110,734	$77,212
$38	$36	$34	$33	$31	$30	$28	$27	$26	$25	$24	$2,710	$2,041	$1,512	$1,094	$763
$4	$4	$4	$3	$3	$3	$3	$3	$3	$3	$2	$282	$213	$158	$114	$79
$33	$32	$30	$29	$28	$26	$25	$24	$23	$22	$21	$2,409	$1,815	$1,344	$972	$678
$1,906	$1,818	$1,735	$1,656	$1,580	$1,507	$1,438	$1,373	$1,310	$1,250	$1,192	$137,206	$103,343	$76,556	$55,367	$38,606

TABLE D-2
FUEL COSTS (NEWBUILDINGS)

		Elev./lift notes	Annual newbuilds	Annual newbuilds w/elev/lift	Vessel elevator factor	annual unit cost w/elev	annual unit cost w/o elev	40-year cost per type	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8
H	Ferry	Elev., 2 dks	2.33	1.86	1.00	$3,825	$113	$1,676,367	$3,113	$11,883	$17,008	$21,638	$25,809	$29,552	$32,898	$35,876
H	Dinner/excursion	2dk, elev/lift	0.25	0.25	0.50	$1,700	$50	$51,167	$95	$363	$519	$660	$788	$902	$1,004	$1,095
H	Gaming	NA	1.40	1.40	1.00	$956	$28	$313,143	$582	$2,220	$3,177	$4,042	$4,821	$5,520	$6,145	$6,702
H	Cruise	2dk, elev/lift	0.05	0.05	0.50	$4,781	$141	$28,782	$53	$204	$292	$372	$443	$507	$565	$616
H	Whalewatcher/sightseeing	2dk, elev/lift	0.73	0.73	0.50	$4,781	$141	$417,332	$775	$2,958	$4,234	$5,387	$6,425	$7,357	$8,190	$8,931
H	Other	2dk, elev/lift	0.38	0.38	0.50	$2,550	$75	$115,126	$214	$816	$1,168	$1,486	$1,772	$2,030	$2,259	$2,464
								$2,601,916								
K	Ferry	Elev., 2 dks	5.05	1.01	1.00	$13,781	$551	$3,661,376	$7,012	$26,765	$38,309	$48,739	$58,133	$66,565	$74,102	$80,809
K	Dinner/excursion	2dk, elev/lift	13.30	13.30	0.50	$7,656	$306	$11,913,567	$23,000	$87,786	$125,647	$159,857	$190,669	$218,323	$243,044	$265,043
K	Gaming	NA	0.96	0.96	0.50	$8,550	$281	$950,840	$1,836	$7,006	$10,028	$12,758	$15,218	$17,425	$19,398	$21,153
K	Cruise	2dk, elev/lift	0.07	0.07	0.50	$22,800	$750	$174,867	$338	$1,289	$1,844	$2,346	$2,799	$3,205	$3,567	$3,890
K	Whalewatcher/sightseeing	2 dk, lift	1.25	1.25	0.25	$11,484	$459	$892,303	$1,752	$6,686	$9,569	$12,175	$14,521	$16,627	$18,510	$20,186
K	Commuter /shuttle	NA	0.00	0.00	0.00	$675	$675	$0	$0	$0	$0	$0	$0	$0	$0	$0
K	Fishing/dive	2 dk, lift	2.90	2.90	0.25	$17,184	$647	$3,075,208	$6,031	$23,021	$32,950	$41,921	$50,001	$57,253	$63,736	$69,505
K	Other	2dk, elev/lift	1.82	1.82	0.50	$7,656	$306	$1,625,921	$3,139	$11,981	$17,148	$21,817	$26,022	$29,796	$33,170	$36,172
								$22,294,083								
T	Ferry	2dk, elev/lift	6.24	2.18	0.50	$16,917	$380	$4,346,020	$8,874	$33,870	$48,478	$61,677	$73,565	$84,235	$93,773	$102,260
T	Dinner/excursion	2dk, elev/lift	6.60	3.30	0.25	$8,564	$295	$1,829,807	$3,810	$14,542	$20,814	$26,481	$31,585	$36,166	$40,261	$43,905
T	Gaming	2 dk, lift	0.00	0.00	0.25	$8,480	$211	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Cruise	2 dk, lift	1.08	0.54	0.25	$25,439	$633	$845,179	$1,752	$6,686	$9,569	$12,174	$14,521	$16,627	$18,510	$20,185
T	Whalewatcher/sightseeing	2 dk, lift	34.56	17.28	0.25	$17,086	$548	$18,879,918	$39,268	$149,877	$214,518	$272,924	$325,529	$372,744	$414,950	$452,508
T	Commuter /shuttle	NA	17.64	8.82	0.00	$169	$169	$522,891	$1,293	$4,935	$7,064	$8,987	$10,720	$12,274	$13,664	$14,901
T	Sailing	2 dk, lift	4.32	2.16	0.00	$18	$18	$13,339	$33	$126	$180	$229	$273	$313	$349	$380
T	Fishing	NA	107.88	0.00	0.00	$150	$150	$3,442,658	$7,029	$26,830	$38,401	$48,857	$58,274	$66,726	$74,281	$81,005
T	Other	2dk, elev/lift	13.56	6.78	0.25	$8,543	$274	$3,703,873	$7,704	$29,403	$42,084	$53,542	$63,863	$73,125	$81,405	$88,773
								$33,583,683								
	TOTAL							**$58,479,682**	**$117,702**	**$449,244**	**$643,002**	**$818,069**	**$975,750**	**$1,117,271**	**$1,243,781**	**$1,356,359**

TABLE D-2
FUEL COSTS (NEWBUILDINGS)

year 9	year 10	year 11	year 12	year 13	year 14	year 15	year 16	year 17	year 18	year 19	year 20	year 21	year 22	year 23	year 24
$38,512	$40,831	$42,857	$44,612	$46,116	$47,389	$48,448	$49,311	$49,993	$50,509	$50,874	$51,098	$51,196	$51,177	$51,053	$50,833
$1,175	$1,246	$1,308	$1,362	$1,408	$1,446	$1,479	$1,505	$1,526	$1,542	$1,553	$1,560	$1,563	$1,562	$1,558	$1,552
$7,194	$7,627	$8,006	$8,333	$8,614	$8,852	$9,050	$9,211	$9,339	$9,435	$9,503	$9,545	$9,563	$9,560	$9,537	$9,495
$661	$701	$736	$766	$792	$814	$832	$847	$858	$867	$873	$877	$879	$879	$877	$873
$9,588	$10,165	$10,669	$11,106	$11,481	$11,797	$12,061	$12,276	$12,446	$12,574	$12,665	$12,721	$12,745	$12,741	$12,710	$12,655
$2,645	$2,804	$2,943	$3,064	$3,167	$3,254	$3,327	$3,386	$3,433	$3,469	$3,494	$3,509	$3,516	$3,515	$3,506	$3,491
$86,746	$91,970	$96,533	$100,486	$103,874	$106,741	$109,127	$111,071	$112,607	$113,770	$114,591	$115,097	$115,317	$115,275	$114,995	$114,499
$284,516	$301,650	$316,617	$329,581	$340,692	$350,095	$357,922	$364,297	$369,337	$373,152	$375,842	$377,503	$378,223	$378,086	$377,167	$375,540
$22,708	$24,075	$25,270	$26,304	$27,191	$27,942	$28,566	$29,075	$29,477	$29,782	$29,997	$30,129	$30,187	$30,176	$30,102	$29,972
$4,176	$4,428	$4,647	$4,838	$5,001	$5,139	$5,254	$5,347	$5,421	$5,477	$5,517	$5,541	$5,552	$5,550	$5,536	$5,512
$21,669	$22,974	$24,113	$25,101	$25,947	$26,663	$27,259	$27,745	$28,129	$28,419	$28,624	$28,750	$28,805	$28,795	$28,725	$28,601
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$74,612	$79,105	$83,030	$86,429	$89,343	$91,809	$93,862	$95,533	$96,855	$97,855	$98,561	$98,997	$99,185	$99,149	$98,909	$98,482
$38,830	$41,168	$43,211	$44,980	$46,496	$47,780	$48,848	$49,718	$50,406	$50,926	$51,294	$51,520	$51,619	$51,600	$51,474	$51,252
$109,774	$116,384	$122,159	$127,161	$131,448	$135,076	$138,096	$140,555	$142,500	$143,972	$145,010	$145,650	$145,928	$145,875	$145,521	$144,893
$47,131	$49,969	$52,449	$54,596	$56,437	$57,994	$59,291	$60,347	$61,182	$61,814	$62,259	$62,535	$62,654	$62,631	$62,479	$62,209
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$21,668	$22,973	$24,113	$25,100	$25,946	$26,662	$27,258	$27,744	$28,128	$28,418	$28,623	$28,750	$28,805	$28,794	$28,724	$28,600
$485,755	$515,008	$540,562	$562,694	$581,666	$597,719	$611,081	$621,965	$630,571	$637,083	$641,676	$644,512	$645,742	$645,507	$643,939	$641,161
$15,996	$16,959	$17,801	$18,530	$19,154	$19,683	$20,123	$20,481	$20,765	$20,979	$21,130	$21,224	$21,264	$21,257	$21,205	$21,114
$408	$433	$454	$473	$489	$502	$513	$522	$530	$535	$539	$541	$542	$542	$541	$539
$86,956	$92,193	$96,767	$100,729	$104,125	$106,999	$109,391	$111,339	$112,880	$114,046	$114,868	$115,376	$115,596	$115,554	$115,273	$114,776
$95,296	$101,035	$106,048	$110,390	$114,111	$117,261	$119,882	$122,017	$123,706	$124,983	$125,884	$126,441	$126,682	$126,636	$126,328	$125,783
$1,456,015	**$1,543,697**	**$1,620,293**	**$1,686,634**	**$1,743,499**	**$1,791,616**	**$1,831,669**	**$1,864,294**	**$1,890,088**	**$1,909,608**	**$1,923,376**	**$1,931,876**	**$1,935,563**	**$1,934,859**	**$1,930,160**	**$1,921,832**

TABLE D-2
FUEL COSTS (NEWBUILDINGS)

year 25	year 26	year 27	year 28	year 29	year 30	year 31	year 32	year 33	year 34	year 35	year 36	year 37	year 38	year 39	year 40
$50,526	$50,140	$49,684	$49,164	$48,587	$47,961	$47,290	$46,579	$45,835	$45,061	$44,262	$43,441	$42,603	$41,750	$40,886	$40,014
$1,542	$1,530	$1,516	$1,501	$1,483	$1,464	$1,443	$1,422	$1,399	$1,375	$1,351	$1,326	$1,300	$1,274	$1,248	$1,221
$9,438	$9,366	$9,281	$9,184	$9,076	$8,959	$8,834	$8,701	$8,562	$8,417	$8,268	$8,115	$7,958	$7,799	$7,638	$7,475
$867	$861	$853	$844	$834	$823	$812	$800	$787	$774	$760	$746	$731	$717	$702	$687
$12,578	$12,482	$12,369	$12,239	$12,096	$11,940	$11,773	$11,596	$11,411	$11,218	$11,019	$10,815	$10,606	$10,394	$10,179	$9,961
$3,470	$3,443	$3,412	$3,376	$3,337	$3,294	$3,248	$3,199	$3,148	$3,095	$3,040	$2,983	$2,926	$2,867	$2,808	$2,748
$113,807	$112,938	$111,910	$110,739	$109,441	$108,029	$106,636	$101,752	$97,092	$92,645	$88,401	$84,352	$80,489	$76,802	$73,285	$69,928
$373,271	$370,421	$367,050	$363,210	$358,952	$354,322	$338,094	$322,609	$307,833	$293,734	$280,280	$267,443	$255,194	$243,505	$232,352	$221,710
$29,791	$29,564	$29,295	$28,988	$28,649	$28,279	$26,984	$25,748	$24,569	$23,443	$22,370	$21,345	$20,367	$19,435	$18,544	$17,695
$5,479	$5,437	$5,388	$5,331	$5,269	$5,201	$4,963	$4,735	$4,518	$4,311	$4,114	$3,926	$3,746	$3,574	$3,410	$3,254
$28,428	$28,211	$27,954	$27,662	$27,338	$26,985	$23,910	$22,815	$21,770	$20,773	$19,821	$18,913	$18,047	$17,221	$16,432	$15,679
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$97,887	$97,139	$96,255	$95,248	$94,132	$92,918	$82,664	$78,878	$75,265	$71,818	$68,529	$65,390	$62,395	$59,537	$56,810	$54,208
$50,943	$50,554	$50,094	$49,570	$48,989	$48,357	$46,142	$44,028	$42,012	$40,088	$38,252	$36,500	$34,828	$33,233	$31,711	$30,258
$144,018	$137,421	$131,127	$125,121	$119,391	$113,922	$108,705	$103,726	$98,975	$94,442	$90,116	$85,989	$82,050	$78,292	$74,706	$71,285
$61,833	$55,724	$53,171	$50,736	$48,412	$46,195	$44,079	$42,060	$40,134	$38,296	$36,542	$34,868	$33,271	$31,747	$30,293	$28,906
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$28,427	$25,976	$24,786	$23,651	$22,568	$21,534	$20,548	$19,607	$18,709	$17,852	$17,034	$16,254	$15,509	$14,799	$14,121	$13,475
$637,286	$576,222	$549,830	$524,647	$500,617	$477,688	$455,809	$434,932	$415,012	$396,004	$377,866	$360,559	$344,045	$328,287	$313,251	$298,904
$20,986	$10,012	$9,554	$9,116	$8,699	$8,300	$7,920	$7,557	$7,211	$6,881	$6,566	$6,265	$5,978	$5,704	$5,443	$5,194
$535	$255	$244	$233	$222	$212	$202	$193	$184	$176	$167	$160	$153	$146	$139	$132
$114,082	$108,857	$103,871	$99,114	$94,574	$90,243	$86,109	$82,165	$78,402	$74,811	$71,385	$68,115	$64,995	$62,018	$59,178	$56,467
$125,023	$113,043	$107,866	$102,925	$98,211	$93,713	$89,421	$85,325	$81,417	$77,688	$74,130	$70,735	$67,495	$64,404	$61,454	$58,639
$1,910,218	**$1,799,598**	**$1,745,509**	**$1,692,600**	**$1,640,876**	**$1,590,339**	**$1,515,584**	**$1,448,427**	**$1,384,243**	**$1,322,899**	**$1,264,271**	**$1,208,239**	**$1,154,687**	**$1,103,506**	**$1,054,591**	**$1,007,841**

TABLE D-3
DISABLED ACCESS ACCOMMODATIONS
CAPITAL COSTS FOR VESSEL ALTERATIONS

		Unit cost w/elev/lift	Units/ year	Annual cost w/elev/lift	Unit cost w/o elev.	Units/ year	Annual cost wo/elev.	Annual cost total	Actual cost	P.V. year 1	P.V. year 5	P.V. year 10	P.V. total	year 1 1	year 2 2	year 3 3	year 4 4
H	Ferry	$164,000	5.58	$915,120	$59,000	1.40	$82,305	$997,425	$9,974,250	$128,560	$532,883	$843,055	$9,322,334	$128,560	$245,344	$351,161	$446,769
H	Dinner/excursion	$128,500	0.60	$77,100	$61,000	0.20	$12,200	$89,300	$893,000	$11,510	$47,709	$75,479	$834,634	$11,510	$21,966	$31,440	$40,000
H	Gaming	$19,000	3.15	$59,850	$19,000	1.05	$19,950	$79,800	$798,000	$10,286	$42,634	$67,449	$745,843	$10,286	$19,629	$28,095	$35,744
H	Cruise	$128,500	0.08	$9,638	$61,000	0.03	$1,525	$11,163	$111,625	$1,439	$5,964	$9,435	$104,329	$1,439	$2,746	$3,930	$5,000
H	Whalewatch/sightsee	$126,500	1.63	$206,353	$59,000	0.54	$32,081	$238,434	$2,384,344	$30,732	$127,386	$201,532	$2,228,503	$30,732	$58,650	$83,945	$106,800
H	Other	$128,500	0.84	$108,422	$61,000	0.28	$17,156	$125,578	$1,255,781	$16,186	$67,091	$106,143	$1,173,703	$16,186	$30,889	$44,212	$56,249
									$15,417,000				$14,409,346				
K	Ferry	$139,500	2.13	$297,515	$34,500	8.53	$294,316	$591,832	$5,918,318	$76,283	$316,192	$500,235	$5,531,497	$76,283	$145,577	$208,365	$265,095
K	Dinner/excursion	$102,000	14.04	$1,432,482	$34,500	14.04	$484,516	$1,916,998	$19,169,977	$247,086	$1,024,174	$1,620,306	$17,917,029	$247,086	$471,539	$674,912	$858,667
K	Gaming	$13,500	1.01	$13,643	$13,500	1.01	$13,643	$27,286	$272,864	$3,517	$14,578	$23,063	$255,029	$3,517	$6,712	$9,607	$12,222
K	Cruise	$102,000	0.07	$7,109	$34,500	0.07	$2,405	$9,514	$95,136	$1,226	$5,083	$8,041	$88,918	$1,226	$2,340	$3,349	$4,261
K	Whalewatch/sightsee	$34,500	1.32	$45,686	$34,500	1.32	$45,686	$91,373	$913,727	$11,777	$48,817	$77,231	$854,006	$11,777	$22,476	$32,169	$40,928
K	Commuter /shuttle	$19,000	0.00	$0	$19,000	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
K	Fishing/dive	$34,000	3.07	$104,267	$34,000	3.07	$104,267	$208,533	$2,085,333	$26,878	$111,411	$176,259	$1,949,036	$26,878	$51,295	$73,418	$93,407
K	Other	$102,000	1.92	$195,500	$34,500	1.92	$66,125	$261,625	$2,616,250	$33,721	$139,776	$221,134	$2,445,252	$33,721	$64,354	$92,110	$117,188
									$31,071,606				$29,040,768				
T	Ferry	$91,000	3.28	$298,116	$23,500	6.08	$142,974	$441,090	$4,410,900	$56,853	$235,656	$372,823	$4,122,604	$56,853	$108,498	$155,293	$197,574
T	Dinner/excursion	$31,000	0.00	$0	$31,000	9.90	$306,900	$306,900	$3,069,000	$39,557	$163,964	$259,401	$2,868,410	$39,557	$75,491	$108,049	$137,468
T	Gaming	$31,000	0.00	$0	$31,000	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Cruise	$30,750	0.00	$0	$30,750	1.62	$49,815	$49,815	$498,150	$6,421	$26,614	$42,105	$465,591	$6,421	$12,253	$17,538	$22,313
T	Whalewatch/sightsee	$30,750	0.00	$0	$30,750	51.84	$1,594,080	$1,594,080	$15,940,800	$205,465	$851,652	$1,347,366	$14,898,910	$205,465	$392,108	$561,224	$714,025
T	Commuter /shuttle	$10,000	0.00	$0	$10,000	26.46	$264,600	$264,600	$2,646,000	$34,105	$141,365	$223,648	$2,473,058	$34,105	$65,086	$93,157	$118,520
T	Sailing	$27,250	0.00	$0	$27,250	6.48	$176,580	$176,580	$1,765,800	$22,760	$94,339	$149,251	$1,650,387	$22,760	$43,435	$62,168	$79,094
T	Other	$30,750	0.00	$0	$30,750	20.34	$625,455	$625,455	$6,254,550	$80,616	$334,155	$528,654	$5,845,753	$80,616	$153,848	$220,202	$280,156
									$34,585,200				$32,324,714				
	TOTAL								**$81,073,806**	**$1,044,979**	**$4,331,442**	**$6,852,611**	**$75,774,827**	**$1,044,979**	**$1,994,235**	**$2,854,344**	**$3,631,481**

Notes:

1. Assume all accommodations installed at once for each vessel.
2. See notes on lifts and elevators on "Capital unit costs" sheet.
3. 10-year amortization of outlays at 7.9%.
4. Assume 1998 effective date for regulations.
5. PV = present value at discount rate of 4.8%
6. 10-year overhaul cycle assumed for all vessels.

TABLE D-3
DISABLED ACCESS ACCOMMODATIONS
CAPITAL COSTS FOR VESSEL ALTERATIONS

year 5	year 6	year 7	year 8	year 9	year 10	year 11	year 12	year 13	year 14	year 15	year 16	year 17	year 18	year 19	year 20
5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
$532,883	$610,172	$679,263	$740,744	$795,169	$843,055	$884,886	$690,837	$585,952	$489,225	$400,130	$318,169	$242,877	$173,815	$110,569	$52,752
$47,709	$54,629	$60,815	$66,319	$71,192	$75,479	$79,224	$61,851	$52,461	$43,801	$35,824	$28,486	$21,745	$15,562	$9,899	$4,723
$42,634	$48,817	$54,345	$59,264	$63,618	$67,449	$70,796	$55,271	$46,880	$39,141	$32,013	$25,455	$19,432	$13,906	$8,846	$4,221
$5,964	$6,829	$7,602	$8,290	$8,899	$9,435	$9,903	$7,731	$6,558	$5,475	$4,478	$3,561	$2,718	$1,945	$1,237	$590
$127,386	$145,862	$162,378	$177,075	$190,085	$201,532	$211,532	$165,145	$140,072	$116,949	$95,651	$76,058	$58,060	$41,550	$26,432	$12,610
$67,091	$76,822	$85,521	$93,261	$100,114	$106,143	$111,409	$86,978	$73,773	$61,595	$50,377	$40,058	$30,579	$21,884	$13,921	$6,642
$316,192	$362,051	$403,047	$439,528	$471,821	$500,235	$525,056	$409,915	$347,680	$290,286	$237,421	$188,789	$144,114	$103,135	$65,607	$31,301
$1,024,174	$1,172,718	$1,305,506	$1,423,671	$1,528,273	$1,620,306	$1,700,703	$1,327,752	$1,126,168	$940,265	$769,028	$611,504	$466,797	$334,063	$212,508	$101,387
$14,578	$16,692	$18,582	$20,264	$21,753	$23,063	$24,208	$18,899	$16,030	$13,384	$10,946	$8,704	$6,644	$4,755	$3,025	$1,443
$5,083	$5,820	$6,479	$7,065	$7,584	$8,041	$8,440	$6,589	$5,589	$4,666	$3,817	$3,035	$2,317	$1,658	$1,055	$503
$48,817	$55,897	$62,226	$67,859	$72,844	$77,231	$81,063	$63,287	$53,678	$44,817	$36,655	$29,147	$22,250	$15,923	$10,129	$4,833
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$111,411	$127,570	$142,015	$154,869	$166,247	$176,259	$185,005	$144,435	$122,506	$102,283	$83,656	$66,520	$50,779	$36,340	$23,117	$11,029
$139,776	$160,048	$178,171	$194,298	$208,573	$221,134	$232,106	$181,207	$153,695	$128,324	$104,954	$83,456	$63,707	$45,592	$29,002	$13,837
$235,656	$269,836	$300,389	$327,578	$351,647	$372,823	$391,322	$305,508	$259,125	$216,349	$176,949	$140,704	$107,407	$76,866	$48,897	$23,329
$163,964	$187,745	$209,004	$227,921	$244,667	$259,401	$272,273	$212,565	$180,293	$150,531	$123,117	$97,898	$74,731	$53,481	$34,021	$16,232
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$26,614	$30,474	$33,925	$36,995	$39,714	$42,105	$44,194	$34,503	$29,265	$24,434	$19,984	$15,891	$12,130	$8,681	$5,522	$2,635
$851,652	$975,174	$1,085,594	$1,183,854	$1,270,836	$1,347,366	$1,414,220	$1,104,093	$936,466	$781,877	$639,485	$508,496	$388,165	$277,790	$176,711	$84,309
$141,365	$161,868	$180,197	$196,507	$210,945	$223,648	$234,745	$183,267	$155,443	$129,783	$106,148	$84,405	$64,431	$46,110	$29,332	$13,994
$94,339	$108,022	$120,254	$131,138	$140,773	$149,251	$156,657	$122,303	$103,734	$86,610	$70,837	$56,327	$42,998	$30,771	$19,575	$9,339
$334,155	$382,620	$425,945	$464,498	$498,627	$528,654	$554,885	$433,203	$367,433	$306,778	$250,909	$199,514	$152,301	$108,994	$69,335	$33,079
$4,331,442	**$4,959,667**	**$5,521,257**	**$6,021,000**	**$6,463,383**	**$6,852,611**	**$7,192,627**	**$5,615,340**	**$4,762,799**	**$3,976,574**	**$3,252,377**	**$2,586,178**	**$1,974,182**	**$1,412,821**	**$898,741**	**$428,789**

TABLE D-4

INDUSTRY FUEL COSTS FOR ALTERATIONS

10-year alteration phase-in

		Elev./lift notes	annual unit cost w/elev	Vessel elevator factor	40/32/24-yr. cost per type	Annual retrofits w/elev/lift	Annual cost	Actual cost 40 yrs.	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	year 11	year 12	year 13	year 14	year 15
H	Ferry	Elev., 2 dks	$3,375	1.00	$1,688,984	5.58	$18,833	$3,766,500	$8,181	$31,224	$44,691	$56,859	$67,819	$77,655	$86,448	$94,273	$101,199	$107,293	$99,001	$91,242	$83,987	$77,205	$70,868
H	Dinner/excursion	2dk, elev/lift	$1,500	0.50	$40,358	0.60	$450	$90,000	$195	$746	$1,068	$1,359	$1,621	$1,856	$2,066	$2,253	$2,418	$2,564	$2,366	$2,180	$2,007	$1,845	$1,693
H	Gaming	NA	$844	0.00	$0	3.15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
H	Cruise	2dk, elev/lift	$4,219	0.50	$14,188	0.08	$158	$31,641	$69	$262	$375	$478	$570	$652	$726	$792	$850	$901	$832	$766	$706	$649	$595
H	Whalewatch/sightse	2dk, elev/lift	$4,219	0.50	$308,597	1.63	$3,441	$688,184	$1,495	$5,705	$8,166	$10,389	$12,391	$14,188	$15,795	$17,225	$18,490	$19,604	$18,089	$16,671	$15,345	$14,106	$12,948
H	Other	2dk, elev/lift	$2,250	0.50	$85,130	0.84	$949	$189,844	$412	$1,574	$2,253	$2,866	$3,418	$3,914	$4,357	$4,752	$5,101	$5,408	$4,990	$4,599	$4,233	$3,891	$3,572
					$2,137,258			$4,766,168															
K	Ferry	Elev., 2 dks	$13,500	1.00	$2,298,731	2.13	$28,792	$4,318,773	$12,507	$47,737	$68,326	$86,928	$103,684	$118,722	$132,185	$144,127	$154,717	$164,034	$149,634	$136,209	$123,700	$112,051	$101,210
K	Dinner/excursion	2dk, elev/lift	$7,500	0.50	$4,204,742	14.04	$52,665	$7,899,716	$22,877	$87,318	$124,978	$159,006	$189,654	$217,161	$241,750	$263,632	$283,001	$300,044	$273,704	$249,148	$226,267	$204,959	$185,128
K	Gaming	NA	$8,438	0.00	$0	1.01	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
K	Cruise	2dk, elev/lift	$22,500	0.50	$62,602	0.07	$784	$117,814	$341	$1,300	$1,861	$2,367	$2,824	$3,233	$3,599	$3,925	$4,213	$4,467	$4,075	$3,709	$3,369	$3,051	$2,756
K	Whalewatch/sightse	2 dk, lift	$11,250	0.00	$0	1.32	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
K	Commuter /shuttle	NA	$0	0.00	$0	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
K	Fishing/dive	2 dk, lift	$16,875	0.00	$0	3.07	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
K	Other	2dk, elev/lift	$7,500	0.50	$573,848	1.92	$7,188	$1,078,125	$3,122	$11,917	$17,057	$21,701	$25,883	$29,637	$32,993	$35,979	$38,623	$40,949	$37,354	$34,003	$30,880	$27,972	$25,266
					$7,139,923			$13,414,227															
T	Ferry	2dk, elev/lift	$16,875	0.50	$1,766,607	3.28	$27,641	$3,455,156	$12,007	$45,829	$65,595	$83,455	$99,540	$113,977	$126,883	$138,368	$148,534	$157,479	$49,588	$124,170	$109,316	$95,563	$82,840
T	Dinner/excursion	2dk, elev/lift	$8,438	0.00	$0	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Gaming	2 dk, lift	$8,438	0.00	$0	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Cruise	2 dk, lift	$25,313	0.00	$0	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Whalewatch/sightse	2 dk, lift	$16,875	0.00	$0	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Commuter /shuttle	NA	$0	0.00	$0	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Sailing	2 dk, lift	$0	0.00	$0	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Other	2dk, elev/lift	$8,438	0.00	$0	0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
					$1,766,607			$3,455,156															
	TOTAL				$11,043,789			$21,635,551	$61,207	$233,613	$334,370	$425,407	$507,403	$580,996	$646,783	$705,328	$757,147	$802,743	$639,632	$662,698	$599,810	$541,293	$486,877

TABLE D-4
INDUSTRY FUEL COSTS FOR ALTERATIONS

year 16	year 17	year 18	year 19	year 20	year 21	year 22	year 23	year 24	year 25	year 26	year 27	year 28
$64,707	$59,155	$54,270	$49,463	$44,982	$40,807	$36,921	$33,305	$29,943	$26,819	$23,919	$21,227	$18,732
$1,546	$1,413	$1,297	$1,182	$1,075	$975	$882	$796	$715	$641	$572	$507	$448
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$544	$497	$456	$416	$378	$343	$310	$280	$252	$225	$201	$178	$157
$11,823	$10,808	$9,916	$9,037	$8,219	$7,456	$6,746	$6,085	$5,471	$4,900	$4,370	$3,878	$3,423
$3,261	$2,982	$2,735	$2,493	$2,267	$2,057	$1,861	$1,679	$1,509	$1,352	$1,206	$1,070	$944
$91,126	$81,754	$73,050	$64,971	$57,479	$50,537	$44,110	$38,166	$32,674	$27,605	$22,932	$18,629	$14,672
$166,684	$149,542	$133,619	$118,842	$105,138	$92,440	$80,685	$69,812	$59,767	$50,495	$41,947	$34,076	$26,838
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$2,482	$2,226	$1,989	$1,769	$1,565	$1,376	$1,201	$1,039	$890	$752	$625	$507	$400
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$22,748	$20,409	$18,236	$16,219	$14,349	$12,616	$11,012	$9,528	$8,157	$6,891	$5,725	$4,651	$3,663
$71,081	$60,227	$50,217	$40,998	$32,518	$24,729	$17,585	$11,044	$5,065				
$0	$0	$0	$0	$0	$0	$0	$0	$0				
$0	$0	$0	$0	$0	$0	$0	$0	$0				
$0	$0	$0	$0	$0	$0	$0	$0	$0				
$0	$0	$0	$0	$0	$0	$0	$0	$0				
$0	$0	$0	$0	$0	$0	$0	$0	$0				
$0	$0	$0	$0	$0	$0	$0	$0	$0				
$0	$0	$0	$0	$0	$0	$0	$0	$0				
$436,003	$389,013	$345,785	$305,390	$267,969	$233,336	$201,313	$171,734	$144,442	$119,680	$101,495	$84,724	$69,276

year 29	year 30	year 31	year 32	year 33	year 34	year 35	year 36	year 37	year 38	year 39	year 40
$16,422	$14,283	$12,306	$10,480	$8,796	$7,244	$5,815	$4,503	$3,298	$2,194	$1,185	$263
$392	$341	$294	$250	$210	$173	$139	$108	$79	$52	$28	$6
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$138	$120	$103	$88	$74	$61	$49	$38	$28	$18	$10	$2
$3,000	$2,610	$2,248	$1,915	$1,607	$1,324	$1,063	$823	$603	$401	$216	$48
$828	$720	$620	$528	$443	$365	$293	$227	$166	$111	$60	$13
$11,039	$7,707	$4,658	$1,871								
$20,191	$14,097	$8,519	$3,423								
$0	$0	$0	$0								
$301	$210	$127	$51								
$0	$0	$0	$0								
$0	$0	$0	$0								
$0	$0	$0	$0								
$2,756	$1,924	$1,163	$467								
$55,066	$42,012	$30,039	$19,074	######	$9,166	$7,359	$5,698	$4,173	$2,777	$1,499	$333

TABLE D-5
MAINTENANCE COSTS FOR ALTERATIONS

		Units per year w/elev/lift	Unit annual cost	Units per year w/o elev/lif	Unit annual cost	40/33/24-year type cost	Actual cost	10 Year Annual Expenses									
								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
H	Ferry	5.58	$2,000	1.40	$500	$1,019,951	$2,371,500	$9,830	$18,759	$26,850	$34,160	$40,745	$46,654	$51,937	$56,638	$60,800	$64,461
H	Dinner/excursion	0.60	$1,500	0.20	$500	$86,017	$200,000	$829	$1,582	$2,264	$2,881	$3,436	$3,935	$4,380	$4,777	$5,128	$5,436
H	Gaming	3.15	$2,000	1.05	$500	$587,069	$1,365,000	$5,658	$10,798	$15,455	$19,662	$23,452	$26,854	$29,894	$32,600	$34,995	$37,103
H	Cruise	0.08	$1,500	0.03	$500	$10,752	$25,000	$104	$198	$283	$360	$430	$492	$548	$597	$641	$680
H	Whalewatcher/sightse	1.63	$1,500	0.54	$500	$233,860	$543,750	$2,254	$4,301	$6,156	$7,832	$9,342	$10,697	$11,908	$12,986	$13,940	$14,780
H	Other	0.84	$1,500	0.28	$500	$120,962	$281,250	$1,166	$2,225	$3,184	$4,051	$4,832	$5,533	$6,160	$6,717	$7,211	$7,645
						$2,058,611	**$4,786,500**										
K	Ferry	2.13	$1,875	8.53	$375	$551,345	$1,079,693	$5,967	$11,388	$16,299	$20,737	$24,734	$28,321	$31,528	$34,382	$36,908	$39,130
K	Dinner/excursion	14.04	$1,375	14.04	$375	$1,882,528	$3,686,534	$20,374	$38,882	$55,652	$70,804	$84,451	$96,700	$107,650	$117,393	$126,018	$133,607
K	Gaming	1.01	$375	1.01	$375	$58,057	$113,693	$628	$1,199	$1,716	$2,184	$2,604	$2,982	$3,320	$3,620	$3,886	$4,120
K	Cruise	0.07	$1,375	0.07	$375	$9,343	$18,295	$101	$193	$276	$351	$419	$480	$534	$583	$625	$663
K	Whalewatcher/sightse	1.32	$375	1.32	$375	$76,075	$148,977	$823	$1,571	$2,249	$2,861	$3,413	$3,908	$4,350	$4,744	$5,093	$5,399
K	Commuter /shuttle	0.00	$375	0.00	$375	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
K	Fishing/dive	3.07	$375	3.07	$375	$176,174	$345,000	$1,907	$3,639	$5,208	$6,626	$7,903	$9,050	$10,074	$10,986	$11,793	$12,503
K	Other	1.92	$1,375	1.92	$375	$256,921	$503,125	$2,781	$5,307	$7,595	$9,663	$11,526	$13,197	$14,692	$16,021	$17,199	$18,234
						$3,010,443	**$5,895,318**										
T	Ferry	3.28	$1,250	6.08	$250	$362,385	$702,000	$4,656	$8,885	$12,717	$16,179	$19,298	$22,097	$24,599	$26,825	$28,796	$30,530
T	Dinner/excursion	0.00	$250	9.90	$250	$159,705	$309,375	$2,052	$3,916	$5,604	$7,130	$8,505	$9,738	$10,841	$11,822	$12,691	$13,455
T	Gaming	0.00	$250	0.00	$250	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
T	Cruise	0.00	$250	1.62	$250	$26,134	$50,625	$336	$641	$917	$1,167	$1,392	$1,594	$1,774	$1,935	$2,077	$2,202
T	Whalewatcher/sightse	0.00	$250	51.84	$250	$836,272	$1,620,000	$10,744	$20,504	$29,347	$37,337	$44,533	$50,992	$56,766	$61,904	$66,453	$70,454
T	Commuter /shuttle	0.00	$250	26.46	$250	$426,847	$826,875	$5,484	$10,465	$14,979	$19,057	$22,731	$26,027	$28,974	$31,597	$33,919	$35,961
T	Sailing	0.00	$250	6.48	$250	$104,534	$202,500	$1,343	$2,563	$3,668	$4,667	$5,567	$6,374	$7,096	$7,738	$8,307	$8,807
T	Other	0.00	$250	20.34	$250	$328,121	$635,625	$4,215	$8,045	$11,514	$14,649	$17,473	$20,007	$22,273	$24,289	$26,073	$27,644
						$2,243,997	**$4,347,000**										
	TOTAL					**$7,313,051**	**$15,028,818**	$81,251	$155,059	$221,935	$282,361	$336,785	$385,632	$429,297	$468,154	$502,551	$532,815

TABLE D-6
REVENUE LOSSES FOR ALTERATIONS

		Population factor 10 ft^2/pa	Population factor 3.75 ft^2/pax	Area loss heads 10/15 ft^2 e	Area loss elevator 48 ft^2	Wheelchair capacity	Fare	Daily trips	Days per week	Weeks per year	Full capacity ratio	40/33/24-year cost per type	Annual unit revenue loss w/elev 10 ft^2/pax	Annual unit revenue loss w/o ele 10 ft^2/pax	Annual unit revenue loss w/elev 3.75 ft^2/pax	Annual unit revenue loss w/o elev 3.75 ft^2/pax	10-year schedule w/ elev/lift Z	10-year schedule w/o elev/lift	Vessel elev/lift factor AB	Actual cost
H	Ferry	1.00	0.00	20	48	8	$5	4	6	50	0.4	$7,833,225	$16,320	$4,800	$0	$0	5.58	1.40	1.00	$18,213,120
H	Dinner/excursion	1.00	0.00	20	48	8	$25	1	6	50	0.4	$578,037	$20,400	$6,000	$0	$0	0.60	0.20	0.50	$1,344,000
H	Gaming	1.00	0.00	20	48	8	$25	6	6	50	0.4	$3,251,457	$122,400	$36,000	$0	$0	3.15	1.05	0.00	$7,560,000
H	Cruise	1.00	0.00	20	48	8	$500	1	1	50	0.4	$32,257	$10,000	$0	$0	$0	0.08	0.03	0.50	$75,000
H	Whalewatch/sightsee	1.00	0.00	20	48	8	$10	2	6	50	0.4	$1,257,230	$16,320	$4,800	$0	$0	1.63	0.54	0.50	$2,923,200
H	Other	1.00	0.00	20	48	8	$10	1	6	50	0.4	$325,146	$8,160	$2,400	$0	$0	0.84	0.28	0.50	$756,000
												$13,277,351								**$30,871,320**
K	Ferry	0.50	0.50	10	48	6	$5	4	6	50	0.4	$4,441,565	$13,920	$2,400	$40,457	$24,000	2.13	8.53	1.00	$8,697,871
K	Dinner/excursion	0.50	0.50	10	48	6	$25	1	6	50	0.4	$27,154,500	$17,400	$3,000	$50,571	$30,000	14.04	14.04	0.50	$53,176,373
K	Gaming	1.00	0.00	10	48	6	$25	6	6	50	0.4	$1,393,377	$104,400	$18,000	$303,429	$180,000	1.01	1.01	0.00	$2,728,636
K	Cruise	1.00	0.00	10	48	6	$500	1	1	50	0.4	$26,893	$10,000	$0	$168,571	$100,000	0.07	0.07	0.50	$52,273
K	Whalewatch/sightsee	0.50	0.50	10	48	6	$10	2	6	50	0.4	$1,338,924	$13,920	$2,400	$40,457	$24,000	1.32	1.32	0.00	$2,622,000
K	Commuter /shuttle	0.00	1.00	0	0	4	$5	4	6	50	0.4	$0	$0	$0	$13,714	$13,714	0.00	0.00	0.00	$0
K	Fishing/dive	0.50	0.50	10	48	4	$25	1	6	50	0.4	$2,869,122	$17,400	$3,000	$42,000	$21,429	3.07	3.07	0.00	$5,618,571
K	Other	0.50	0.50	10	48	6	$10	1	6	50	0.4	$1,482,380	$8,960	$1,200	$20,229	$12,000	1.92	1.92	0.50	$2,902,929
												$38,706,561								**$75,798,654**
T	Ferry	0.75	0.25	7.5	48	4	$5	4	6	50	0.4	$2,985,273	$13,320	$1,800	$32,743	$16,286	3.28	6.08	0.50	$5,782,976
T	Dinner/excursion	0.75	0.25	15	0	4	$25	1	6	50	0.4	$5,920,483	$4,500	$4,500	$23,571	$23,571	0.00	9.90	0.00	$11,468,973
T	Gaming	1.00	0.00	15	0	4	$25	6	6	50	0.4	$0	$27,000	$27,000	$141,429	$141,429	0.00	0.00	0.00	$0
T	Cruise	1.00	0.00	15	0	3	$500	1	1	50	0.4	$0	$15,000	$0	$84,286	$84,286	0.00	1.62	0.00	$0
T	Whalewatch/sightsee	0.75	0.25	15	0	3	$10	2	6	50	0.4	$21,934,224	$3,600	$3,600	$15,429	$15,429	0.00	51.84	0.00	$42,490,286
T	Commuter /shuttle	0.00	1.00	0	0	2	$5	4	6	50	0.4	$11,707,810	$0	$0	$6,857	$6,857	0.00	26.46	0.00	$22,680,000
T	Sailing	1.00	0.00	15	0	3	$25	1	6	50	0.4	$1,881,612	$4,500	$4,500	$19,286	$19,286	0.00	6.48	0.00	$3,645,000
T	Other	0.75	0.25	15	0	3	$10	1	6	50	0.4	$4,303,068	$1,800	$1,800	$7,714	$7,714	0.00	20.34	0.00	$8,335,768
												$48,732,472								**$94,403,003**
TOTAL												**$100,716,384**								**$201,072,976**

TABLE D-7
NEWBUILDING ACTUAL COSTS

						CAPITAL COSTS		Total			Annual cost	Total actual cost
		Annual	Annual			Ann. cost yrs. 1-25	$8,344,710	$208,617,755		H	$690,181	$27,607,250
		fuel	maint.			Ann. cost yrs. 26-33	$2,629,629	$13,148,146		K	$1,939,448	$58,183,439
						Ann. cost yrs. 34-40	$690,181	$6,901,813		T	$5,715,081	$142,877,025
								$228,667,714			$8,344,710	$228,667,714
			ACTUAL COST CALCULATION, FUEL					ACTUAL COST CALCULATION, MAINTENANCE				
	Vessel service	Annual increment*		*Annual increment is the unit annual cost times times the newbuildings added each year.				Annual increment*				
	Ferry	$7,167	$5,733,450	annual cost X 40years X 40/2 = 800X				$3,953	$3,162,000			
	Dinner/excurs	$219	$175,000					$375	$300,000			
H	Gaming	$1,339	$1,071,000					$2,800	$2,240,000			
	Cruise	$123	$98,438					$75	$60,000			
	Whalewatcher	$1,784	$1,427,344					$1,088	$870,000			
	Other	$492	$393,750					$563	$450,000			
			$8,898,981						**$7,082,000**			
	Ferry	$16,143	$12,107,186	annual cost X ((30years X 30/2)+(10yearsX30)) = 750X				$3,408	$2,556,056			
	Dinner/excurs	$52,947	$39,709,983					$18,286	$13,714,594			
	Gaming	$4,226	$3,169,315					$1,316	$986,906			
K	Cruise	$777	$582,863					$91	$68,063			
	Whalewatcher	$4,032	$3,024,295					$1,411	$1,058,063			
	Commuter /sh	$0	$0					$0	$0			
	Fishing/dive	$13,885	$10,413,563					$3,267	$2,450,250			
	Other	$7,226	$5,419,477					$2,496	$1,871,719			
			$74,426,681						**$22,705,650**			
	Ferry	$20,428	$14,044,388	annual cost X ((25years X 25/2)+(15yearsX25)) = 687.5X				$3,744	$2,574,000			
	Dinner/excurs	$8,771	$6,029,912					$4,125	$2,835,938			
	Gaming	$0	$0					$0	$0			
	Cruise	$4,032	$2,772,193					$675	$464,063			
T	Whalewatcher	$90,396	$62,147,250					$21,600	$14,850,000			
	Commuter /sh	$2,977	$2,046,516					$4,410	$3,031,875			
	Sailing	$76	$52,207					$2,160	$1,485,000			
	Fishing/dive	$16,182	$11,125,125					$8,475	$5,826,563			
	Other	$17,734	$12,192,082						$0			
			$110,409,673						**$31,067,438**			
		TOTAL	**$193,735,335**						**$60,855,088**			

APPENDIX E

DETAILED COST SPREADSHEETS AND NOTES-- SHORE ACCESS

1. **Unit and industry rollout cost spreadsheets**
2. **Tidal ranges from Army Corps Port Series**
3. **Cost estimate for construction of Massachusetts Bay Transit Authority passenger vessel dock in East Boston, Massachusetts**

ACCESS COMPONENTS AND COSTS FOR SCENARIO 1

Costs for all access solution come from (linked) unitcost.xls

Physical Barrier	Access Solution	Access Cost	Per Unit	Total
1. Greater than 5' tidal range	1a. Double gangway entry ramp.	1a.	$30,000	$30,000
	1b. Two 30', accessible gangways.	1b.	$5,250	$10,500
2. 10' height difference from land to pass. platform.	2a. 120' fixed ramp system.	2a.	$31,000	$31,000
	2b. Fixed ramp supporting float	2b.	$70,000	$70,000
3. Max. 1' height difference between boat and pass. platform.	3. 12' accessible boarding gangway	3	$2,100	$2,100
		Total		$143,600

Physical Barrier	Non-Accessible Solution.	Cost	
1. Greater than 5' tidal range	1. 50' Gangway.	1	$5,300
2. 10' height difference from land to pass. platform.	2. None.	2	$0
3. Max. 1' height difference between boat and pass. platform.	3. Portable Stairs.	3	$0
		Total	$5,300

ACCESS PREMIUM	**$138,300**

ACCESS COMPONENTS AND COSTS FOR SCENARIO 2				
Costs for all access solution come from (linked) unitcost.xls				
		Access	Per	
Physical Barrier	Access Solution	Cost	Unit	Total
1. Less than 5' tidal range	1 60' accessible gangway.	1	$15,900	$15,900
2. 10' height difference from land to pass. platform.	2a. 120' fixed ramp system.	2a.	$31,000	$31,000
	2b. Fixed ramp supporting float	2b.	$70,000	$70,000
3. Max. 1' height difference between boat and	3. 12' accessible boarding gangway	3	$2,100	$2,100
pass. platform.		Total		$119,000
Physical Barrier	Non-Accessible Solution.	Cost		
1. Less than 5' tidal range	1. 50' Gangway.	1		$5,300
2. 10' height difference from land to pass. platform.	2. None.	2		$0
3. Max. 1' height difference between boat and	3. Portable Stairs.	3		$0
pass. platform.		Total		$5,300
		ACCESS PREMIUM		**$113,700**

ACCESS COMPONENTS AND COSTS FOR SCENARIO 3				
Costs for all access solution come from (linked) unitcost.xls				
		Access	Per	
Physical Barrier	Access Solution	Cost	Unit	Total
1. Greater than 5' tidal range	1a. Double gangway entry ramp.	1a.	$30,000	$30,000
	1b. Two 30' accessible gangways.	1b.	$5,250	$10,500
2. No height difference from land to pass. platform.	2. None			
3. Max. 1' height difference between boat and	3. 12' accessible boarding gangway	3	$2,100	$2,100
pass. platform.		Total		$42,600
Physical Barrier	Non-Accessible Solution.	Cost		
1. Greater than 5' tidal range	1. 50' Gangway.	1		$5,300
2. No height difference from land to pass. platform.	2. None.	2		$0
3. Max. 1' height difference between boat and	3. Portable Stairs.	3		$0
pass. platform.		Total		$5,300
		ACCESS PREMIUM		**$37,300**

ACCESS COMPONENTS AND COSTS FOR SCENARIO 4			
Costs for all access solution come from (linked) unitcost.xls			
	Access	Per	
Physical Barrier / Access Solution	Cost	Unit	Total
1. Less than 5' tidal range / 1 60' accessible gangway.	1	$15,900	$15,900
2. No height difference from land to pass. platform. / 2. None			
3. Max. 1' height difference between boat and pass. platform. / 3. 12' accessible boarding gangway	3	$2,100	$2,100
	Total		$18,000
Physical Barrier / Non-Accessible Solution.	Cost		
1. Less than 5' tidal range / 1. 50' Gangway.	1		$5,300
2. 10' height difference from land to pass. platform. / 2. None.	2		$0
3. Max. 1' height difference between boat and pass. platform. / 3. Portable Stairs.	3		$0
	Total		$5,300
	ACCESS PREMIUM		**$12,700**

ACCESS COMPONENTS AND COSTS FOR SCENARIO 5			
Costs for all access solution come from (linked) unitcost.xls			
Physical Barrier	Access Solution	Access Cost	
1. Greater than 5' tidal range	1. Single, 80', accessible gangway.	1a.	$21,200
2. 10' height difference from land to pass. platform.	2. None	2	$0
3. Max. 1' height difference between boat and	3. 12' accessible boarding gangway	3	$2,100
pass. platform.		Total	$23,300
Physical Barrier	Non-Accessible Solution.	Cost	
1. Greater than 5' tidal range	1. 50' Gangway.	1	$5,300
2. 10' height difference from land to pass. platform.	2. None.	2	$0
3. Max. 1' height difference between boat and	3. Portable Stairs.	3	$0
pass. platform.		Total	$5,300
		ACCESS PREMIUM	**$18,000**

ACCESSIBLE COMPONENT UNIT COSTS

Unit costs from this sheet are linked to Scenario.xls.

Standard Gangway Costs

1.Unit costs are at $35/SF up to 50'. $53/sf over 50'.
2.Each 10' run has 50sf (10' run x 5' width)

Gangway Length	Square Footage	Unit Cost	Total Cost
10	50	$35	$1,750
20	100	$35	$3,500
30	150	$35	$5,250
40	200	$35	$7,000
50	250	$35	$8,750
60	300	$53	$15,900
70	350	$53	$18,550
80	400	$53	$21,200

Standard fixed ramp costs.

1. Fixed ramp costs consist of 3 components:
   A. Gangway.
   B. Resting area AND supporting structure.
   C. Supporting float.

   A. Gangway unit costs are the same as the gangway unit costs.
   B. Resting area and supporting structure.
   are estimated at additional cost of $100/sf.
   - Each resting area is estimated at 25sf total area.
   C. Supporting float costs are estimated at $100/sf.
   - Each 1' run is estimated to require a 5sf supporting float area.
   D. Fixed ramp requirements are calculated in 30' segments
   -Each 30" (2.5') vertical drop requires a 30' ramp segment.

Maximum Vertical Drop	Fixed Ramp Length	Gangway Cost	Support structure cost	Subtotal	Float Cost	Total Cost
2.5	30	$5,250	$2,500	$7,750	$17,500	$25,250
5	60	$10,500	$5,000	$15,500	$35,000	$50,500
7.5	90	$15,750	$7,500	$23,250	$52,500	$75,750
10	120	$21,000	$10,000	$31,000	$70,000	$101,000
12.5	150	$26,250	$12,500	$38,750	$87,500	$126,250
15	180	$31,500	$15,000	$46,500	$105,000	$151,500
17.5	210	$36,750	$17,500	$54,250	$122,500	$176,750
20	240	$42,000	$20,000	$62,000	$140,000	$202,000

Standard boarding gangways

1. The standard boarding gangway for all facilities is 12'
2. The standard gangway will address up to a 12" height difference.
3. The standard boarding gangway will have the same costs as the standard gangway.

Gangway Length	Square Footage	Unit Cost	Total Cost
12	60	$35	$2,100

Double gangway entry ramp

1. Any facility using a double gangway will require an entry ramp.
2. The standard entry ramp will be 60' to allow for a 5' separation between the gangways.
3. Cost of the 60' ramp will be the same as the fixed ramp ***less*** the float costs.

Vertical Drop	Ramp Length	Gangway Costs	Superstructure cost	Total Cost
5	60	$10,500	$19,500	$30,000

Shore facility field results and data

PHYSICAL CHARACTERISTICS		Scheduled Service (+ +) H and/or K boats	Boats served	Scheduled Service (+ -) T boats	Boats served	Unscheduled Service (- +) H and/or K boats	Boats served	Unscheduled Service (- -) T boats	Boats served
Less Than 10/20 change &	(+ +)	1. World Trade Ctr., Boston	2	1. Yankee Fleet, Glouc.	7	1. Pier 10, NYC.	2	1. Battery Park Marina, NYC	8
available water sheet.		2. Cape Ann Tours, Glouc.	3	2. Capt. Tom's, Glouc.	1			2. Bar Harbor #2, ME	2
		3. Blount Marine, Warren	1.5	3. Essex River Tours, Essex.	1			3. Hood River,OR.	0.5
		4. E. 34th St., NYC	2	4. Pickering Wharf, Salem.	3				
		5. Hunter's Point, NYC	**0.5**	5. Seven Seas, Glouc.	2				
		6. South St.,Pier 16, NYC.	3	**6. Prudence Island, Bristol.**	**0.5**				
		7. Wall St., Pier 11, NYC.	3	7. Spirit of Newport, Newport.	1				
		8. Battery Park, NYC.	**0.5**	**8. Block Isle Ferry, Newport**	**1**				
		9. Battery Park City, NYC	**1**	9. LaGuardia Airport, NYC	0.5				
		10. Colgate Pier, NJ	**0.5**	10. CNY/Pier 4, Boston	2				
		11. Hoboken Pier, NJ	**1**	11. Logan Airport, Boston.	0.5				
		12. W. 38th St., NYC.	2	12. Bar Harbor #1, ME	1				
		13. Weehauken Pier, NJ	**0.5**	13. Bar Harbor #3, ME	3				
		14. World Yacht/Pier 81, NYC.	4	**14. Alameda, CA**	**1**				
		15. Circle Line/Pier 82, NYC.	**1**	15. San Fran/Hornblower, CA	2				
		16. CNY/Pier 1, Boston.	1	16. Cape May/Term. 1, NJ	1				
		17. Woods Hole, MA	**2**	17. Cape May/Term 2, NJ	1				
		18. San Fran./Pier 1&1/2, CA	**3**	18. S.Freeport/Muni.Dock, ME	0.5				
		19. San Fran/Alcatraz, CA	1.5	19. Bustins Isle, ME	0.5				
		20. Larkspur/GG Term., CA	**1.5**	20. Hingham, MA	0.5				
		21. SF/GG Term, CA	**1.5**						
		22. Elgin/Grand Victoria, IL	1						
		23. Joliet/Harrah's Casino, IL	2						
		24. Joliet/Empress Casino, IL	1						
		25. Martha's Vineyard, MA	**1**						
		26. Nantucket, MA	**1**						
		27. World Trade Fish Pier, Bos.	3						
		28. San Francisco R/W Fleet	3						
		Non-ferry terminals	**15**	**Non-ferry terminals**	**17**	**Non-ferry terminals**	**1**	**Non-ferry terminals**	**3**
		58% of H/K total		**63% of T total**		**4% of H/K total**		**11% of T total**	
		Total vessels (non-ferry)	**33**	**Total vessels (non-ferry)**	**27.5**	**Total vessels (non-ferry)**	**2**	**Total vessels (non-ferry)**	**10.5**
		Ratio non-ferry facilities/vess	**0.45**	**Ratio non-ferry facilities/vess**	**0.62**	**Ratio non-ferry facilities/v**	**0.50**	**Ratio non-ferry facilities/ve**	**0.29**
		CATEGORY 1		**CATEGORY 3**		**CATEGORY 5**		**CATEGORY 7**	
Less Than 10/20 change &	(+ -)	1. Rowes Wharf, Boston.	8	1. Central Wharf, Boston.	2			1. San Fran. Pac. Mar. Yacht	4
constricted water sheet.		2. Long Wharf, Boston.	4	2. Lighthouse Marina, Glouc.	1				
		3. Captain Bill's, Glouc.	3	3. Long Wharf, Newport.	1				
				4. City Water Taxi, Newport.	2				
				5. Cape May/Term 3, NJ	6				
		Non-ferry terminals	**3**	6. Cape May/Term 4, NJ	4			**Non-ferry terminals**	**1**
		11% of H/K total		**Non-ferry terminals**	**6**			**4% of T total**	
		Total vessels	**15**	**22% of T total**				**Total vessels**	**4**
		Ratio non-ferry facilities/vess	**0.20**	**Total vessels**	**16**			**Ratio non-ferry facilities/ve**	**0.25**
				Ratio non-ferry facilities/vess	**0.38**				
		CATEGORY 2		**CATEGORY 4**		**CATEGORY 6**		**CATEGORY 8**	
More Than 10/20 change &	(- +)	1.Northeast Harbor, ME	1						
available water sheet.		2. Cincinnati #1	1						
		3. Cincinnati #2	2						
		4. Cincinnati #3	1						
		5. Cincinnati #4	1	**Total H&K terminals = 39**			**Total non-ferry vessels**		**122**
		6. Cincinnati #5	6	**Non-ferry H&K = 26**			**Total non-ferry facilities**		**53**
		7. Cincinnati #5	2	**Total T terminals = 30**			**Ratio**		**0.43**
		Non-ferry terminals	**7**	**Non-ferry T = 27**					
		27% of H/K total							
		Total vessels	**14**						
		Ratio non-ferry facilities/vess	**0.50**						

Industry Implementation Cost Calculation 1 (non-ferry only)

Assumptions/Parameters

1. Use facility/vessel ratio = 0.33.
2. Low cost distribution of Access Solutions 1/2/3/4 (10%/10%/40%/40%)

																		H/K Total	$11,115,030	17.19%
																		T Total	$53,529,769	82.81%
	Number		Access Solution 1			Access Solution 2			Access Solution 3			Access Solution 4			Access Solution 5			
Access	of			Per Unit			Per Unit			Per Unit			Per Unit			Per Unit		Total
Category	Terminals		Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Actual costs
++++ (4)	209		21	$138,300	$2,890,769	21	$113,700	$2,376,575	84	$37,300	$3,118,602	84	$12,700	$1,061,830				$9,447,776
+-++ (3)	27		3	$138,300	$374,099	3	$113,700	$307,557	11	$37,300	$403,584	11	$12,700	$137,413				$1,222,653
+++- (3)	989		99	$138,300	$13,677,669	99	$113,700	$11,244,765	396	$37,300	$14,755,664	396	$12,700	$5,024,046				$44,702,144
+-+- (2)	345											173	$12,700	$2,193,036	173	$18,000	$3,108,240	$5,301,276
++-+ (3)	10		1	$138,300	$136,036	1	$113,700	$111,839	4	$37,300	$146,758	4	$12,700	$49,968				$444,601
+--+ (2)	0																	$0
++-- (2)	168											84	$12,700	$1,069,774	84	$18,000	$1,516,215	$2,585,988
-+-- (1)	61											31	$12,700	$389,009	31	$18,000	$551,351	$940,359
TOTAL	1610		123		$17,078,574	123		$14,040,736	494		$18,424,607	762		$9,925,076	288		$5,175,806	$64,644,799

Industry Implementation Cost Calculation 2 (non-ferry only)

Assumptions/Parameters

1. Use facility/vessel ratio = 0.33.
2. Medium cost distribution of Access Solutions 1/2/3/4 (25%/25%/25%/25%)

																		H/K Total	$18,566,035	18.59%
																		T Total	$81,302,993	81.41%
	Number		Access Solution 1			Access Solution 2			Access Solution 3			Access Solution 4			Access Solution 5			
Access	of			Per Unit			Per Unit			Per Unit			Per Unit			Per Unit		Total
Category	Terminals		Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Actual costs
++++ (4)	209		52	$138,300	$7,226,921	52	$113,700	$5,941,439	52	$37,300	$1,949,126	52	$12,700	$663,644				$15,781,130
+-++ (3)	27		7	$138,300	$935,249	7	$113,700	$768,892	7	$37,300	$252,240	7	$12,700	$85,883				$2,042,264
+++- (3)	989		247	$138,300	$34,194,174	247	$113,700	$28,111,913	247	$37,300	$9,222,290	247	$12,700	$3,140,029				$74,668,405
+-+- (2)	345											173			173	$18,000	$3,108,240	$3,108,240
++-+ (3)	10		2	$138,300	$340,090	2	$113,700	$279,597	2	$37,300	$91,724	2	$12,700	$31,230				$742,641
+--+ (2)	0																	$0
++-- (2)	168											84	$12,700	$1,069,774	84	$18,000	$1,516,215	$2,585,988
-+-- (1)	61											31	$12,700	$389,009	31	$18,000	$551,351	$940,359
TOTAL	1810		309		$42,696,434			$35,101,841	309		$11,515,380	596		$5,379,568	288		$5,175,806	$99,869,028

Industry Implementation Cost Calculation 3 (non-ferry only)

Assumptions/Parameters

1. Use facility/vessel ratio = 0.33.
2. High cost distribution of Access Solutions 1/2/3/4 (40%/40%/10%/10%)

																		H/K Total	$26,017,040	18.65%
																		T Total	$113,462,290	81.35%
	Number		Access Solution 1			Access Solution 2			Access Solution 3			Access Solution 4			Access Solution 5			
Access	of			Per Unit			Per Unit			Per Unit			Per Unit			Per Unit		Total
Category	Terminals		Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Actual costs
++++ (4)	209		84	$138,300	$11,563,074	84	$113,700	$9,506,302	21	$37,300	$779,651	21	$12,700	$265,457				$22,114,484
+-++ (3)	27		11	$138,300	$1,496,398	11	$113,700	$1,230,227	3	$37,300	$100,896	3	$12,700	$34,353				$2,861,874
+++- (3)	989		396	$138,300	$54,710,678	396	$113,700	$44,979,060	99	$37,300	$3,688,916	99	$12,700	$1,256,012				$104,634,666
+-+- (2)	345											173	$12,700	$2,193,036	173	$18,000	$3,108,240	$5,301,276
++-+ (3)	10		4	$138,300	$544,145	4	$113,700	$447,355	1	$37,300	$36,689	1	$12,700	$12,492				$1,040,682
+--+ (2)	0																	$0
++-- (2)	168											84	$12,700	$1,069,774	84	$18,000	$1,516,215	$2,585,988
-+-- (1)	61											31	$12,700	$389,009	31	$18,000	$551,351	$940,359
TOTAL	1810		494		$68,314,294	494		$56,162,945	123		$4,606,152	296		$3,761,351	173		$5,175,806	$139,479,330

Industry Implementation Cost Calculation 4

Assumptions/Parameters
1. Use facility/vessel ratio = 0.55.
2. Low cost distribution of Access Solutions 1/2/3/4 (10%/10%/40%/40%)
3. Actual numbers of ferry terminals from UHI data base.

																Ferry H/K Total	$10,124,800	67.78%
																Ferry T Total	$4,813,800	32.22%
																Non-ferry H/K Total	$18,525,051	17.19%
																Non-ferry T Total	$89,216,281	82.81%
	Number	Access Solution 1			Access Solution 2			Access Solution 3			Access Solution 4			Access Solution 5			
Access	of		Per Unit			Per Unit			Per Unit			Per Unit			Per Unit		Total
Category	Terminals	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Actual costs
Ferry ++++ (4)	224	22	$138,300	$3,097,920	22	$113,700	$2,546,880	90	$37,300	$3,342,060	90	$12,700	$1,137,920				$10,124,800
Ferry +++- (3)	142	11	$138,300	$1,472,895	11	$113,700	$1,210,905	43	$37,300	$1,588,980	43	$12,700	$541,020				$4,813,800
FERRY TOTAL	366	33		$4,570,815	33		$3,757,785	132		$4,931,060	132		$1,678,940				$14,938,600
++++ (4)	348	35	$138,300	$4,817,948	35	$113,700	$3,960,959	139	$37,300	$5,197,670	139	$12,700	$1,769,716				$15,746,293
+-++ (3)	45	5	$138,300	$623,499	5	$113,700	$512,595	18	$37,300	$672,640	18	$12,700	$229,022				$2,037,756
+++- (3)	1648	165	$138,300	$22,796,116	165	$113,700	$18,741,275	659	$37,300	$24,592,773	659	$12,700	$8,373,411				$74,503,574
+-+- (2)	576										288	$12,700	$3,655,060	288	$18,000	$5,180,400	$8,835,460
++-+ (3)	16	2	$138,300	$226,727	2	$113,700	$186,398	7	$37,300	$244,596	7	$12,700	$83,281				$741,002
+--+ (2)	0													0	$18,000	$0	$0
++-- (2)	281										140	$12,700	$1,782,956	140	$18,000	$2,527,025	$4,309,981
-+-- (1)	102										51	$12,700	$648,348	51	$18,000	$918,918	$1,567,266
NON-FERRY	3017	206		$28,464,289	206		$23,401,227	823		$30,707,679	1111		$14,110,490	479		$8,626,343	$107,741,331
TOTAL																	

Industry Implementation Cost Calculation 5

Assumptions/Parameters
1. Use facility/vessel ratio = 0.55.
2. Medium cost distribution of Access Solutions 1/2/3/4 (25%/25%/25%/25%)
3. Actual numbers of ferry terminals from UHI data base.

																Ferry H/K Total	$16,912,000	67.78%
																Ferry T Total	$8,040,750	32.22%
																Non-ferry H/K Total	$30,943,392	18.48%
																Non-ferry T Total	$136,519,627	81.52%
	Number	Access Solution 1			Access Solution 2			Access Solution 3			Access Solution 4			Access Solution 5			
Access	of		Per Unit			Per Unit			Per Unit			Per Unit			Per Unit		Total
Category	Terminals	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Actual costs
Ferry ++++ (4)	224	56	$138,300	$7,744,800	56	$113,700	$6,367,200	56	$37,300	$2,088,800	56	$12,700	$711,200				$16,912,000
Ferry +++- (3)	142	27	$138,300	$3,682,238	27	$113,700	$3,027,263	27	$37,300	$993,113	27	$12,700	$338,138				$8,040,750
FERRY TOTAL	366	83		$11,427,038	83		$9,394,463	83		$3,081,913	83		$1,049,338				$24,952,750
++++ (4)	348	87	$138,300	$12,044,869	87	$113,700	$9,902,398	87	$37,300	$3,248,544	87	$12,700	$1,106,073				$26,301,883
+-++ (3)	45	11	$138,300	$1,558,748	11	$113,700	$1,281,487	11	$37,300	$420,400	11	$12,700	$143,139				$3,403,773
+++- (3)	1648	412	$138,300	$56,990,289	412	$113,700	$46,853,188	412	$37,300	$15,370,483	412	$12,700	$5,233,382				$124,447,342
+-+- (2)	576										288			288	$18,000	$5,180,400	$5,180,400
++-+ (3)	16	4	$138,300	$566,817	4	$113,700	$465,995	4	$37,300	$152,873	4	$12,700	$52,050				$1,237,736
+--+ (2)	0																$0
++-- (2)	281										140			281	$18,000	$5,054,049	$5,054,049
-+-- (1)	102										51			102	$18,000	$1,837,836	$1,837,836
NON-FERRY	3017	515		$71,160,723			$58,503,068			$19,192,299			$6,534,643	671		$12,072,285	$167,463,019
TOTAL																	

Industry Implementation Cost Calculation 6

Assumptions/Parameters
1. Use facility/vessel ratio = 0.55.
2. High cost distribution of Access Solutions 1/2/3/4 (40%/40%/10%/10%)
3. Actual numbers of ferry terminals from UHI data base.

																Ferry H/K Total	$23,699,200	67.78%
																Ferry T Total	$11,267,700	32.22%
																Non-ferry H/K Total	$43,361,733	18.95%
																Non-ferry T Total	$185,448,756	81.05%
	Number	Access Solution 1			Access Solution 2			Access Solution 3			Access Solution 4			Access Solution 5			
Access	of		Per Unit			Per Unit			Per Unit			Per Unit			Per Unit		Total
Category	Terminals	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Number	Premium	Total	Actual costs
Ferry ++++ (4)	224	90	$138,300	$12,391,680	90	$113,700	$10,187,520	22	$37,300	$835,520	22	$12,700	$284,480				$23,699,200
Ferry +++- (3)	142	43	$138,300	$5,891,580	43	$113,700	$4,843,620	11	$37,300	$397,245	11	$12,700	$135,255				$11,267,700
FERRY TOTAL	366	132		$18,283,260	132		$15,031,140	33		$1,232,765	33		$419,735				$34,966,900
++++ (4)	348	139	$138,300	$19,271,790	139	$113,700	$15,843,836	35	$37,300	$1,299,418	35	$12,700	$442,429				$36,857,473
+-++ (3)	45	18	$138,300	$2,493,996	18	$113,700	$2,050,379	5	$37,300	$168,160	5	$12,700	$57,256				$4,769,791
+++- (3)	1648	659	$138,300	$91,184,463	659	$113,700	$74,965,101	165	$37,300	$6,148,193	165	$12,700	$2,093,353				$174,391,109
+-+- (2)	576										288	$12,700		288	$18,000	$5,180,400	$5,180,400
++-+ (3)	16	7	$138,300	$906,908	7	$113,700	$745,592	2	$37,300	$61,149	2	$12,700	$20,820				$1,734,469
+--+ (2)	0																$0
++-- (2)	281										140	$12,700	$1,782,956	140	$18,000	$2,527,025	$4,309,981
-+-- (1)	102										51	$12,700	$648,348	51	$18,000	$918,918	$1,567,266
NON-FERRY	3017			$113,857,157			$93,604,908			$7,676,920	494		$5,045,161			$8,626,343	$228,810,489
TOTAL																	

						Dock and pier capital outlays									
						Industry costs with amortization									
	Total actual cost	Annual actual cost	PV 5	PV 10	PV 20	PV 30	PV 40	PV 50	PV Total	1	2	3	4	5	6
Ferry low	$14,938,600	$373,465	$199,527	$315,664	$197,521	$123,595	$77,337	$4,839	$7,331,905	$48,137	$91,864	$131,485	$167,284	$199,527	$228,466
Ferry medium	$24,952,750	$623,819	$333,281	$527,271	$329,929	$206,447	$129,180	$8,083	$12,246,876	$80,405	$153,446	$219,626	$279,423	$333,281	$381,619
Ferry high	$34,966,900	$874,173	$467,035	$738,878	$462,338	$289,299	$181,023	$11,327	$17,161,848	$112,674	$215,027	$307,768	$391,562	$467,035	$534,772
Non-ferry 1	$64,644,799	$1,616,120	$863,427	$1,365,995	$854,745	$534,840	$334,665	$20,941	$31,727,839	$208,305	$397,530	$568,983	$723,897	$863,427	$988,657
Non-ferry 2	$99,869,028	$2,496,726	$1,333,899	$2,110,311	$1,320,485	$826,268	$517,021	$32,352	$49,015,985	$321,809	$614,139	$879,016	$1,118,341	$1,333,899	$1,527,365
Non-ferry 3	$139,479,330	$3,486,983	$1,862,953	$2,947,307	$1,844,219	$1,153,984	$722,083	$45,183	$68,456,827	$449,445	$857,720	$1,227,653	$1,561,900	$1,862,953	$2,133,152
Non-ferry 4	$107,741,331	$2,693,533	$1,439,045	$2,276,659	$1,424,574	$891,399	$557,775	$34,902	$52,879,732	$347,176	$662,549	$948,305	$1,206,495	$1,439,045	$1,647,761
Non-ferry 5	$167,463,019	$4,186,575	$2,236,716	$3,538,624	$2,214,224	$1,385,507	$866,954	$54,248	$82,191,296	$539,617	$1,029,804	$1,473,957	$1,875,263	$2,236,716	$2,561,125
Non-ferry 6	$228,810,489	$5,720,262	$3,056,102	$4,834,944	$3,025,371	$1,893,066	$1,184,549	$74,121	$112,300,798	$737,298	$1,407,057	$2,013,918	$2,562,236	$3,056,102	$3,499,354
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Ferry low	$254,336	$277,356	$297,735	$315,664	$301,206	$287,411	$274,247	$261,686	$249,700	$238,264	$227,351	$216,938	$207,002	$197,521	$188,474
Ferry medium	$424,831	$463,283	$497,322	$527,271	$503,121	$480,078	$458,089	$437,108	$417,088	$397,985	$379,756	$362,363	$345,766	$329,929	$314,818
Ferry high	$595,326	$649,210	$696,910	$738,878	$705,036	$672,744	$641,932	$612,530	$584,475	$557,706	$532,162	$507,788	$484,531	$462,338	$441,162
Non-ferry 1	$1,100,604	$1,200,222	$1,288,407	$1,365,995	$1,303,430	$1,243,731	$1,186,767	$1,132,411	$1,080,545	$1,031,054	$983,830	$938,769	$895,772	$854,745	$815,596
Non-ferry 2	$1,700,311	$1,854,210	$1,990,445	$2,110,311	$2,013,655	$1,921,427	$1,833,422	$1,749,449	$1,669,321	$1,592,864	$1,519,908	$1,450,294	$1,383,869	$1,320,485	$1,260,005
Non-ferry 3	$2,374,692	$2,589,631	$2,779,900	$2,947,307	$2,812,316	$2,683,508	$2,560,599	$2,443,320	$2,331,412	$2,224,630	$2,122,738	$2,025,514	$1,932,742	$1,844,219	$1,759,751
Non-ferry 4	$1,834,340	$2,000,371	$2,147,344	$2,276,659	$2,172,384	$2,072,886	$1,977,944	$1,887,351	$1,800,908	$1,718,423	$1,639,717	$1,564,616	$1,492,954	$1,424,574	$1,359,326
Non-ferry 5	$2,851,126	$3,109,188	$3,337,631	$3,538,624	$3,376,550	$3,221,899	$3,074,331	$2,933,522	$2,799,162	$2,670,956	$2,548,622	$2,431,892	$2,320,507	$2,214,224	$2,112,810
Non-ferry 6	$3,895,591	$4,248,191	$4,560,320	$4,834,944	$4,613,497	$4,402,191	$4,200,564	$4,008,172	$3,824,592	$3,649,419	$3,482,271	$3,322,777	$3,170,589	$3,025,371	$2,886,805
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Ferry low	$179,842	$171,605	$163,745	$156,245	$149,089	$142,260	$135,745	$129,527	$123,595	$117,934	$112,532	$107,378	$102,460	$97,767	$93,289
Ferry medium	$300,399	$286,640	$273,512	$260,985	$249,031	$237,625	$226,741	$216,356	$206,447	$196,991	$187,969	$179,360	$171,145	$163,306	$155,826
Ferry high	$420,957	$401,676	$383,279	$365,724	$348,973	$332,990	$317,738	$303,185	$289,299	$276,049	$263,405	$251,341	$239,829	$228,845	$218,363
Non-ferry 1	$778,240	$742,596	$708,584	$676,130	$645,162	$615,612	$587,416	$560,512	$534,840	$510,343	$486,969	$464,665	$443,382	$423,075	$403,697
Non-ferry 2	$1,202,295	$1,147,228	$1,094,683	$1,044,545	$996,703	$951,053	$907,493	$865,928	$826,268	$788,423	$752,312	$717,855	$684,976	$653,603	$623,667
Non-ferry 3	$1,679,152	$1,602,244	$1,528,859	$1,458,835	$1,392,018	$1,328,262	$1,267,425	$1,209,375	$1,153,984	$1,101,130	$1,050,696	$1,002,573	$956,653	$912,837	$871,028
Non-ferry 4	$1,297,067	$1,237,660	$1,180,973	$1,126,883	$1,075,270	$1,026,021	$979,027	$934,186	$891,399	$850,572	$811,614	$774,441	$738,971	$705,125	$672,829
Non-ferry 5	$2,016,040	$1,923,702	$1,835,594	$1,751,521	$1,671,298	$1,594,750	$1,521,708	$1,452,012	$1,385,507	$1,322,049	$1,261,497	$1,203,719	$1,148,586	$1,095,979	$1,045,782
Non-ferry 6	$2,754,584	$2,628,420	$2,508,035	$2,393,163	$2,283,552	$2,178,962	$2,079,162	$1,983,934	$1,893,066	$1,806,361	$1,723,627	$1,644,682	$1,569,353	$1,497,474	$1,428,888
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
Ferry low	$89,017	$84,939	$81,049	$77,337	$73,795	$63,373	$53,752	$44,879	$36,706	$29,187	$22,280	$15,945	$10,143	$4,839	
Ferry medium	$148,689	$141,879	$135,381	$129,180	$123,263	$105,856	$89,785	$74,963	$61,311	$48,753	$37,216	$26,633	$16,942	$8,083	
Ferry high	$208,362	$198,818	$189,712	$181,023	$172,732	$148,339	$125,817	$105,048	$85,917	$68,318	$52,151	$37,322	$23,742	$11,327	
Non-ferry 1	$385,207	$367,564	$350,729	$334,665	$319,337	$274,240	$232,604	$194,206	$158,838	$126,303	$96,414	$68,999	$43,892	$20,941	
Non-ferry 2	$595,102	$567,846	$541,838	$517,021	$493,340	$423,670	$359,347	$300,027	$245,388	$195,124	$148,949	$106,596	$67,809	$32,352	
Non-ferry 3	$831,133	$793,066	$756,743	$722,083	$689,010	$591,707	$501,872	$419,025	$342,714	$272,514	$208,026	$148,874	$94,703	$45,183	
Non-ferry 4	$642,012	$612,607	$584,549	$557,775	$532,229	$457,066	$387,673	$323,677	$264,731	$210,505	$160,691	$114,998	$73,154	$34,902	
Non-ferry 5	$997,883	$952,179	$908,568	$866,954	$827,246	$710,421	$602,563	$503,094	$411,473	$327,189	$249,762	$178,742	$113,704	$54,248	
Non-ferry 6	$1,363,443	$1,300,995	$1,241,407	$1,184,549	$1,130,295	$970,673	$823,302	$687,394	$562,209	$447,049	$341,259	$244,222	$155,357	$74,121	

Mean Tidal Ranges for U.S. Army Corp Port Series

			Tidal Ranges		
Series #	**Name**	**Location**	**Avg.**	**Low**	**High**
1	**Searsport**	**All Sites**	**11.1**	**10**	**13.1**
	ME	Belfast, ME	10.0		
		Fort Point, ME	10.3		
		Bangor, ME	13.1		
3	**Boston**	**All Sites**	**9.4**	**9**	**9.6**
	MA	Boston Light, MA	9.0		
		Comm. Pier, MA	9.5		
		Mystic River, MA	9.6		
		Wellington Bridge, MA	9.6		
		Cradock Bridge, MA	9.3		
		Winthrop, MA	9.4		
		Malden/Neponset, MA	9.6		
		Weymouth, MA	9.2		
		Sheep Island, MA	9.5		
		Fore River Bridge, MA	9.5		
		HIngham,MA	9.5		
		Island End River	9.6		
4	**Southern**	**All Sites**	**5.8**	**2.6**	**6.8**
	New Eng.	Bridgeport, CT	6.8		
		New Haven, CT	6.2		
		New London, CT	2.6		
		Norwich, CT	3.1		
		Providence, RI	4.6		
		Fall River, MA	4.4		
		Taunton, MA	2.8		
		New Bedford, MA	3.7		
5	**NY&NJ**	**All Sites**	**5.8**	**2.4**	**7.4**
		Newark, NJ	5.4	5.2	5.5
		Perth Amboy, NJ	5.1		
		Keyport Harbor, NJ	4.9		
		Mattawan, NJ	4.9		
		Shoal Harbor, NJ	4.7		
		Sandy Hook, NJ	4.7		
		East Rockaway, NY	4.3		
		Jamaica Bay, NY	4.9		
		Sheepshead Bay, NY	4.7		
		Buttermilk Channel, NE	4.4		
		Belmont Island, NY	4.2		
		East River/Battery, NY	4.4		
		Throgs Neck, NY	7.1		
		Harlem River, NY	4.4	3.9	4.9

			Tidal Ranges		
Series #	**Name**	**Location**	**Avg.**	**Low**	**High**
		Bronx River, NY	6.9		
		WestChester Creek, NY	7.0		
		EastChester Creek, NY	7.3		
		Flushing Bay, NY	6.8		
		Manhasset Bay. NY	7.4		
		Hempstead, NY	7.1		
		Glen Cove, NY	7.4		
		New Rochelle, NY	7.3		
		Echo Bay Harbor, NY	7.3		
		Port Chester, NY	7.1		
		Huntington, NY	7.4		
		Northport, NY	7.2		
		Port Jefferson, NY	6.6		
		Mattatuck, NY	4.9		
		Greenport, NY	2.4		
6	**Albany and**	**All Sites**	**3.9**	**2.8**	**4.7**
	Hudson Rivers,	Battery, NY	4.5		
	NY	Yonkers,NY	3.7		
		Newburgh, NY	2.8		
		Poughkeepsie, NY	3.1		
		Kingston, NY	3.7		
		Albany, NY	4.6		
		Troy, NY	4.7		
8	**Phila,PA; Camden, NJ;**	**All Sites**	**5.3**	**3.5**	**6.9**
	Wilmington,DE,	Phila., PA	6		
	& Delaware River	Chester, PA	5.7		
		New Castle, DE	5.5		
		Liston Point, DE	5.8		
		Lewes, DE	4.1		
		Trenton, NJ	6.9		
		Wilmington, DE	5.6		
		Newport, DE	3.9		
		Paulsboro, NJ	5		
		Mount Royal, NJ	4.6		
		Mantica, NJ	3.5		
		Schuylkill River, PA	5.9		
		Camden, NJ	6		
10	**Baltimore, MD**	**Baltimore, MD**	**1.1**		
11	**Norfolk, Portsmouth &**	**All Sites**	**2.7**	**2.5**	**3**
	Chesapeake, VA.	Cape Henry	2.8		
		Old Point Comfort	2.5		
		Norfolk Harbor	2.8	2.5	3
		Atlantic Intercoastal WW	3		

			Tidal Ranges		
Series #	**Name**	**Location**	**Avg.**	**Low**	**High**
		Newport News	2.7	2.4	2.9
		Port of Hampton	2.5	2.2	2.8
12	**Wilmington, DE**	**All Sites**	**3.6**	**2.9**	**4.3**
		Wilmington, NC	4.3	4.1	4.5
		Morehead City, NC	2.9		
13	**Charleston, SC**	**All Sites**	**4.5**	**4**	**5**
		Charleston,SC	5		
		Georgetown, SC	4.0	3.3	4.6
14	**Savanah, Brunswick**	**All Sites**	**7.3**	**7.1**	**7.4**
	GA	Savanah,GA	7.4	6.9	7.9
		Brunswick, GA	7.1	6.6	7.6
15	**Jacksonville, FL**	**All Sites**	**5.4**	**4.9**	**5.9**
		Jacksonville, FL	4.9		
		Fernandino Beach, FL	5.9	5.8	6
16	**Miami, FL**	**All Sites**	**2.7**	**2.3**	**3.4**
		Miami, FL	2.3	2	2.5
		Port Everglades, FL	2.5	2.3	2.6
		Palm Beach, FL	2.7	2.6	2.8
		Port Canaveral. FL	3.4		
17	**Tampa, FL**	**Tampa,FL**	**1.6**	**1.3**	**1.8**
18	**Mobile, AL**	**Mobile Bay, AL**	**1.4**	**1.2**	**1.5**
19	**Panama City, FL**	**All Sites**	**1.7**	**1.4**	**2.3**
		Panama City, FL	2.3	1.5	3
		Port St. Joe, FL	1.4		
		Apalachicola River, FL	1.7		
		Pensacola,FL	1.4	1.1	1.6
		Pascagoula, MS	1.7	1.6	1.7
		Gulfport, MS	1.7		
20A	**Mississippi River Ports**	**New Orleans, LA**	**0.8**		
21	**Ports of Baton Rouge**	**All Sites**	**1.2**	**0.5**	**1.2**
	LA	Baton Rouge, LA	1.2	0.9	1.4
		Calcasieu River, LA	2		
		Lake Charles, LA	0.5		
22	**Ports of Port Arthur**	**All Sites**	**0.5**	**0**	**1.5**
	TX	Port Arthur,TX	1.5		

			Tidal Ranges		
Series #	Name	Location	Avg.	Low	High
		Beaumont, TX	0		
		Orange,TX	0		
23	Galveston,TX	**All Sites**	**1.4**	**1.3**	**1.5**
		Galveston, TX	1.5	1.4	1.6
		Texas City,TX	1.3		
24	Houston, TX	**Buffalo Bayou,TX**	**0.8**	**0.5**	**1**
25	Corpus Christi,TX	**All Sites**	**0.7**	**0**	**1.4**
		Aransas Pass, TX	1.4		
		Corpus Christi,TX	0		
26	Freeport, TX	**All Sites**	**1.2**	**0.5**	**1.8**
		Freeport, TX	1.8		
		Mattagorda Bay, TX	1.4		
		Port O'Connor, TX	0.5		
		Port Lavaca, TX	0.7		
		Branzos Harbor Isle, TX	1.8	1.5	2
27	San Diego, CA	**San Diego, CA**	**5.7**		
28	Los Angeles, CA	**All Sites**	**3.7**	**3.7**	**3.8**
		Los Angeles, CA	3.8		
		Long Beach, CA	3.7		
		Port Hueneve, CA	3.7		
30	San Francisco, CA	**All Sites**	**6.6**	**5.9**	**7.4**
		San Francisco, CA	6.5	5.7	7.2
		Redwood City, CA	7.4	6.9	7.9
		Humboldt Bay, CA	5.9	4.8	7
31	Oakland, CA	**All Sites**	**6.0**	**5.8**	**6.2**
		Oakland/Alameda, CA	6.2	6	6.3
		Richmond, CA	5.8		
		Carquinez Strait, CA	5.9	5.8	6
32	Sacramento, CA	**All Sites**	**4.2**	**4**	**4.5**
		Sacramento, CA	4.5		
		Stockton, CA	4.0	3.2	4.7
33	Coos Bay, OR	**All Sites**	**7.7**	**7.3**	**8.2**
		Coos Bay, OR	7.3	7	7.5
		Portland, OR	8.2		
34	Portland, OR	**Portland. OR**	**8.0**		

			Tidal Ranges		
Series #	**Name**	**Location**	**Avg.**	**Low**	**High**
35	**Tacoma, WA**	**All Sites**	**8.7**	**7.4**	**10.5**
		Tacoma, WA	8.1		
		Olympia, WA	10.5		
		Group Harbor, WA	7.4	6.8	7.9
37	**Port Angeles, WA**	**All Sites**	**5.5**	**4.2**	**7.4**
		Port Angeles, WA	4.2		
		Port Townsend, WA	5.2		
		Port Everett, WA	7.4		
		Anacortes, WA	4.8		
		Bellingham, WA	5.9		
38	**Alaska**	**All Sites**	**12.3**	**1.2**	**25.1**
		Anchorage, AK	25.1		
		E.Foreland, AK	18		
		Kenai River, AK	17.8		
		Homer, AK	15.6		
		Seward, AK	8.3		
		Whittier, AK	11.3		
		Port Valdex, AK	9.4		
		Kodiak Harbor, AK	6.6		
		Dutch Harbor, AK	2.2		
		Nome, AK	1.2		
		Dillingham, AK	16.0	15.4	16.6
		Metlakatla, AK	12.1		
		Ketchikan,AK	13		
		Wrangel, AK	13.7		
		Petersburg, AK	13.8		
		Sitka, AK	7.7		
		Juneau, AK	13.8		
		Haines, AK	14.2		
		Skagway, AK	14.3		
39	**SW & Western, AK**	**All Sites**	**6.7**	**0**	**16.6**
		Cordova, AK	10.1		
		Seldovia, AK	15.5		
		Ninilchik, AK	16.6		
		Port Lions, AK	7.6		
		Old Harbor, AK	6.5		
		King Cove, AK	4.8		
		Bethel, AK	2.3		
		St. George, AK	2		
		St. Paul, AK	2		
		St. Michael, AK	0		
41	**Buffalo, NY**	**Lake Erie**	**4.0**		

			Tidal Ranges		
Series #	Name	Location	Avg.	Low	High
42	**Lake Erie**	**All Sites**	**4.0**	**4**	**4.1**
		Erie, PA	4		
		Conneaut, OH	4		
		Astabula, OH	4		
		Fairport Harbor, OH	4		
		Lorain, OH	4.1		
		Port Huron, OH	4		
		Sandusky, OH	4		
43	**Cleveland, OH**	**Cleveland, OH**	**4.0**		
44	**Toledo, OH**	**Toledo, OH**	**4.0**		
45	**Port of Detroit**	**No Data Available**			
46	**Chicago, IL**	**Calumet Harbor, IL**	**6.4**		
47	**Milwaukee, WI**	**Milwaukee, WI**	**5.7**		
48	**Ports on Lake Mich.**	**All Sites**	**3.0**	**0.3**	**6.3**
		Green Bay, WI	2.4		
		Ludington, MI	3		
		Muskegon, MI	3		
		Grand Haven, MI	3		
		Ferrysburg, MI	3		
		Indiana Harbor, IN	0.3	0.1	0.5
		Burns Waterway, IN	6.3		
49	**Duluth, MN**	**No Data Available**			
50	**Ports of Hawaii**	**All Sites**	**1.7**	**1.2**	**2.3**
		Honolulu, HI	1.9		
		Port Allen, HI	1.7		
		Nawiliwili, HI	1.2		
		Kahuliu, HI	2.3		
		Kaunakakai, HI	2.1		
		Kawaihae, HI	1.3		
		Hilo, HI	1.7		
60	**Pittsburgh, PA**	**No Data Available**			
61	**Huntington, WV**	**No Data Available**			
62	**Cincinnatti, OH**	**No Data Available**			
63	**Louisville, KY**	**No Data Available**			

			Tidal Ranges		
Series #	Name	Location	Avg.	Low	High
64	Tennessee River	No Data Available			
65	Illinois Waterway	No Data Available			
68	Missouri Waterway	No Data Available			
69	Minneapolis, MN	No Data Available			
70	St. Louis, MO	No Data Available			
71	Memphis, TN	All Sites	36.5	34	38
		Cairo, IL	34		
		Memphis, TN	37		
		Helena, AR	37		
		Hickman Harbor, KY	38		
72	Natchez, MI	No Data Available			

					Dock and pier capital outlays											
					Society costs											
	Raw Total	Raw annual	PV 1	PV 5	PV 10	PV 20	PV 30	PV 40	PV Total	1	2	3	4	5	6	7
Ferry low	$14,938,600	$373,465	$324,464	$268,981	$212,772	$133,138	$83,308	$52,129	$1,981,927	$324,464	$309,603	$295,422	$281,892	$268,981	$256,661	$244,905
Ferry medium	$24,952,750	$623,819	$541,969	$449,293	$355,405	$222,387	$139,155	$87,073	$3,310,520	$541,969	$517,146	$493,460	$470,859	$449,293	$428,714	$409,079
Ferry high	$34,966,900	$874,173	$759,475	$629,605	$498,037	$311,637	$195,001	$122,018	$4,639,113	$759,475	$724,690	$691,498	$659,826	$629,605	$600,768	$573,252
Non-ferry 1	$64,644,799	$1,616,120	$1,404,073	$1,163,978	$920,743	$576,136	$360,506	$225,580	$8,576,526	$1,404,073	$1,339,765	$1,278,401	$1,219,849	$1,163,978	$1,110,666	$1,059,795
Non-ferry 2	$99,869,028	$2,496,726	$2,169,137	$1,798,216	$1,422,445	$890,067	$556,942	$348,495	$13,249,779	$2,169,137	$2,069,787	$1,974,988	$1,884,530	$1,798,216	$1,715,855	$1,637,266
Non-ferry 3	$139,479,330	$3,486,983	$3,029,466	$2,511,429	$1,986,618	$1,243,087	$777,837	$486,716	$18,504,940	$3,029,466	$2,890,711	$2,758,312	$2,631,977	$2,511,429	$2,396,402	$2,286,643
Non-ferry 4	$107,741,331	$2,693,533	$2,340,122	$1,939,963	$1,534,571	$960,227	$600,843	$375,966	$14,294,210	$2,340,122	$2,232,941	$2,130,669	$2,033,081	$1,939,963	$1,851,109	$1,766,326
Non-ferry 5	$167,463,019	$4,186,575	$3,637,266	$3,015,296	$2,385,193	$1,492,488	$933,895	$584,366	$22,217,580	$3,637,266	$3,470,674	$3,311,712	$3,160,030	$3,015,296	$2,877,191	$2,745,411
Non-ferry 6	$228,810,489	$5,720,262	$4,969,722	$4,119,903	$3,258,971	$2,039,237	$1,276,012	$798,440	$30,356,644	$4,969,722	$4,742,101	$4,524,906	$4,317,658	$4,119,903	$3,931,205	$3,751,150
8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
$233,688	$222,985	$212,772	$203,027	$193,728	$184,855	$176,388	$168,309	$160,600	$153,245	$146,226	$139,529	$133,138	$127,040	$121,221	$115,669	$110,371
$390,342	$372,464	$355,405	$339,127	$323,594	$308,773	$294,631	$281,136	$268,260	$255,973	$244,249	$233,062	$222,387	$212,202	$202,483	$193,209	$184,359
$546,996	$521,943	$498,037	$475,226	$453,460	$432,691	$412,873	$393,963	$375,919	$358,701	$342,272	$326,596	$311,637	$297,363	$283,744	$270,748	$258,347
$1,011,255	$964,938	$920,743	$878,571	$838,331	$799,934	$763,296	$728,336	$694,977	$663,146	$632,773	$603,791	$576,136	$549,749	$524,569	$500,543	$477,618
$1,562,277	$1,490,722	$1,422,445	$1,357,295	$1,295,129	$1,235,810	$1,179,208	$1,125,198	$1,073,662	$1,024,487	$977,564	$932,790	$890,067	$849,300	$810,401	$773,284	$737,866
$2,181,911	$2,081,976	$1,986,618	$1,895,628	$1,808,806	$1,725,960	$1,646,908	$1,571,477	$1,499,501	$1,430,822	$1,365,288	$1,302,756	$1,243,087	$1,186,152	$1,131,824	$1,079,985	$1,030,520
$1,685,425	$1,608,230	$1,534,571	$1,464,285	$1,397,219	$1,333,224	$1,272,160	$1,213,893	$1,158,295	$1,105,244	$1,054,622	$1,006,318	$960,227	$916,248	$874,282	$834,239	$796,029
$2,619,667	$2,499,682	$2,385,193	$2,275,948	$2,171,706	$2,072,238	$1,977,327	$1,886,762	$1,800,345	$1,717,887	$1,639,205	$1,564,127	$1,492,488	$1,424,129	$1,358,902	$1,296,662	$1,237,273
$3,579,341	$3,415,402	$3,258,971	$3,109,706	$2,967,276	$2,831,370	$2,701,689	$2,577,948	$2,459,874	$2,347,208	$2,239,702	$2,137,120	$2,039,237	$1,945,837	$1,856,715	$1,771,674	$1,690,529
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
$105,316	$100,493	$95,890	$91,498	$87,307	$83,308	$79,493	$75,852	$72,378	$69,063	$65,900	$62,881	$60,001	$57,253	$54,631	$52,129	
$175,915	$167,858	$160,170	$152,834	$145,834	$139,155	$132,781	$126,699	$120,896	$115,359	$110,076	$105,034	$100,223	$95,633	$91,253	$87,073	
$246,515	$235,224	$224,450	$214,170	$204,361	$195,001	$186,069	$177,547	$169,415	$161,656	$154,252	$147,187	$140,445	$134,013	$127,875	$122,018	
$455,742	$434,868	$414,951	$395,945	$377,810	$360,506	$343,994	$328,239	$313,205	$298,860	$285,172	$272,110	$259,647	$247,755	$236,407	$225,580	
$704,071	$671,823	$641,053	$611,691	$583,675	$556,942	$531,433	$507,093	$483,867	$461,705	$440,558	$420,380	$401,126	$382,754	$365,223	$348,495	
$983,321	$938,283	$895,308	$854,302	$815,174	$777,837	$742,211	$708,217	$675,779	$644,828	$615,294	$587,112	$560,222	$534,563	$510,079	$486,716	
$759,570	$724,780	$691,584	$659,909	$629,684	$600,843	$573,324	$547,065	$522,008	$498,100	$475,286	$453,517	$432,745	$412,925	$394,012	$375,966	
$1,180,604	$1,126,531	$1,074,934	$1,025,700	$978,722	$933,895	$891,121	$850,306	$811,361	$774,199	$738,740	$704,904	$672,619	$641,812	$612,416	$584,366	
$1,813,100	$1,539,218	$1,468,719	$1,401,450	$1,337,261	$1,276,012	$1,217,569	$1,161,803	$1,108,590	$1,057,815	$1,009,366	$963,135	$919,022	$876,929	$836,765	$798,440	

					Dock and pier capital outlays										
					Industry costs with amortization										
	Raw Total	Raw annual	PV 5	PV 10	PV 20	PV 30	PV 40	PV 50	PV Total	1	2	3	4	5	6
Ferry low	$14,938,600	$373,465	$199,527	$315,664	$197,521	$123,595	$77,337	$4,839	$866,762	$48,137	$91,864	$131,485	$167,284	$199,527	$228,486
Ferry medium	$24,952,750	$623,819	$333,281	$527,271	$329,929	$206,447	$129,180	$8,083	$1,447,800	$80,405	$153,446	$219,626	$279,423	$333,281	$381,619
Ferry high	$34,966,900	$874,173	$467,035	$738,878	$462,338	$289,299	$181,023	$11,327	$2,028,838	$112,674	$215,027	$307,768	$391,562	$467,035	$534,772
Non-ferry 1	$64,644,799	$1,616,120	$863,427	$1,365,995	$854,745	$534,840	$334,665	$20,941	$3,750,799	$208,305	$397,530	$568,983	$723,897	$863,427	$988,657
Non-ferry 2	$99,869,028	$2,496,726	$1,333,899	$2,110,311	$1,320,485	$826,268	$517,021	$32,352	$5,794,567	$321,809	$614,139	$879,018	$1,118,341	$1,333,899	$1,527,365
Non-ferry 3	$139,479,330	$3,486,983	$1,862,953	$2,947,307	$1,844,219	$1,153,984	$722,083	$45,183	$8,092,823	$449,445	$857,720	$1,227,853	$1,561,900	$1,862,953	$2,133,152
Non-ferry 4	$107,741,331	$2,693,533	$1,439,045	$2,276,659	$1,424,574	$891,399	$557,775	$34,902	$6,251,331	$347,176	$662,549	$948,305	$1,206,495	$1,439,045	$1,647,761
Non-ferry 5	$167,463,019	$4,186,575	$2,236,716	$3,538,624	$2,214,224	$1,385,507	$866,954	$54,248	$9,716,483	$539,617	$1,029,804	$1,473,957	$1,875,263	$2,236,716	$2,561,125
Non-ferry 6	$228,810,489	$5,720,262	$3,056,102	$4,834,944	$3,025,371	$1,893,066	$1,184,549	$74,121	$13,275,965	$737,298	$1,407,057	$2,013,918	$2,562,236	$3,056,102	$3,499,354
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Ferry low	$254,336	$277,356	$297,735	$315,664	$301,206	$287,411	$274,247	$261,686	$249,700	$238,264	$227,351	$216,938	$207,002	$197,521	$188,474
Ferry medium	$424,831	$463,283	$497,322	$527,271	$503,121	$480,078	$458,089	$437,108	$417,088	$397,985	$379,756	$362,363	$345,766	$329,929	$314,818
Ferry high	$595,326	$649,210	$696,910	$738,878	$705,036	$672,744	$641,932	$612,530	$584,475	$557,706	$532,162	$507,788	$484,531	$462,338	$441,162
Non-ferry 1	$1,100,804	$1,200,222	$1,288,407	$1,365,995	$1,303,430	$1,243,731	$1,186,767	$1,132,411	$1,080,545	$1,031,054	$983,830	$938,769	$895,772	$854,745	$815,596
Non-ferry 2	$1,700,311	$1,854,210	$1,990,445	$2,110,311	$2,013,655	$1,921,427	$1,833,422	$1,749,449	$1,669,321	$1,592,864	$1,519,908	$1,450,294	$1,383,869	$1,320,485	$1,260,005
Non-ferry 3	$2,374,892	$2,589,631	$2,779,900	$2,947,307	$2,812,316	$2,683,508	$2,560,599	$2,443,320	$2,331,412	$2,224,630	$2,122,738	$2,025,514	$1,932,742	$1,844,219	$1,759,751
Non-ferry 4	$1,834,340	$2,000,371	$2,147,344	$2,276,659	$2,172,384	$2,072,886	$1,977,944	$1,887,351	$1,800,908	$1,718,423	$1,639,717	$1,564,616	$1,492,954	$1,424,574	$1,359,326
Non-ferry 5	$2,851,126	$3,109,188	$3,337,831	$3,538,624	$3,376,550	$3,221,899	$3,074,331	$2,933,522	$2,799,162	$2,670,956	$2,548,622	$2,431,892	$2,320,507	$2,214,224	$2,112,810
Non-ferry 6	$3,895,591	$4,248,191	$4,560,320	$4,834,944	$4,613,497	$4,402,191	$4,200,564	$4,008,172	$3,824,592	$3,649,419	$3,482,271	$3,322,777	$3,170,589	$3,025,371	$2,886,805
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Ferry low	$179,842	$171,605	$163,745	$156,245	$149,089	$142,260	$135,745	$129,527	$123,595	$117,934	$112,532	$107,378	$102,460	$97,767	$93,289
Ferry medium	$300,399	$286,640	$273,512	$260,985	$249,031	$237,625	$226,741	$216,356	$206,447	$196,991	$187,969	$179,360	$171,145	$163,306	$155,826
Ferry high	$420,957	$401,676	$383,279	$365,724	$348,973	$332,990	$317,738	$303,185	$289,299	$276,049	$263,405	$251,341	$239,829	$228,845	$218,363
Non-ferry 1	$778,240	$742,596	$708,584	$676,130	$645,162	$615,612	$587,416	$560,512	$534,840	$510,343	$486,969	$464,665	$443,382	$423,075	$403,697
Non-ferry 2	$1,202,295	$1,147,228	$1,094,683	$1,044,545	$998,703	$951,053	$907,493	$865,928	$826,268	$788,423	$752,312	$717,855	$684,976	$653,603	$623,667
Non-ferry 3	$1,679,152	$1,602,244	$1,528,859	$1,458,835	$1,392,018	$1,328,262	$1,267,425	$1,209,375	$1,153,984	$1,101,130	$1,050,696	$1,002,573	$956,653	$912,837	$871,028
Non-ferry 4	$1,297,067	$1,237,660	$1,180,973	$1,126,883	$1,075,270	$1,026,021	$979,027	$934,186	$891,399	$850,572	$811,614	$774,441	$738,971	$705,125	$672,829
Non-ferry 5	$2,016,040	$1,923,702	$1,835,594	$1,751,521	$1,671,298	$1,594,750	$1,521,708	$1,452,012	$1,385,507	$1,322,049	$1,261,497	$1,203,719	$1,148,586	$1,095,979	$1,045,782
Non-ferry 6	$2,754,584	$2,628,420	$2,508,035	$2,393,163	$2,283,552	$2,178,962	$2,079,162	$1,983,934	$1,893,066	$1,806,361	$1,723,627	$1,644,682	$1,569,353	$1,497,474	$1,428,888
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
Ferry low	$89,017	$84,939	$81,049	$77,337	$73,795	$63,373	$53,752	$44,879	$36,706	$29,187	$22,280	$15,945	$10,143	$4,839	
Ferry medium	$148,689	$141,879	$135,381	$129,180	$123,263	$105,856	$89,785	$74,963	$61,311	$48,753	$37,216	$26,633	$16,942	$8,083	
Ferry high	$208,362	$198,818	$189,712	$181,023	$172,732	$148,339	$125,817	$105,048	$85,917	$68,318	$52,151	$37,322	$23,742	$11,327	
Non-ferry 1	$385,207	$367,564	$350,729	$334,665	$319,337	$274,240	$232,604	$194,206	$158,838	$126,303	$96,414	$68,999	$43,892	$20,941	
Non-ferry 2	$595,102	$567,846	$541,838	$517,021	$493,340	$423,670	$359,347	$300,027	$245,388	$195,124	$148,949	$106,596	$67,809	$32,352	
Non-ferry 3	$831,133	$793,066	$756,743	$722,083	$689,010	$591,707	$501,872	$419,025	$342,714	$272,514	$208,026	$148,874	$94,703	$45,183	
Non-ferry 4	$642,012	$612,607	$584,549	$557,775	$532,229	$457,066	$387,673	$323,677	$264,731	$210,505	$160,691	$114,998	$73,154	$34,902	
Non-ferry 5	$997,883	$952,179	$908,568	$866,954	$827,246	$710,421	$602,563	$503,094	$411,473	$327,189	$249,782	$178,742	$113,704	$54,248	
Non-ferry 6	$1,363,443	$1,300,995	$1,241,407	$1,184,549	$1,130,295	$970,673	$823,302	$687,394	$562,209	$447,049	$341,259	$244,222	$155,357	$74,121	

Unit Cost and Cost Factors for Landside Facilities

GANGWAYS

Standard gangway will be:

30ft long
36" inside clearance.
Double handrails.
Non-slip surface
36" diamond plate (1 end).
Low profile wheels (?)
Tactile surface at each end.
Cost = $35/ft^2

Based on this gangway profile, unit cost options include:

1. Increase length in 10ft increments to 80ft (cost = $50/ft2 @ lengths greater than 50').
2. Increase inside clearance in 12" increments to maximum feasible (unit area cost increases 10% for widths greater than 6').

FIXED RAMPS

The fixed ramp unit cost is for a 10 foot elevation. The optional increase is for elevations in 2.5 foot increments to 25 feet.

2..

Standard fixed ramp components will include:

Maximum runs of 30ft.
36" inside clearance
double handrails
Non-slip surface
Tactile surface at each end.
Cost = $35/ft^2

5ft square resting areas and separate stairs.
Floats to support structure.
Cost = $100/ft^2

BOARDING GANGWAYS AND RAMPS

Standard boarding gangwayor ramp willinclude the following:

3ft long
36" inside clearance.
Double handrails.
Non-slip surface
36" diamond plate (1 end).
Low profile wheels (?)
Tactile surface at each end.

Unit cost options will include:

1. 3ft increments to 12ft.

Cost = $35/ft^2

CHILDS ENGINEERING CORPORATION
Box 333
MEDFIELD, MASSACHUSETTS 02052

(508) 359-8945
FAX (508) 359-2751

LETTER OF TRANSMITTAL

DATE	JOB NO.
7 September 1995	

ATTENTION: Joe Feiner

RE:

TO: Volpe National Transportation
System Center
55 Broadway, DTS 927
Cambridge, MA 02142-1093

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1			East Boston Ferry Terminal Information

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19 _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS _____

COPY TO _____

SIGNED: David Porter

If enclosures are not as noted, kindly notify us at once.

COMPARISON OF BIDS
CONTRACT R7CN10
EAST BOSTON FERRY TERMINAL,
EAST BOSTON

BIDDER E
CHILDS ENGINEERING CORPORATION

BIDDER A
R.D.A. CONSTRUCTION CORP.

DATE 05/17/95

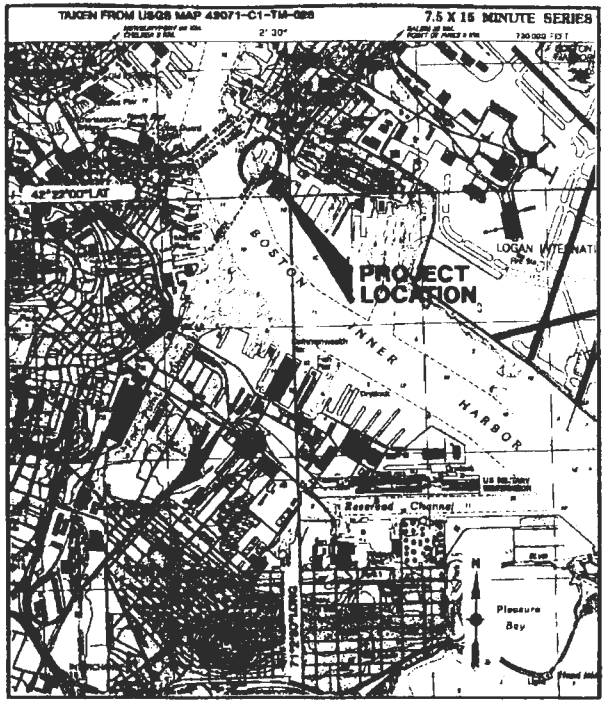
LINE ITEM	DESCRIPTION	UNIT	QUANTITY	BIDDER E UNIT PRICE	BIDDER E TOTAL PRICE	BIDDER A UNIT PRICE	BIDDER A TOTAL PRICE	VARIANCE IN UNIT PRICE	VARIANCE IN TOTAL PRICE
0.100 B	DEMOLITION	LS	1	50,000.00	50,000.00	100,000.00	100,000.00	50,000-	50,000-
0.200 B	FIXED TIMBER PIER	LS	1	105,000.00	105,000.00	110,800.00	110,800.00	5,800-	5,800-
0.300 B	ALUMINUM GANGWAY (48')	EA	2	10,000.00	20,000.00	5,791.00	11,582.00	4,209	8,418
0.400 B	RAMP SYSTEM - FLOATING DOCK	LS	1	60,000.00	60,000.00	44,800.00	44,800.00	15,200	15,200
0.500 B	FABRICATED STEEL SECTIONAL FLOATING DOCK (5X10X40)	EA	5	29,000.00	145,000.00	27,000.00	135,000.00	2,000	10,000
0.600 B	FABRICATED STEEL SECTIONAL FLOATING DOCK (5X10X20)	EA	2	20,000.00	40,000.00	12,500.00	25,000.00	7,500	15,000
0.700 B	STEEL PIPE PILES	EA	8	6,000.00	48,000.00	10,000.00	80,000.00	4,000-	32,000-
0.800 B	MARINE LIGHTING SYSTEM	LS	1	35,000.00	35,000.00	18,508.00	18,508.00	16,492	16,492
	TOTAL CONTRACT PRICE				503,000.00		525,690.00		

SCHEDULE OF BID PRICES

The Subdivision of Total Estimated Contract Bid Price is as Follows

ITEM NO.	QUANTITY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE Dollars	UNIT PRICE Cents	AMOUNT Dollars
5000.100	1	DEMOLITION AT _____ LUMP SUM			
5000.200	1	FIXED TIMBER PIER AT _____ LUMP SUM			
5000.300	2	ALUMINUM GANGWAY (48') AT _____ EACH			
5000.400	1	RAMP SYSTEM - FLOATING DOCK AT _____ LUMP SUM			
5000.500	5	FABRICATED STEEL SECTIONAL FLOATING DOCK (5X10X40) AT _____ EACH			
		CARRIED FORWARD			

ITEM NO.	QUANTITY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE Dollars	UNIT PRICE Cents	AMOUNT Dollars
		BROUGHT FORWARD			
5000.600	2	FABRICATED STEEL SECTIONAL FLOATING DOCK (5X10X20) AT _____ EACH			
5000.700	8	STEEL PIPE PILES AT _____ EACH			
5000.800	1	MARINE LIGHTING SYSTEM AT _____ LUMP SUM			
		TOTAL ESTIMATED CONTRACT BID PRICE			



LOCATION PLAN

MASSACHUSETTS
BAY
TRANSPORTATION
AUTHORITY

EAST BOSTON FERRY TERMINAL CONSTRUCTION PROJECT

CONTRACT NO. R7CN10

CHILDS ENGINEERING CORPORATION
MEDFIELD, MA

VOLUME 1 OF 1

Plan No.'s 112861-112870

David L. Porter, P.E.
Project Manager

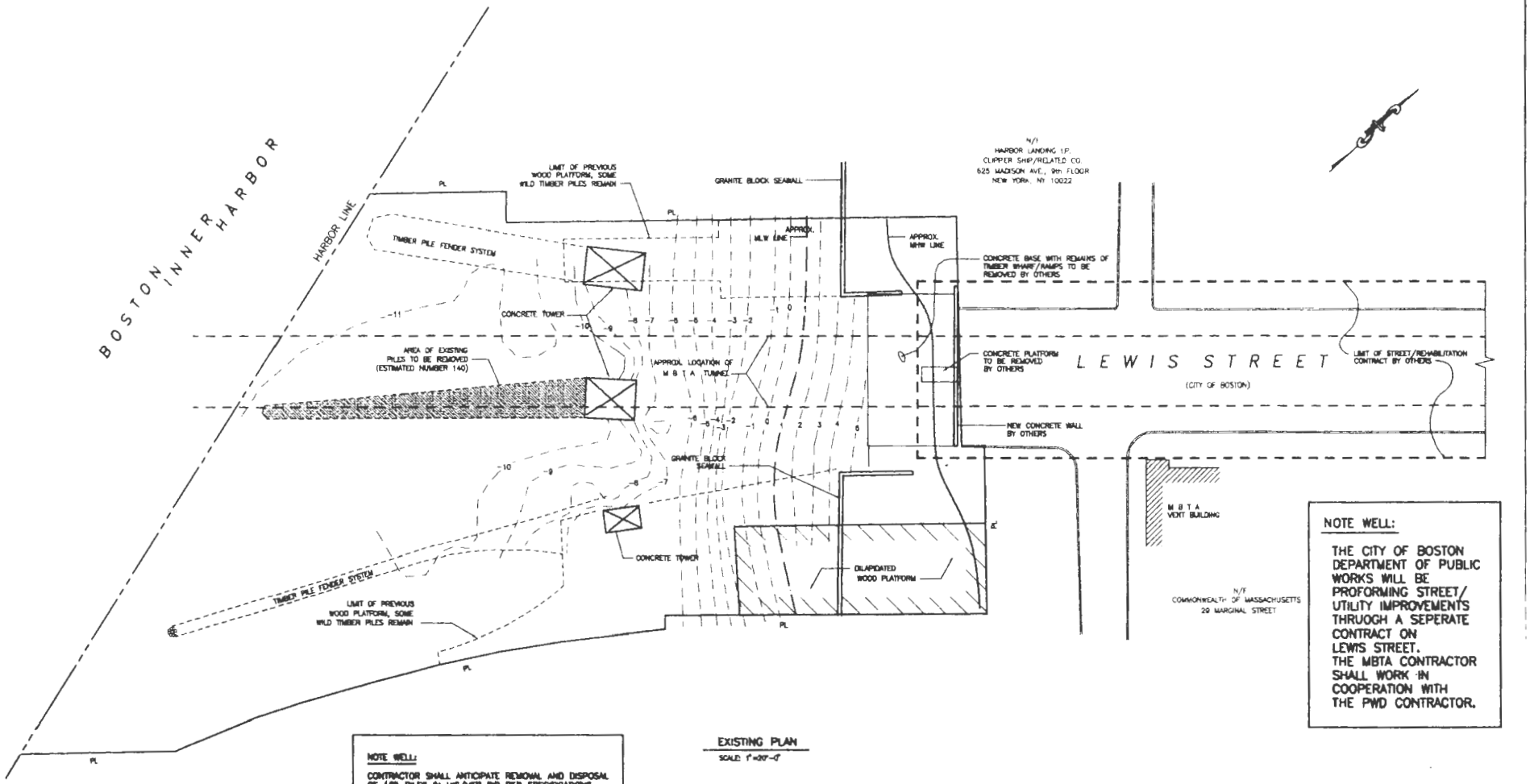
John F. Bannon, P.E.
Project Engineer

APPROVALS:

Howard Haywood
Assistant General Manager
for Design and Construction

Date:

SHEET 1 OF 10 PLAN NO. 112861



NOTE WELL:

THE CITY OF BOSTON DEPARTMENT OF PUBLIC WORKS WILL BE PROFORMING STREET/ UTILITY IMPROVEMENTS THRUOGH A SEPERATE CONTRACT ON LEWIS STREET. THE MBTA CONTRACTOR SHALL WORK IN COOPERATION WITH THE PWD CONTRACTOR.

NOTE WELL:

CONTRACTOR SHALL ANTICIPATE REMOVAL AND DISPOSAL OF 165 PILES IN HIS/HER BID PER SPECIFICATIONS.

EXISTING PLAN

SCALE: 1"=20'-0"

DATUM: BOSTON CITY BASE

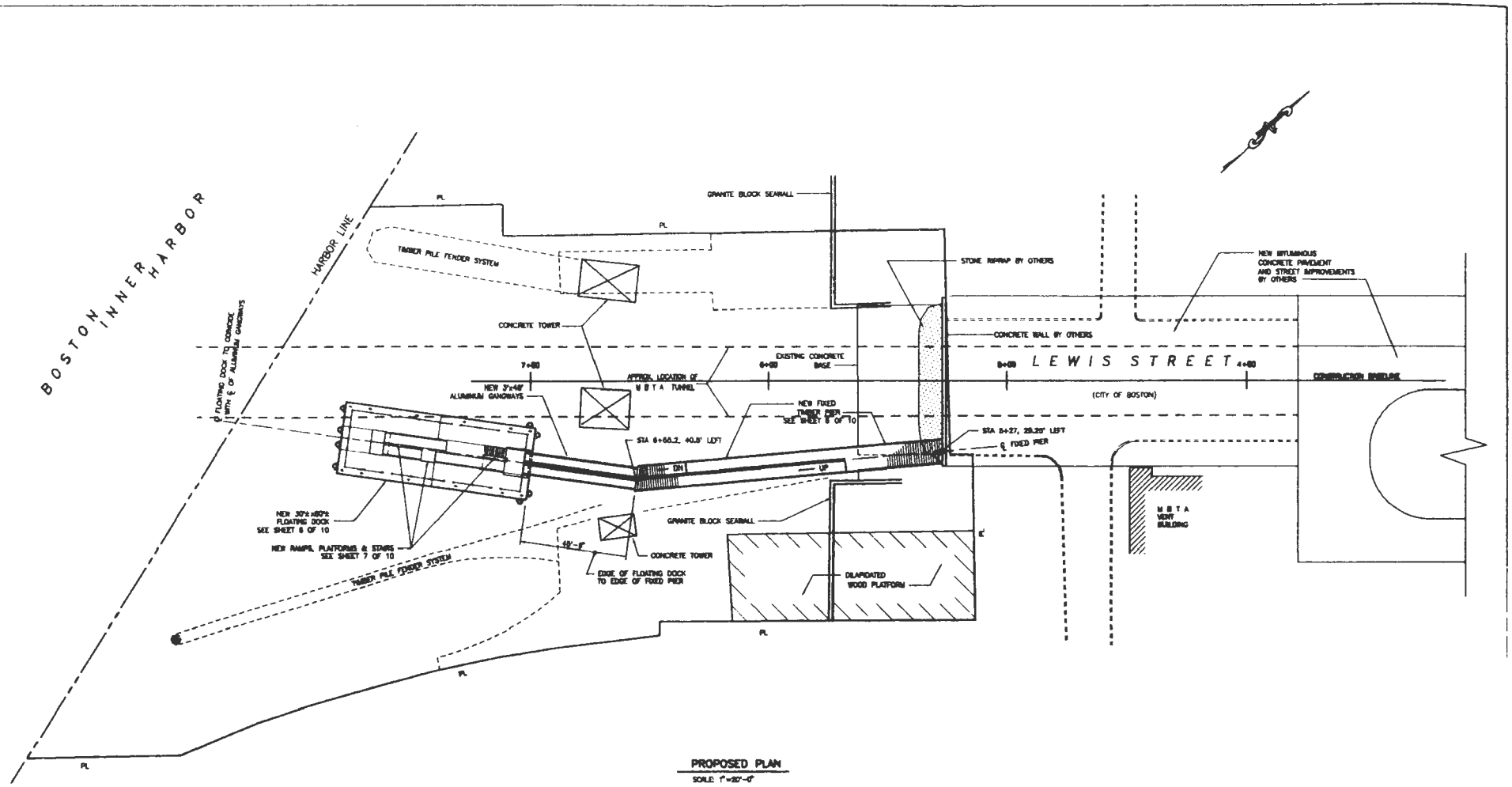
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EAST BOSTON FERRY TERMINAL
EAST BOSTON, MASSACHUSETTS
CONTRACT NO. 87CN10

EXISTING CONDITIONS

ISSUE	DATE	DESCRIPTION	BY	CHKD	APP.

SCALE: 1"=20'-0" | DRAWN BY: TED | CHECKED BY: JFB | APPROVED BY: DLP | PLAN NO. 113882 | SHEET 2 OF 10 | ISSUE 1

DATE: APRIL, 1995



PROPOSED PLAN
SCALE: 1"=20'-0"

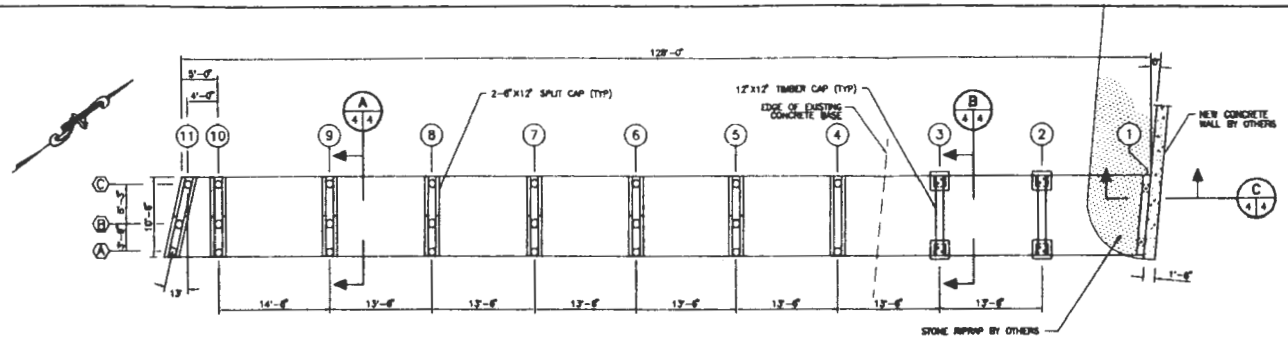
DATUM: BOSTON CITY BASE

ISSUE	DATE	DESCRIPTION	BY	CHKD	APP'D

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EAST BOSTON FERRY TERMINAL
EAST BOSTON, MASSACHUSETTS
CONTRACT NO. 87CH10

PROPOSED CONDITIONS

SCALE: 1"=20'-0"	BY	BY	BY	PLAN NO. 112883
DATE: APRIL, 1988	TED	JFB	DLP	SHEET 3 OF 10

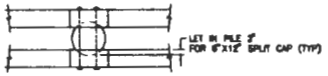


PILE /PILE CAP PLAN

SCALE: 1/8"=1'-0"

NOTE WELL:

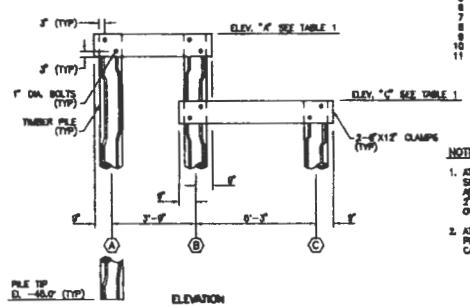
CONTRACTOR SHALL COORDINATE HIS WORK WITH DPW CONTRACTOR PROFORMING REHABILITATION OF LEWIS STREET. CONTRACTOR MAY REQUEST AN EXTENSION OF TIME TO COMPLETE FIXED PIER CONSTRUCTION BETWEEN BENT ① AND BENT ② IF CONCRETE WALL AND RIPRAP WORK BY OTHERS IS NOT COMPLETE PRIOR TO CONTRACT COMPLETION DATE.
NO CLAIM FOR EXTRA COST WILL BE ALLOWED.
THE CONTRACTOR SHALL ACCOUNT FOR THIS SITUATION IN SUBMITTING HIS/HER BID.



PARTIAL PLAN
NOT TO SCALE

TABLE 1

BENT NO.	ELEVATION "A"	ELEVATION "C"
4	13.33'	13.33'
5	14.00'	13.33'
6	14.66'	13.33'
7	15.33'	13.33'
8	16.03'	13.33'
9	16.71'	13.33'
10	17.42'	13.83'
11	17.42'	13.66'

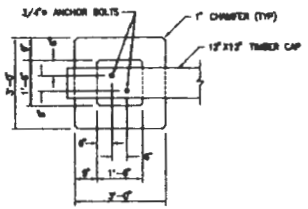


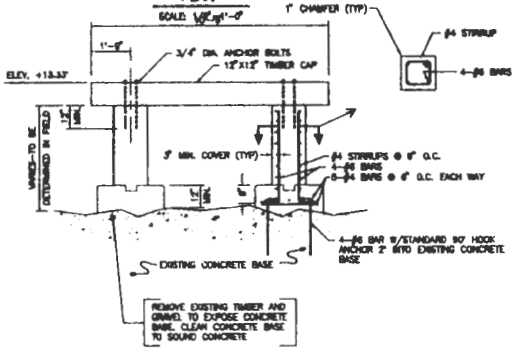
NOTE:
1. AT BENT 5, PILE ROW "B", SPLIT CAPS WILL OVERLAP APPROX. 4", NOTCH CAPS 2" EACH TO ALLOW FOR OVERLAP.
2. AT BENT 4 PILE ROW "B" PILE OMITTED AND PILE CAP CONTINUOUS

ELEVATION

A 4/4 2-6"X12" SPLIT CAP

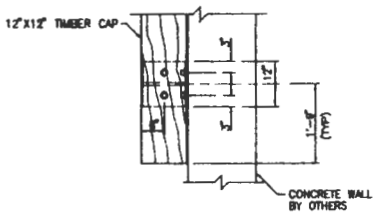
SCALE: 3/8"=1'-0"

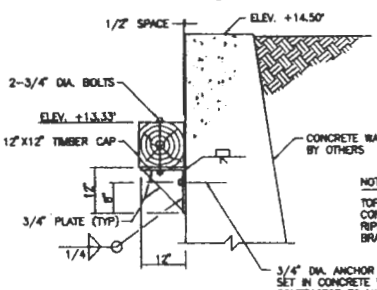




B 4/4 CONCRETE FOOTING & COLUMN

SCALE: 3/8"=1'-0"





NOTE:
TOP OF STONE RIPRAP @ EL +13.0', CONTRACTOR TO REMOVE AND RESET STONE RIPRAP AS NECESSARY TO INSTALL SUPPORT BRACKETS AND TIMBER PILE CAP.

3/4" DIA. ANCHOR BOLTS, SET IN CONCRETE WALLS BY OTHERS CONTRACTOR TO VARIFY ANCHOR BOLT LOCATION WITH DRILL HOLES IN SUPPORT BRACKET TO INSURE FINISHED PIER DECK ELEVATION OF +14.5'

ELEVATION

C 4/4 SUPPORT BRACKET

SCALE: 3/4"=1'-0"

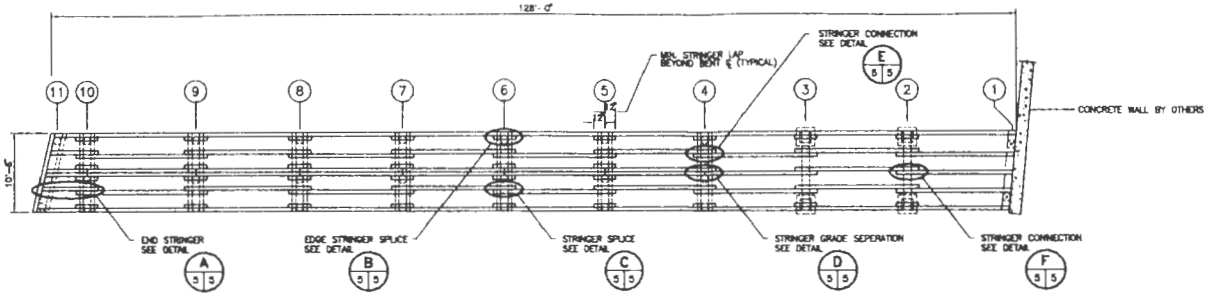
DATUM: BOSTON CITY BASE

ISSUE	DATE	DESCRIPTION	BY	CHKD	APP.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EAST BOSTON FERRY TERMINAL
EAST BOSTON, MASSACHUSETTS
CONTRACT NO. R7CN10

TIMBER PIER
PILE/PILE CAP PLAN

SCALE: 1/8"=1'-0"	DESIGNED BY	DRAWN BY	CHECKED BY	PLAN NO. 113864	ISSUE
DATE: APRIL, 1995	APL	JFB	DLP	SHEET 4 OF 10	1

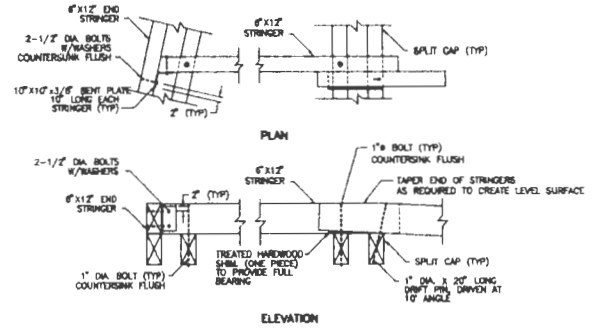


TIMBER STRINGER PLAN

SCALE: 1/8"=1'-0"

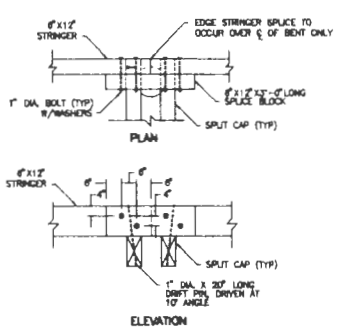
NOTE:

1.) AT CHANGES IN SLOPE, BENT #9 LOW RAMP AND BENT #10 HIGH RAMP, TRIM SPLICE BLOCKS FLUSH WITH TOP OF TIMBER STRINGERS.



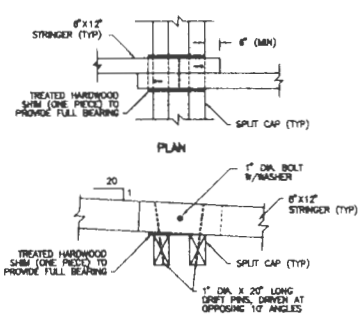
A 5|5 END STRINGER DETAIL

SCALE: 1/2"=1'-0"



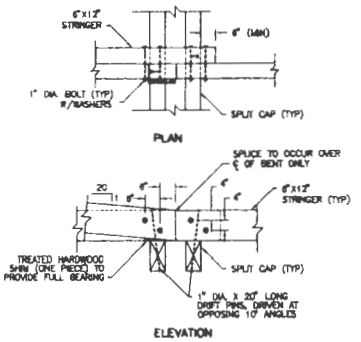
B 5|5 EDGE STRINGER SPLICE DETAIL

SCALE: 1/2"=1'-0"



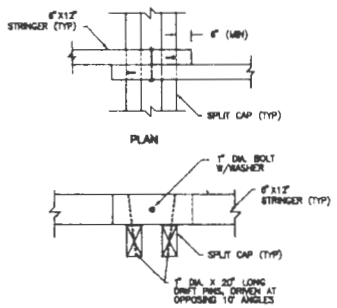
C 5|5 STRINGER SPLICE DETAIL

SCALE: 1/2"=1'-0"



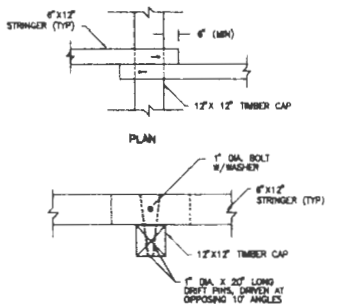
D 5|5 STRINGER GRADE SEPARATION DETAIL

SCALE: 1/2"=1'-0"



E 5|5 STRINGER CONNECTION DETAIL

SCALE: 1/2"=1'-0"



F 5|5 STRINGER CONNECTION DETAIL

SCALE: 1/2"=1'-0"

DATUM: BOSTON CITY BASE

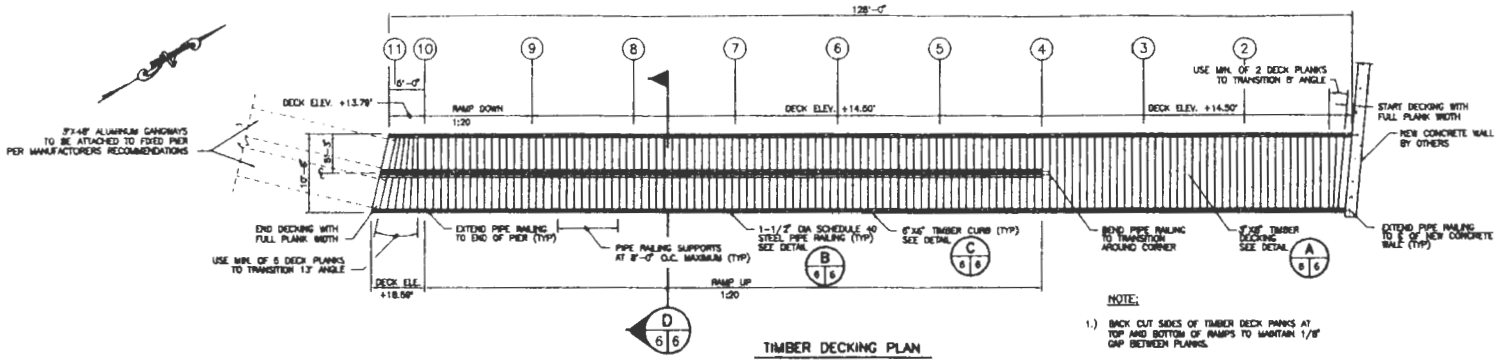
ISSUE	DATE	DESCRIPTION	BY	CHKD	APP.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EAST BOSTON FERRY TERMINAL
EAST BOSTON, MASSACHUSETTS
CONTRACT NO. 97CN10

TIMBER PIER/ STRINGER PLAN

SCALE: 1/8"=1'-0"	DESIGN BY:	DRAWN BY: APL	CHECK BY: DLP
DATE: APRIL, 1998			

PLAN NO. 112985 | SHEET 5 OF 10 | ISSUE 1

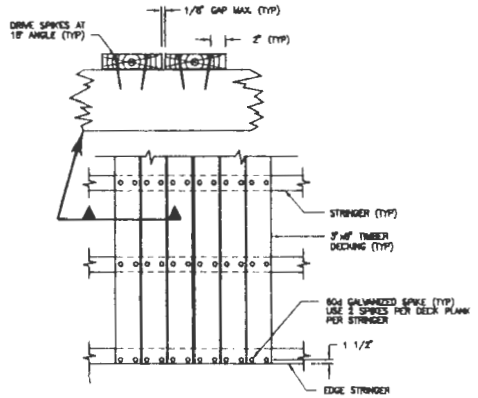


TIMBER DECKING PLAN

SCALE: 1/8"=1'-0"

NOTE:

1.) BACK CUT SIDES OF TIMBER DECK PANKS AT TOP AND BOTTOM OF RAMPS TO MAINTAIN 1/8" GAP BETWEEN PLANKS.



NOTE:

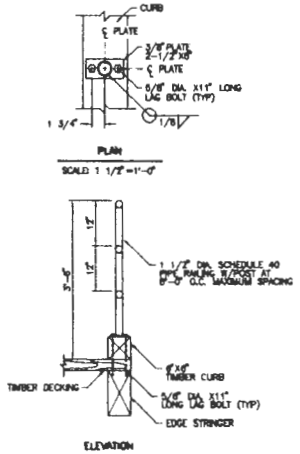
1.) PLACE DECKING WITH VISIBLE HEARTWOOD DOWN.

2.) PREDRILL DECK PLANKS AS NECESSARY TO PREVENT SPLITTING

3.) DECK PLANKS TO COVER FULL WIDTH OF PIER, NO BUTT JOINTS ALLOWED.

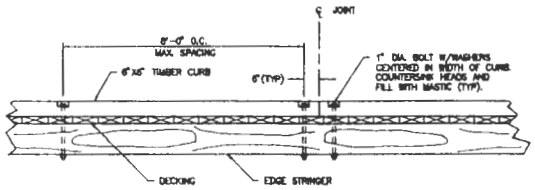
A 6/6 DECK CONNECTION DETAIL

SCALE: 1/2"=1'-0"



B 6/6 PIPE RAILING DETAIL

SCALE: 3/4"=1'-0"

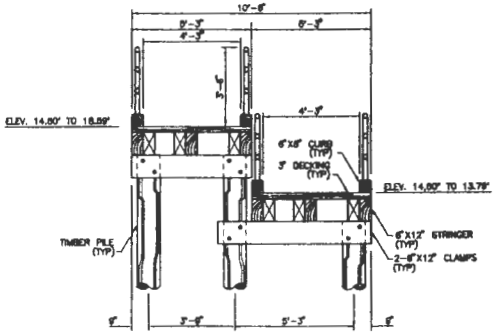


NOTE:

STAGGER 1" DIA. BOLT SPACING AS NECESSARY TO AVOID LAG BOLTS FOR PIPE RAILING

C 6/6 CURB DETAILS

SCALE: 1/2"=1"



D 6/6 SECTION

SCALE: 3/8"=1'-0"

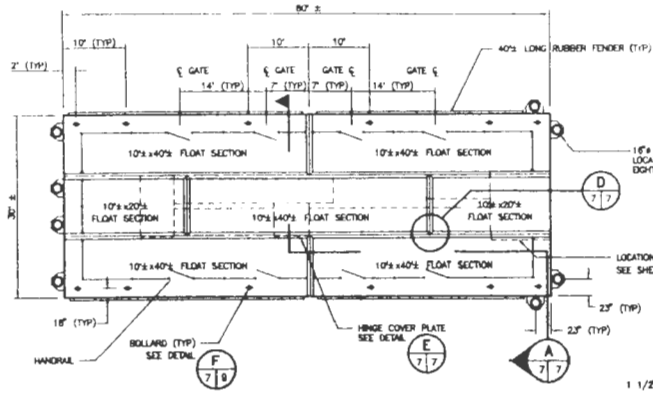
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EAST BOSTON FERRY TERMINAL
EAST BOSTON, MASSACHUSETTS
CONTRACT NO. R7CN10

TIMBER PIER DECK PLAN

DATUM: BOSTON CITY BASE

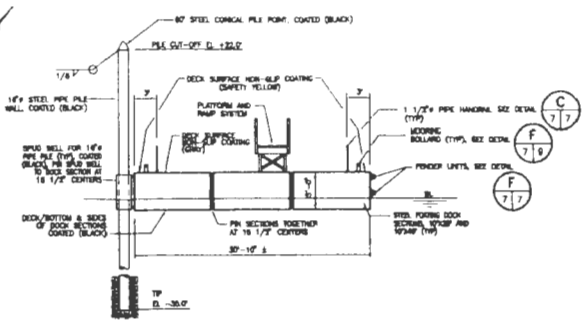
ISSUE	DATE	DESCRIPTION	BY	CHKD	APP.

SCALE: 1/8"=1'-0" | DESIGN BY | DRAWN BY | CHECK BY
DATE APRIL, 1995 | APL | JFB | DLP
PLAN NO. 112886
SHEET 6 OF 10
ISSUE 1



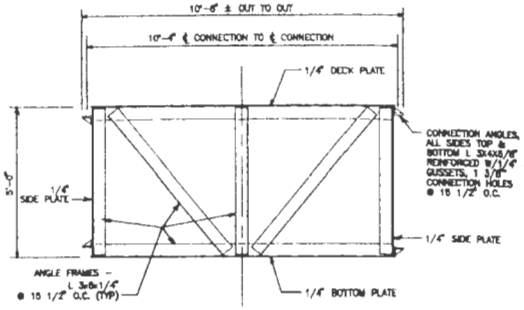
FLOATING DOCK PLAN

SCALE: 1"=10'-0"



A 7/7 TYPICAL SECTION

SCALE: 1/8"=1'-0"

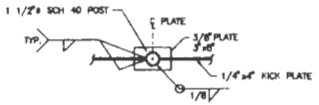


ALL HULL SEAMS DOUBLE WELDED WITH 1/4" FILLET, FRAMES AND GUSSETTS WELDED ALL AROUND. ALL STEEL PLATE AND SHAPES ASTM A-36.

AFTER FABRICATION ALL EXTERNAL SURFACES TO BE COATED.

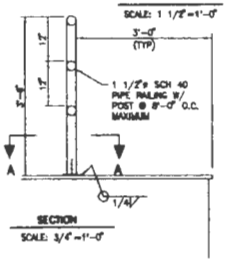
B 7/7 STEEL FLOAT SECTION DETAIL

SCALE: 1/2"=1'-0"



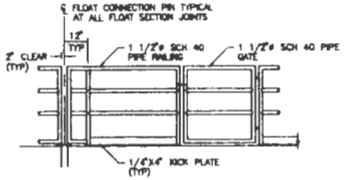
SECTION A-A

SCALE: 1 1/2"=1'-0"



SECTION

SCALE: 3/4"=1'-0"



ELEVATION

SCALE: 3/8"=1'-0"

NOTE:

1.) GATES TO PROVIDE A 36" CLEAR PASSAGE INCLUDING HINGE AND HARDWARE.

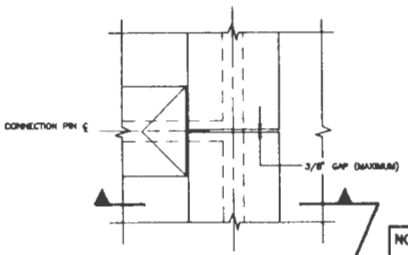
2.) HINGE GATE FOR 180° SWING.

3.) PROVIDE GATE LATCH MECHANISM AND POSITIVE STOP TO PREVENT GATE FROM SWINGING OUTBOARD.

4.) PROVIDE LATCH MECHANISM TO HOLD GATE IN OPEN POSITION.

C 7/7 FLOAT RAILING DETAIL

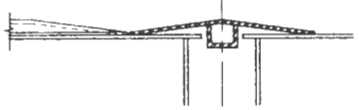
SCALE AS SHOWN



PLAN

SCALE: 1 1/2"=1'-0"

NOTE WELL:
NOTCH COVER PLATES AS REQUIRED TO FIT AROUND PLATFORM/RAMP STRUCTURES.

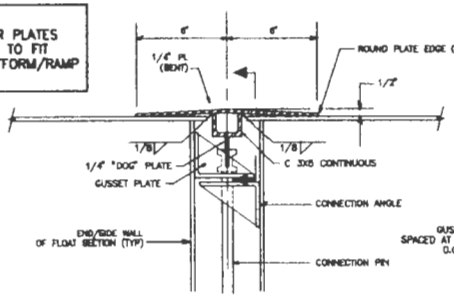


SECTION

SCALE: 3"=1'-0"

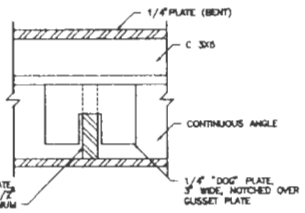
D 7/7 COVER PLATE INTERSECTION

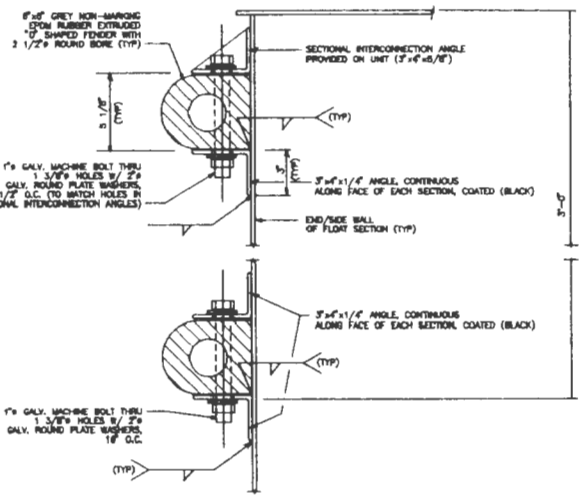
SCALE: AS SHOWN



E 7/7 COVER PLATE

SCALE: 3"=1'-0"





F 7/7 FENDER CONNECTION DETAIL

SCALE: 3"=1'-0"

SECTION

NOT TO SCALE

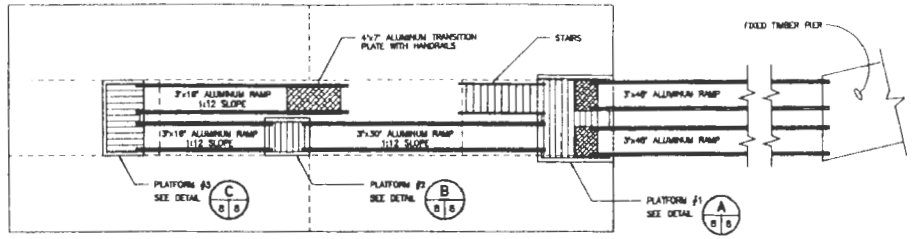
DATUM: BOSTON CITY BASE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EAST BOSTON FERRY TERMINAL
EAST BOSTON, MASSACHUSETTS
CONTRACT NO. R7CN10

FLOATING DOCK

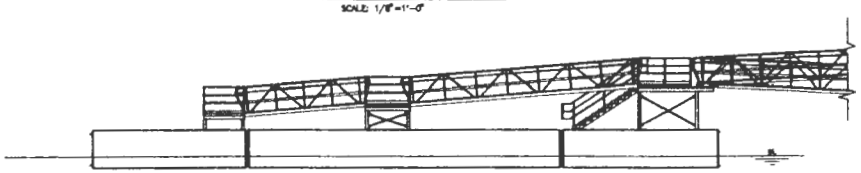
ISSUE	DATE	DESCRIPTION	BY	CHKD	APP.

SCALE: 1"=10'-0"	DRAWN BY	DESIGN BY	CHECK BY	PLAN NO. 112867	ISSUE
DATE: APRIL, 1998	JTB	APL	DLP	SHEET 7 OF 10	1



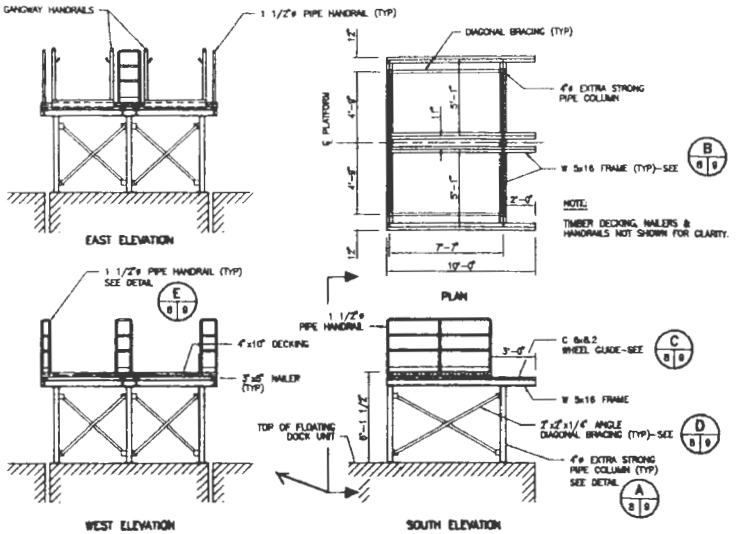
RAMP SYSTEM PLAN

SCALE: 1/8"=1'-0"



RAMP SYSTEM ELEVATION

SCALE: 1/8"=1'-0"

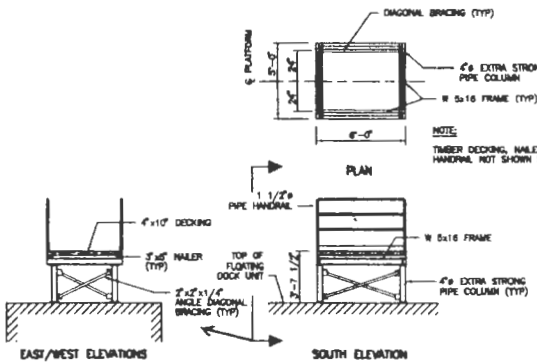


A FIXED PLATFORM #1

SCALE: 1/4"=1'-0"

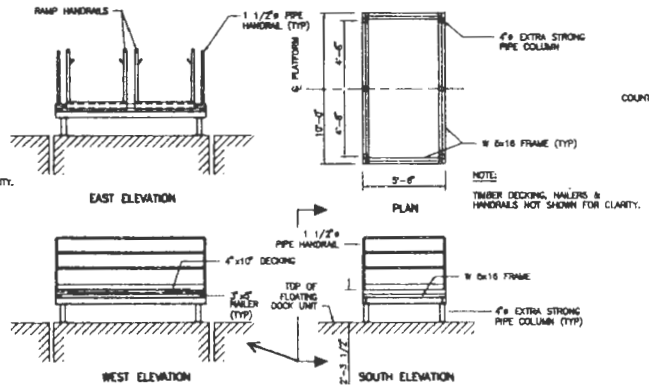
NOTE WELL:

PLATFORMS AND RAMPS SHALL BE PERMENANTLY INSTALLED ON FLOATING DOCK AFTER FIXED PIER AND FLOATING DOCK ARE IN FINAL POSITION. ADJUST PLATFORM/RAMP POSITION PRIOR TO PERMENANT ATTACHMENT TO INSURE PROPER OPERATION OF GANGWAYS AT ALL LEVELS.



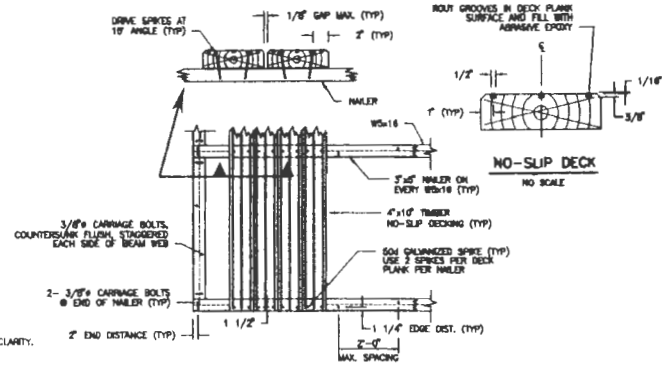
B FIXED PLATFORM #2

SCALE: 1/4"=1'-0"



C FIXED PLATFORM #3

SCALE: 1/4"=1'-0"



NO-SLIP DECK

NO SCALE

D NAILER/DECKING CONNECTION

SCALE: 1/2"=1'-0"

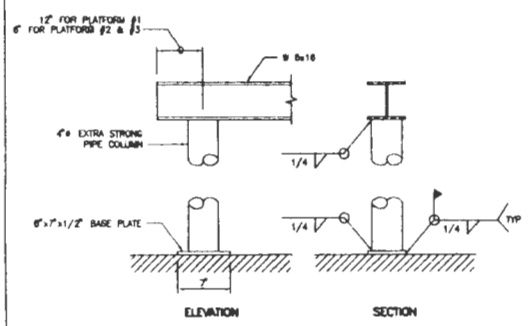
DATUM: BOSTON CITY BASE

ISSUE	DATE	DESCRIPTION	BY	CHKD	APP.

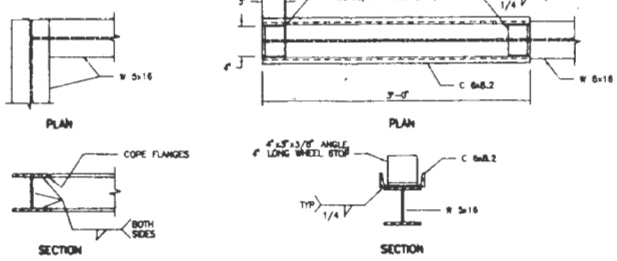
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EAST BOSTON FERRY TERMINAL
EAST BOSTON, MASSACHUSETTS
CONTRACT NO. R7CN10

RAMP SYSTEM

SCALE: 1/8"=1'-0"	DRAWN BY:	DESIGN BY:	CHECK BY:	PLAN NO. 112009	ISSUE 1
DATE: APRIL, 1995	APL	JFB	DLP	SHEET 8 OF 10	

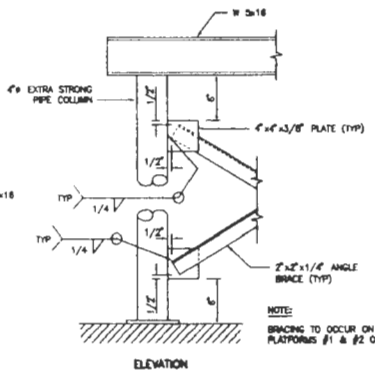


A 8|9 4"ø PIPE COLUMN CONNECTION
SCALE: 1 1/2"=1'-0"

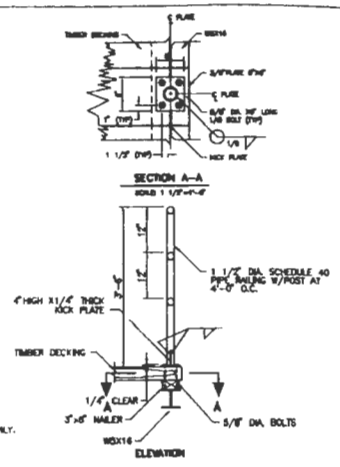


B 8|9 W 5x16 TO W 5x16 CONNECTION
SCALE: 1 1/2"=1'-0"

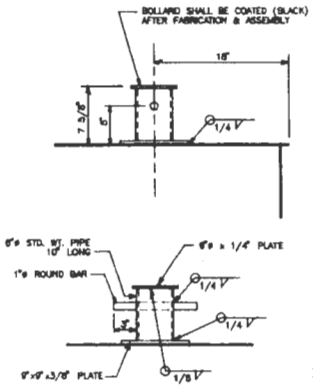
C 8|9 WHEEL GUIDE DETAIL
SCALE: 1 1/2"=1'-0"



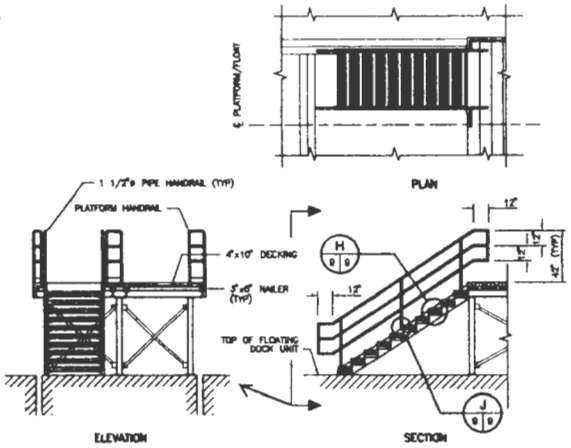
D 8|9 DIAGONAL BRACING CONNECTION
SCALE: 1 1/2"=1'-0"



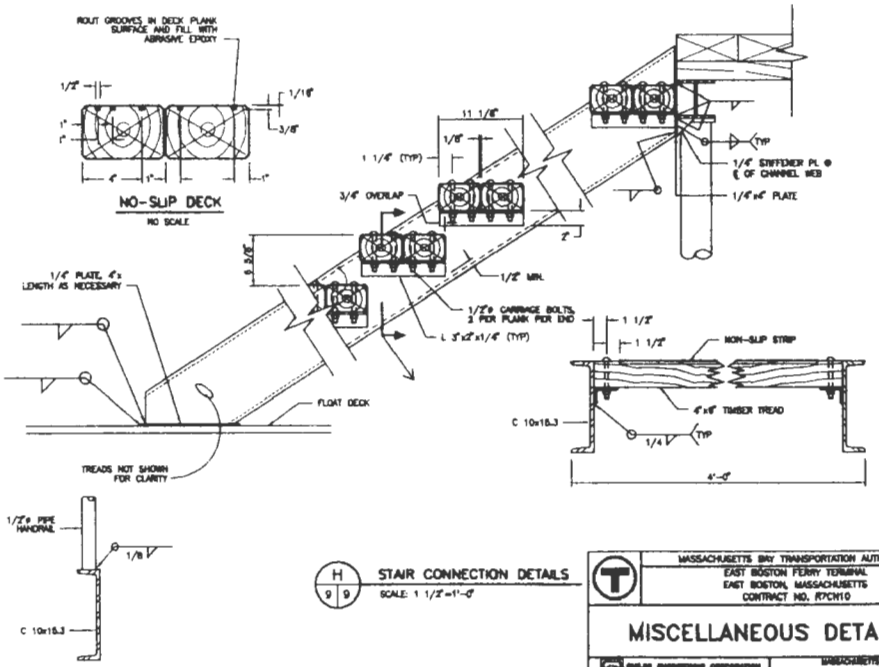
E 8|9 PLATFORM RAILING DETAIL
SCALE: 3/4"=1'-0"



F 7|9 FLOATING DOCK BOLLARD FABRICATION/CONNECTION DETAIL
SCALE: 1 1/2"=1'-0"



G 8|9 STAIR DETAIL
SCALE: 1/4"=1'-0"



J 9|9 STAIR HANDRAIL CONNECTION
SCALE: 1 1/2"=1'-0"

H 9|9 STAIR CONNECTION DETAILS
SCALE: 1 1/2"=1'-0"

DATUM: BOSTON CITY BASE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EAST BOSTON FERRY TERMINAL
EAST BOSTON, MASSACHUSETTS
CONTRACT NO. RFCN10

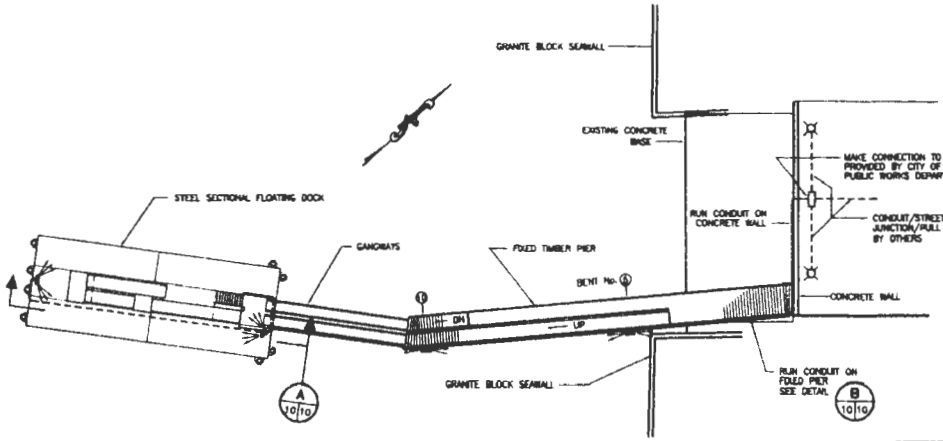
MISCELLANEOUS DETAILS

ISSUE	DATE	DESCRIPTION	BY	CHKD	APP.

DESIGN REVIEWS, OPTIMIZATION AND VALUE ENGINEERING APPROVED BY

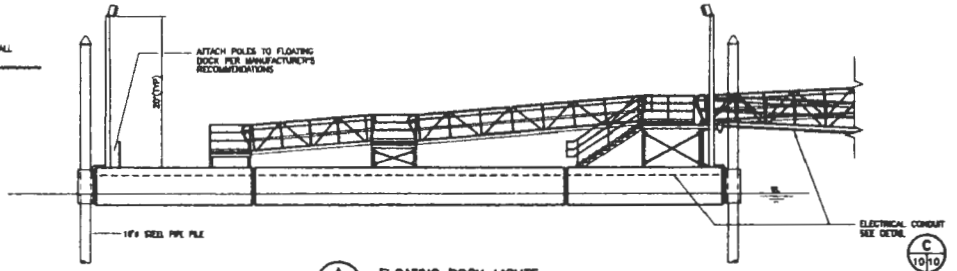
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY APPROVED BY

SCALE: 1/8"=1'-0"	DESIGNED BY: RV	DRAWN BY: RV	CHECKED BY: RV	PLAN NO. 112800	ISSUE 1
DATE: APRIL, 1998	APL	JPS	DLP	SHEET 9 OF 10	



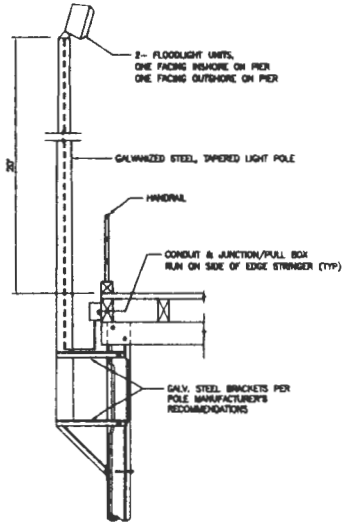
ELECTRICAL PLAN

SCALE: 1"=20'-0"



A 10/10 FLOATING DOCK LIGHTS

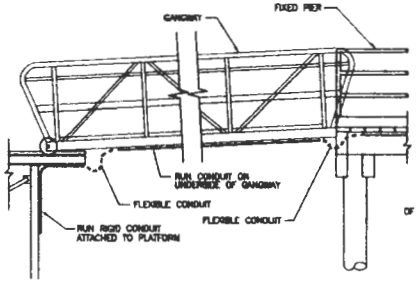
SCALE: 1/8"=1'-0"



ELEVATION

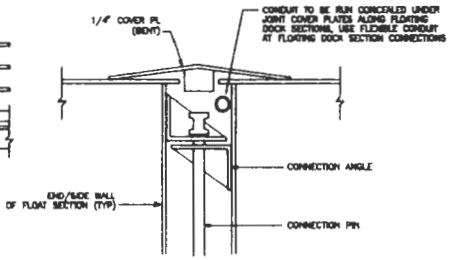
B 10/10 FIXED PIER LIGHT CONNECTION

SCALE: 3/8"=1'-0"



CONDUIT @ PIER AND GANGWAY

SCALE: 3/8"=1'-0"



CONDUIT @ FLOATING DOCK

SCALE: 3"=1'-0"

NOTE WELL:

CONDUIT RUNS ARE SCHEMATIC, CONTRACTOR SHALL PROVIDE COMPLETE DETAILS OF PROPOSED MARINE LIGHTING SYSTEM.

C 10/10 ELECTRICAL CONDUIT CONNECTION

SCALE: AS SHOWN

DATUM: BOSTON CITY BASE

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
EAST BOSTON FERRY TERMINAL
EAST BOSTON, MASSACHUSETTS
CONTRACT NO. R7CN10

MARINE LIGHTING SYSTEM

ISSUE	DATE	DESCRIPTION	BY	CHKD	APP.

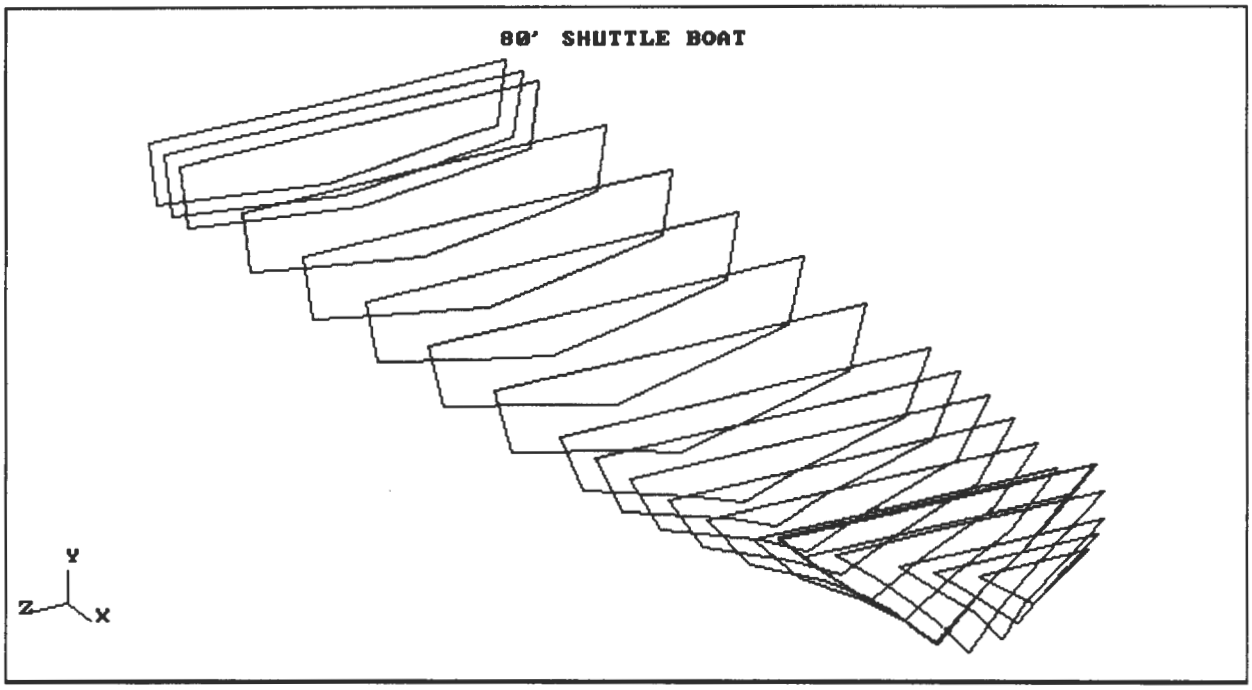
APPROVED BY

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
APPROVED BY

SCALE: 1"=20'-0"	DESIGN BY	DRAWN BY	CHECK BY	PLAN NO. 112870	ISSUE
DATE: APRIL, 1995	TEG	JFB	DLP	SHEET 10 OF 10	1

APPENDIX F

STABILITY ANALYSIS FOR ELEVATOR INSTALLATIONS


80' SHUTTLE BOAT
Y
Z
X

DAMAGE STABILITY SUMMARY

RUN			---Intact Condition---			---------Equilibrium Condition After Damage----------				
			MN.DRAFT	VCG	GMt	HEEL	MAX.GZ	RANGE	AREA	DAM.GMt	
No.	FILE NAME	DAMAGED COMP. LISTING	(ft)	(ft)	(ft)	(deg)	(ft)	(deg)	(ft-deg)	(ft)	SURVIVAL
1	RETU001A	1	4.900	11.480	7.778	0.0	1.577	40.00	23.92	7.665	Yes
2	RETU002A	2	4.900	11.480	7.778	0.0	1.563	40.00	23.62	7.187	Yes
3	RETU003A	3	4.900	11.480	7.778	0.0	1.339	38.21	19.75	5.622	Yes
4	RETU004A	4	4.900	11.480	7.778	0.0	1.042	35.91	15.76	4.732	Yes
5	RETU005A	6	4.900	11.480	7.778	0.2S	1.002	34.46	15.06	----	Yes
6	RETU006A	7	4.900	11.480	7.778	0.3P	1.121	35.98	16.57	----	Yes
7	RETU007A	7,8	4.900	11.480	7.778	0.3P	1.068	35.35	15.96	----	Yes

TRIM & STABILITY SUMMARY
DEPART, W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	60.53	9.810	42.310A	0.000	
Constant	0.00	0.000	36.750A	0.000	0.00
Misc. Weight	27.76	15.763	39.620A	0.000	0.00
Diesel Oil	8.65	3.687	41.909A	0.000	6.46
Misc.	0.38	5.150	68.250A	0.000	1.10
TOTALS	97.32	10.946	41.608A	0.000	7.56

STABILITY CALCULATION

KMt	18.662 ft
VCG	10.946 ft
GMt	7.717 ft
F.S. Correction	0.078 ft
GMt Corrected	7.639 ft

TRIM CALCULATION

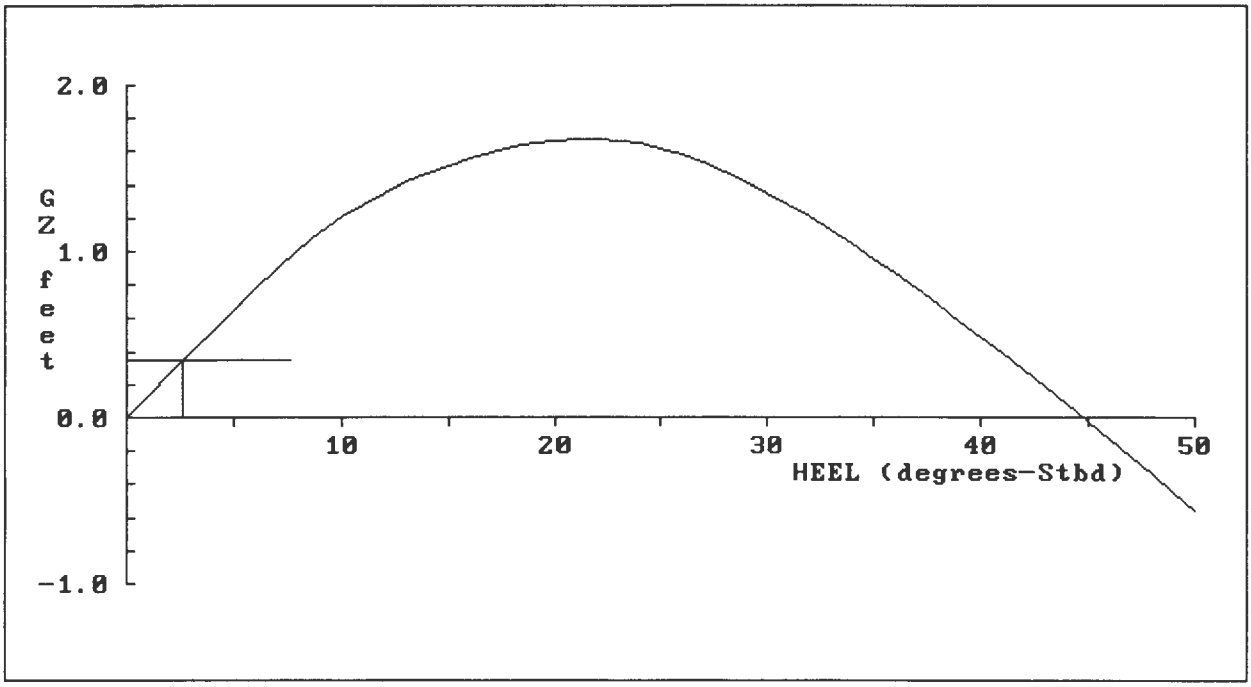
LCF Draft	5.115 ft
LCB (even keel)	40.77 ft-AFT
LCF	41.374 ft-AFT
MT1in	16 ft-LT/in
Trim	0.411 ft-AFT
Prop. Immersion	211 %
List	0.00 deg

DRAFTS

A.P. 5ft- 3.54in (1.614m)
M.S. 5ft- 1.07in (1.551m)
F.P. 4ft-10.61in (1.489m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART, W/ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	7.639	ft
Mean Draft	=	5.089	ft
Projected Area (Hull)	=	1175.046	ft2
Vertical Arm (Hull)	=	11.050	ft
Projected Area (Cargo)	=	0.000	ft2
Vertical Arm (Cargo)	=	0.000	ft
Steady Wind Pressure	=	0.0034	LT/ft2
Displacement	=	97.32	LTons
Wind Heeling Lever	=	0.349	ft
Angle of Heel	=	2.62	deg (based on GMt)
Angle of Heel	=	2.65	deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	3.911	ft
Heel to 1/2 freeboard	=	9.24	deg
Permissible heel angle	=	9.24	deg

TRIM & STABILITY SUMMARY
DEPART, NO ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	60.53	9.810	42.310A	0.000	
Constant	0.00	0.000	36.750A	0.000	0.00
Misc. Weight	15.71	15.581	41.822A	0.000	0.00
Diesel Oil	8.65	3.687	41.909A	0.000	6.46
Misc.	0.38	5.150	68.250A	0.000	1.10
TOTALS	85.27	10.231	42.295A	0.000	7.56

STABILITY CALCULATION

KMt	20.289 ft
VCG	10.231 ft
GMt	10.057 ft
F.S. Correction	0.089 ft
GMt Corrected	9.969 ft

TRIM CALCULATION

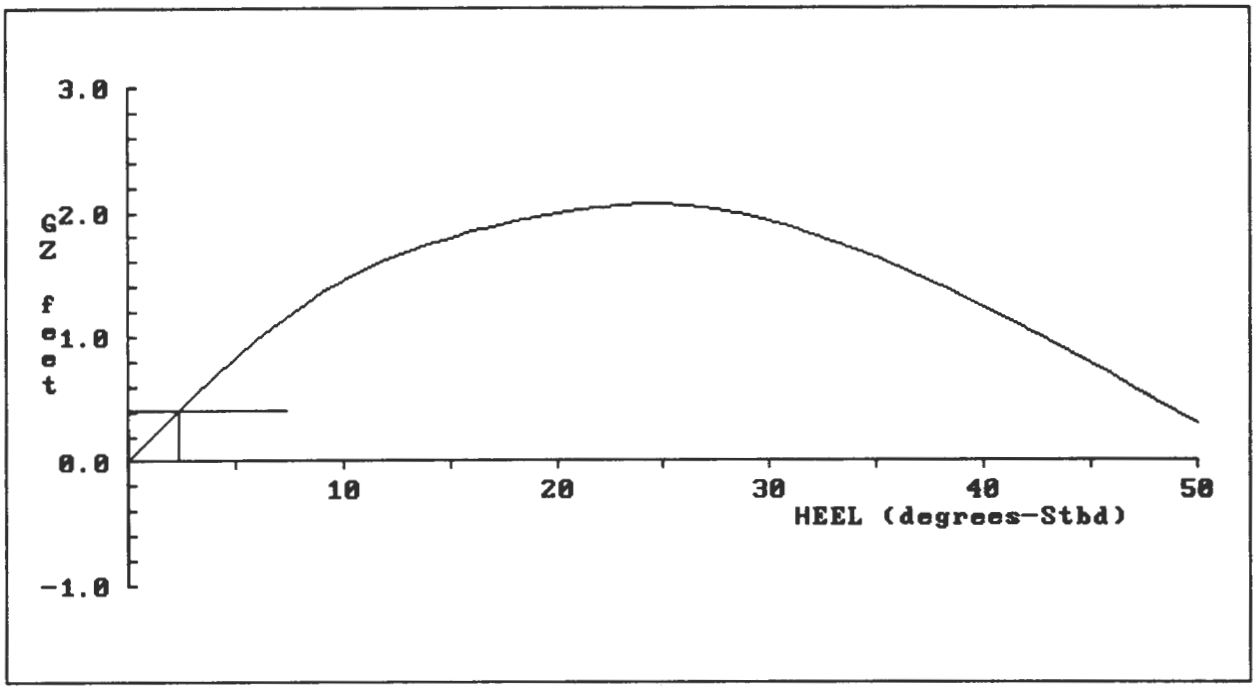
LCF Draft	4.811 ft
LCB (even keel)	40.65 ft-AFT
LCF	41.690 ft-AFT
MT1in	16 ft-LT/in
Trim	0.730 ft-AFT
Prop. Immersion	205 %
List	0.00 deg

DRAFTS

A.P. 5ft- 1.53in (1.563m)
M.S. 4ft- 9.15in (1.452m)
F.P. 4ft- 4.77in (1.340m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART, NO ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	9.969 ft
Mean Draft	=	4.762 ft
Projected Area (Hull)	=	1174.821 ft2
Vertical Arm (Hull)	=	11.051 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0034 LT/ft2
Displacement	=	85.27 LTons
Wind Heeling Lever	=	0.406 ft
Angle of Heel	=	2.33 deg (based on GMt)
Angle of Heel	=	2.35 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	4.238 ft
Heel to 1/2 freeboard	=	10.00 deg
Permissible heel angle	=	10.00 deg

TRIM & STABILITY SUMMARY
RETURN, NO ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	60.53	9.810	42.310A	0.000	
Constant	0.00	0.000	36.750A	0.000	0.00
Misc. Weight	14.91	16.004	42.416A	0.000	0.00
Diesel Oil	0.91	3.687	41.909A	0.000	6.46
Misc.	2.23	5.150	68.250A	0.000	0.00
TOTALS	78.58	10.782	43.062A	0.000	6.46

STABILITY CALCULATION

KMt	21.333	ft
VCG	10.782	ft
GMt	10.551	ft
F.S. Correction	0.082	ft
GMt Corrected	10.469	ft

TRIM CALCULATION

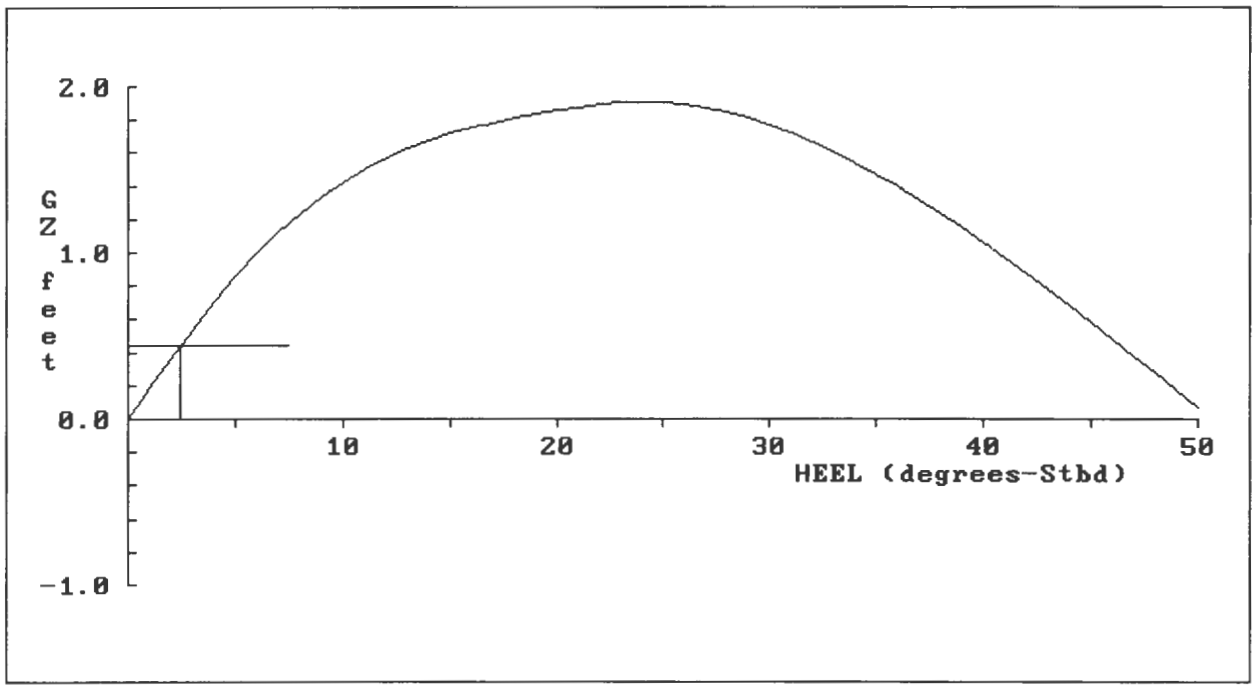
LCF Draft	4.641	ft
LCB (even keel)	40.56	ft-AFT
LCF	41.888	ft-AFT
MT1in	16	ft-LT/in
Trim	1.044	ft-AFT
Prop. Immersion	203	%
List	0.00	deg

DRAFTS

A.P.	5ft- 1.09in	(1.552m)
M.S.	4ft- 6.82in	(1.392m)
F.P.	4ft- 0.56in	(1.233m)

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN, NO ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	10.469 ft
Mean Draft	=	4.568 ft
Projected Area (Hull)	=	1175.113 ft2
Vertical Arm (Hull)	=	11.049 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0034 LT/ft2
Displacement	=	78.58 LTons
Wind Heeling Lever	=	0.446 ft
Angle of Heel	=	2.44 deg (based on GMt)
Angle of Heel	=	2.46 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	4.432 ft
Heel to 1/2 freeboard	=	10.44 deg
Permissible heel angle	=	10.44 deg

TRIM & STABILITY SUMMARY
RETURN, W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	60.53	9.810	42.310A	0.000	
Constant	0.00	0.000	36.750A	0.000	0.00
Misc. Weight	26.96	16.002	39.884A	0.000	0.00
Diesel Oil	0.91	3.687	41.909A	0.000	6.46
Misc.	2.23	5.150	68.250A	0.000	0.00
TOTALS	90.63	11.476	42.223A	0.000	6.46

STABILITY CALCULATION

KMt	19.452	ft
VCG	11.476	ft
GMt	7.976	ft
F.S. Correction	0.071	ft
GMt Corrected	7.905	ft

TRIM CALCULATION

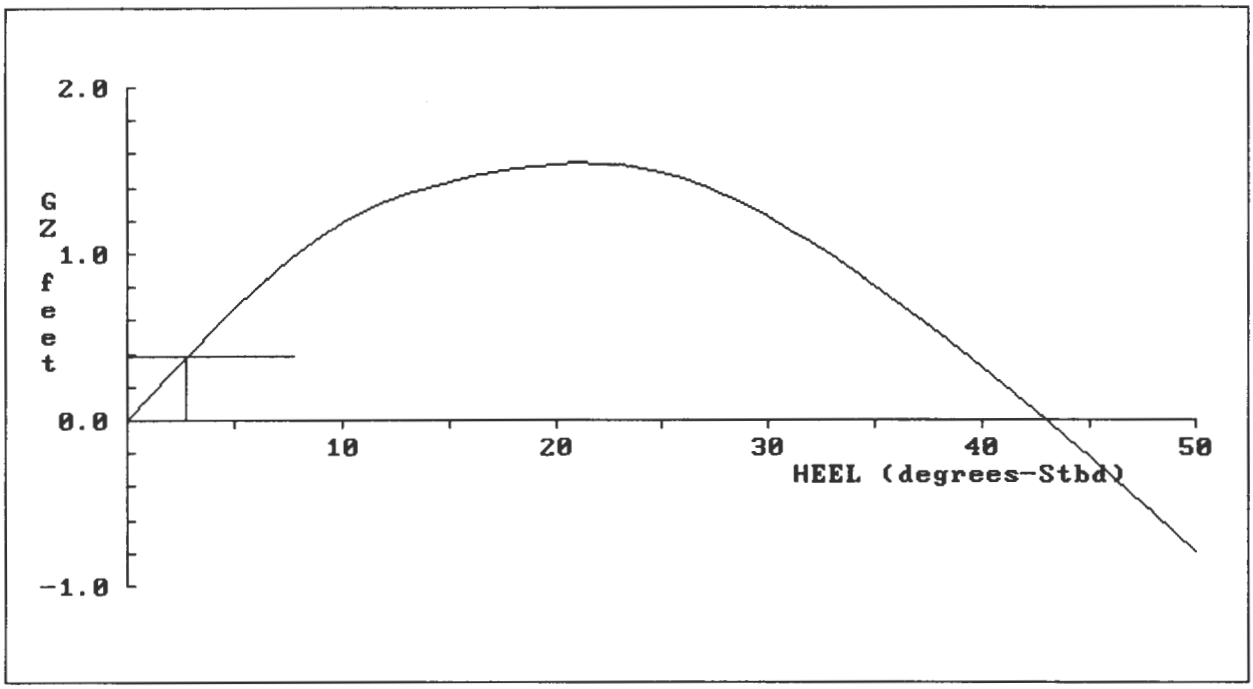
LCF Draft	4.948	ft
LCB (even keel)	40.73	ft-AFT
LCF	41.531	ft-AFT
MT1in	16	ft-LT/in
Trim	0.697	ft-AFT
Prop. Immersion	209	%
List	0.00	deg

DRAFTS

A.P. 5ft- 3.01in (1.600m)
M.S. 4ft-10.83in (1.494m)
F.P. 4ft- 6.65in (1.388m)

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN, W/ELEVATOR

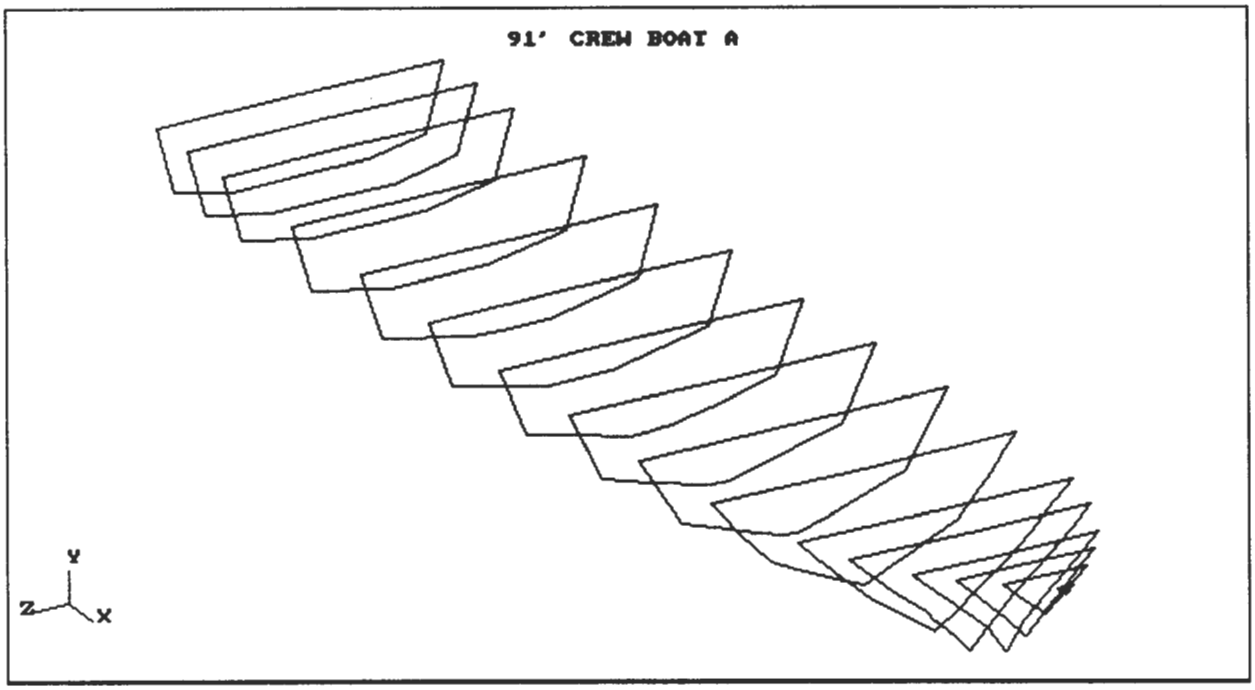


Heel resulting from steady wind pressure:

GMt (corrected)	=	7.905 ft
Mean Draft	=	4.902 ft
Projected Area (Hull)	=	1174.822 ft2
Vertical Arm (Hull)	=	11.051 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0034 LT/ft2
Displacement	=	90.63 LTons
Wind Heeling Lever	=	0.379 ft
Angle of Heel	=	2.75 deg (based on GMt)
Angle of Heel	=	2.76 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	4.098 ft
Heel to 1/2 freeboard	=	9.67 deg
Permissible heel angle	=	9.67 deg


91' CREW BOAT A
Y
Z
X

DAMAGE STABILITY SUMMARY
RETURN W/ELEVATOR

RUN No.	FILE NAME	DAMAGED COMP. LISTING	---Intact Condition--- MN.DRAFT (ft)	VCG (ft)	GMt (ft)	---------Equilibrium Condition After Damage---------- HEEL (deg)	MAX.GZ (ft)	RANGE (deg)	AREA (ft-deg)	DAM.GMt (ft)	SURVIVAL	
1	ADAR001A	1	3.745	12.070	2.754	0.0	0.496	34.07	0.00	2.781	Yes	
2	ADAR002A	2	3.745	12.070	2.754	0.0	0.516	33.64	0.00	2.496	Yes	
3	ADAR003A	3	3.745	12.070	2.754	0.0	0.108	24.93	0.00	0.144	No	*F
4	ADAR004A	4	3.745	12.070	2.754	0.0	0.499	33.42	0.00	2.723	Yes	
5	ADAR005A	5	3.745	12.070	2.754	3.0S	0.305	28.90	0.00	----	No	*F
6	ADAR006A	4,5	3.745	12.070	2.754	3.1S	0.325	28.51	0.00	----	No	*F
7	ADAR007A	7	3.745	12.070	2.754	0.0	0.146	24.45	0.00	0.626	No	*F
8	ADAR008A	8	3.745	12.070	2.754	0.0	0.270	28.01	0.00	1.228	No	*F

***F WARNING: The required GMt for non-survival cases does not meet all survival criteria.**

TRIM & STABILITY SUMMARY
DEPART, NO ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	57.57	8.330	53.300A	0.000	
Constant	0.00	0.000	45.500A	0.000	0.00
Misc. Cargo	17.85	16.600	54.500A	0.000	0.00
Misc. Weight	14.50	9.124	59.893A	0.000	0.00
Diesel Oil	11.58	4.165	58.627A	0.000	16.34
TOTALS	101.50	9.423	55.060A	0.000	16.34

STABILITY CALCULATION

KMt	14.402	ft
VCG	9.423	ft
GMt	4.980	ft
F.S. Correction	0.161	ft
GMt Corrected	4.819	ft

TRIM CALCULATION

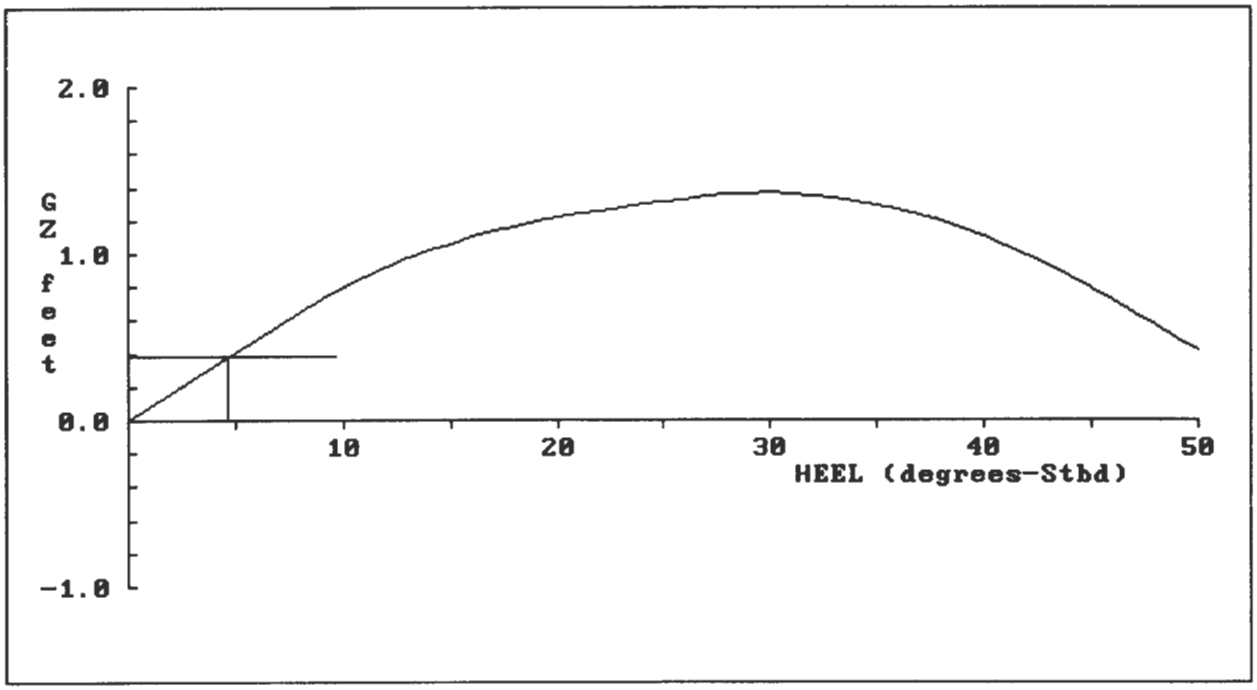
LCF Draft	3.906	ft
LCB (even keel)	52.97	ft-AFT
LCF	51.375	ft-AFT
MT1in	21	ft-LT/in
Trim	0.829	ft-AFT
List	0.00	deg

DRAFTS

A.P.	4ft- 3.21in (1.301m)
M.S.	3ft-10.23in (1.174m)
F.P.	3ft- 5.26in (1.048m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART, NO ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	4.819 ft
Mean Draft	=	3.853 ft
Projected Area (Hull)	=	1387.745 ft2
Vertical Arm (Hull)	=	10.681 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0032 LT/ft2
Displacement	=	101.50 LTons
Wind Heeling Lever	=	0.383 ft
Angle of Heel	=	4.55 deg (based on GMt)
Angle of Heel	=	4.67 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	5.097 ft
Heel to 1/2 freeboard	=	12.50 deg
Permissible heel angle	=	12.50 deg

TRIM & STABILITY SUMMARY
DEPART W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	57.57	8.330	53.300A	0.000	
Constant	0.00	0.000	45.500A	0.000	0.00
Misc. Cargo	17.85	16.600	54.500A	0.000	0.00
Misc. Weight	26.80	16.410	53.287A	0.000	0.00
Diesel Oil	11.58	4.165	58.627A	0.000	16.34
TOTALS	113.80	11.106	54.027A	0.000	16.34

STABILITY CALCULATION

KMt	13.643	ft
VCG	11.106	ft
GMt	2.536	ft
F.S. Correction	0.144	ft
GMt Corrected	2.393	ft

TRIM CALCULATION

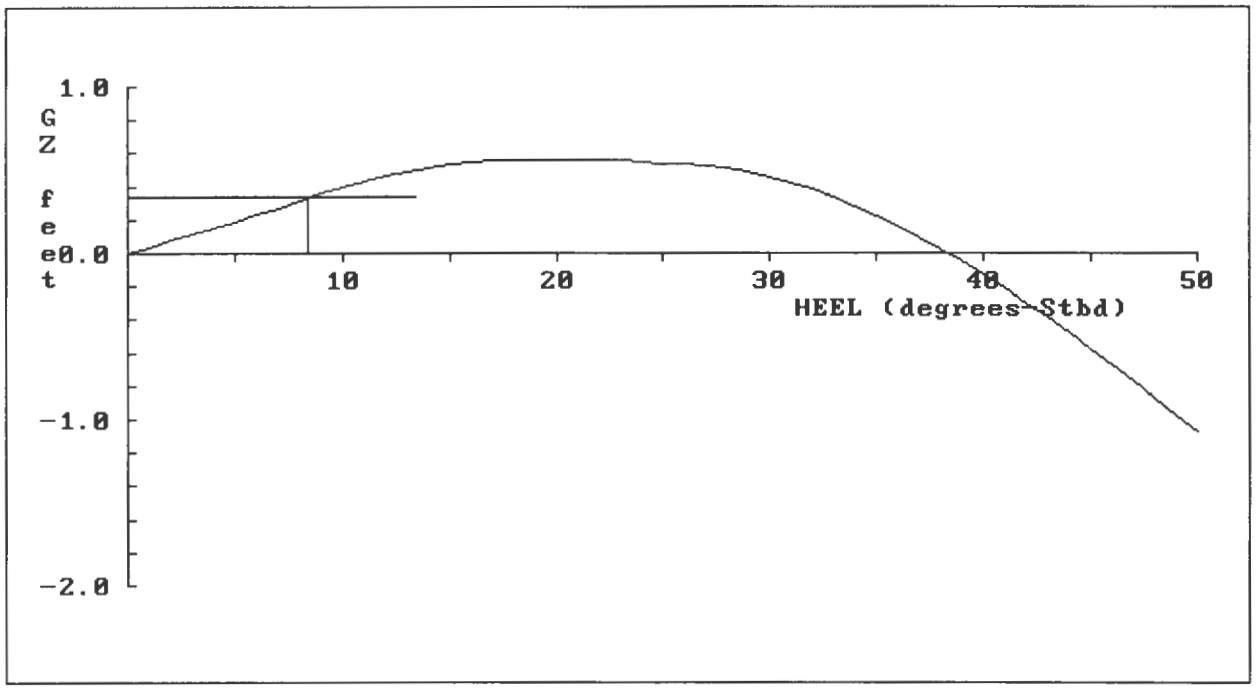
LCF Draft	4.190	ft
LCB (even keel)	52.78	ft-AFT
LCF	51.056	ft-AFT
MT1in	22	ft-LT/in
Trim	0.538	ft-AFT
List	0.00	deg

DRAFTS

A.P. 4ft- 5.11in (1.349m)
M.S. 4ft- 1.88in (1.267m)
F.P. 3ft-10.66in (1.185m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART W/ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	2.393 ft
Mean Draft	=	4.157 ft
Projected Area (Hull)	=	1387.374 ft2
Vertical Arm (Hull)	=	10.683 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0032 LT/ft2
Displacement	=	113.80 LTons
Wind Heeling Lever	=	0.336 ft
Angle of Heel	=	7.99 deg (based on GMt)
Angle of Heel	=	8.42 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	4.793 ft
Heel to 1/2 freeboard	=	11.77 deg
Permissible heel angle	=	11.77 deg

TRIM & STABILITY SUMMARY
RETURN, NO ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	57.57	8.330	53.300A	0.000	
Constant	0.00	0.000	45.500A	0.000	0.00
Misc. Cargo	17.85	16.600	54.500A	0.000	0.00
Misc. Weight	5.85	9.557	63.392A	0.000	0.00
Diesel Oil	1.21	4.165	58.627A	0.000	16.34
TOTALS	82.48	10.146	54.353A	0.000	16.34

STABILITY CALCULATION

KMt	15.994	ft
VCG	10.146	ft
GMt	5.848	ft
F.S. Correction	0.198	ft
GMt Corrected	5.650	ft

TRIM CALCULATION

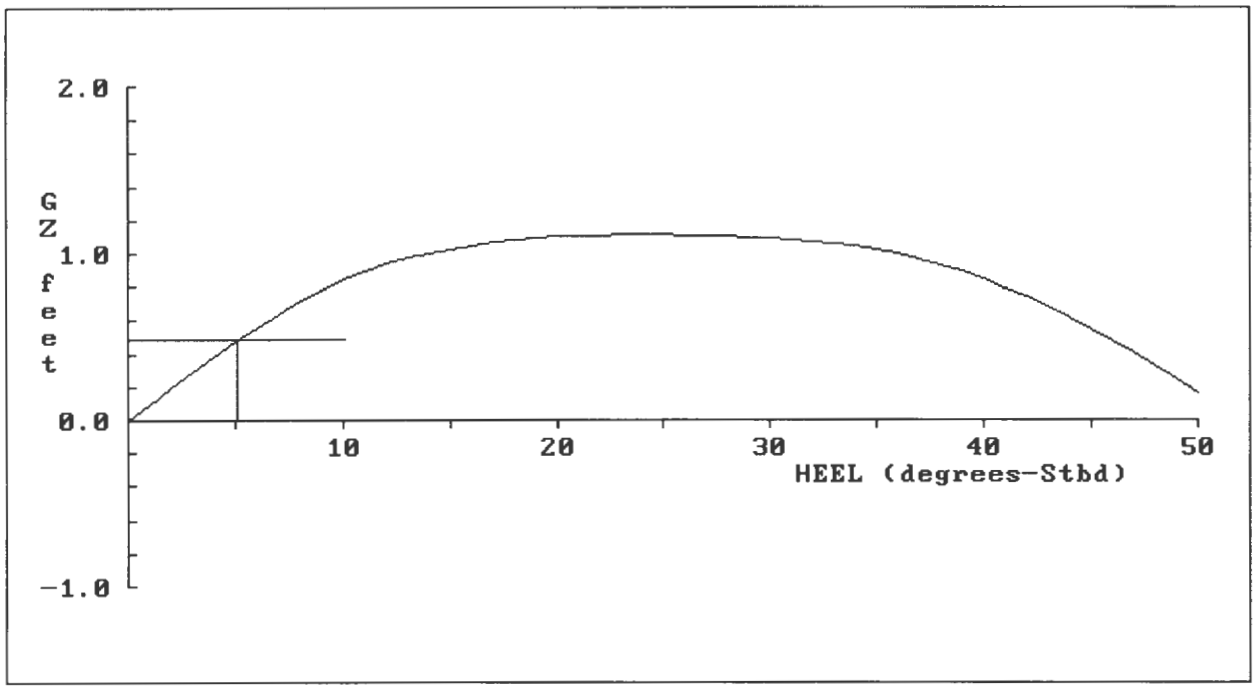
LCF Draft	3.458	ft
LCB (even keel)	53.26	ft-AFT
LCF	52.070	ft-AFT
MT1in	20	ft-LT/in
Trim	0.373	ft-AFT
List	0.00	deg

DRAFTS

A.P.	3ft- 7.41in	(1.103m)
M.S.	3ft- 5.17in	(1.046m)
F.P.	3ft- 2.94in	(0.989m)

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN, NO ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	5.650 ft
Mean Draft	=	3.431 ft
Projected Area (Hull)	=	1387.909 ft2
Vertical Arm (Hull)	=	10.680 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0032 LT/ft2
Displacement	=	82.48 LTons
Wind Heeling Lever	=	0.483 ft
Angle of Heel	=	4.88 deg (based on GMt)
Angle of Heel	=	5.07 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	5.519 ft
Heel to 1/2 freeboard	=	13.49 deg
Permissible heel angle	=	13.49 deg

TRIM & STABILITY SUMMARY
RETURN, W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	57.57	8.330	53.300A	0.000	
Constant	0.00	0.000	45.500A	0.000	0.00
Misc. Cargo	17.85	16.600	54.500A	0.000	0.00
Misc. Weight	18.15	20.022	51.267A	0.000	0.00
Diesel Oil	1.21	4.165	58.627A	0.000	16.34
TOTALS	94.78	12.074	53.204A	0.000	16.34

STABILITY CALCULATION

KMt	14.940	ft
VCG	12.074	ft
GMt	2.866	ft
F.S. Correction	0.172	ft
GMt Corrected	2.693	ft

TRIM CALCULATION

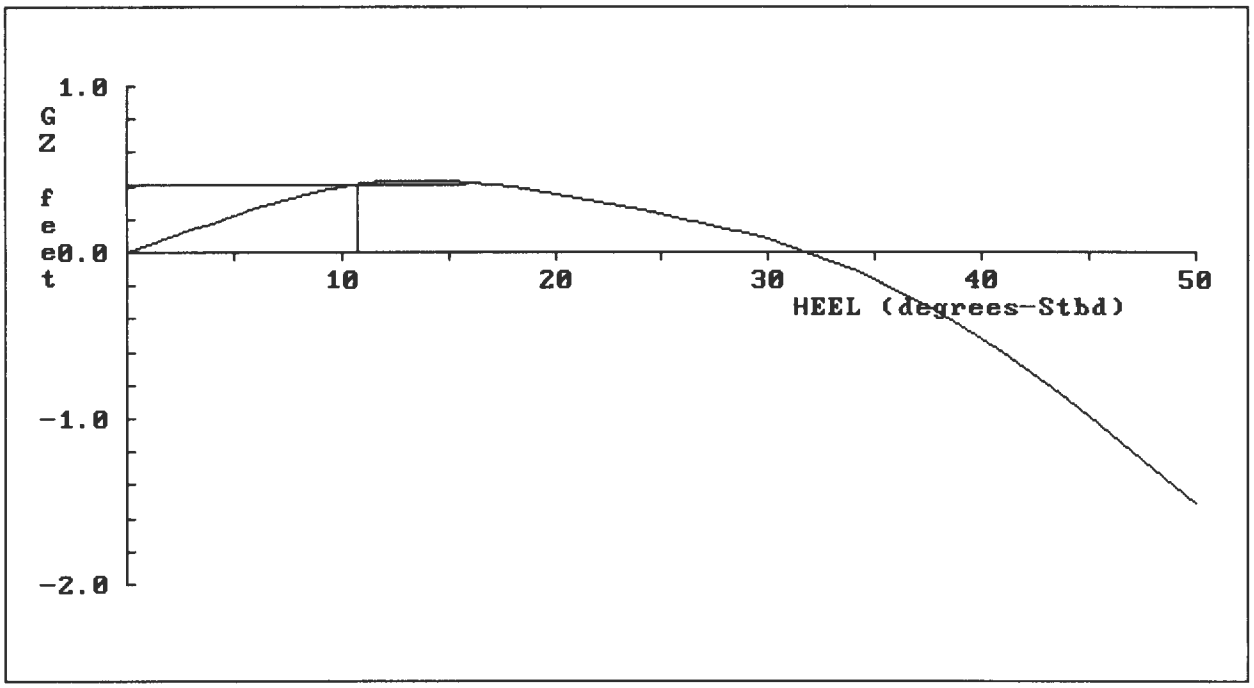
LCF Draft	3.748	ft
LCB (even keel)	53.08	ft-AFT
LCF	51.611	ft-AFT
MT1in	21	ft-LT/in
Trim	0.048	ft-AFT
List	0.00	deg

DRAFTS

A.P. 3ft- 9.23in (1.149m)
M.S. 3ft- 8.94in (1.142m)
F.P. 3ft- 8.66in (1.134m)

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN, W/ELEVATOR

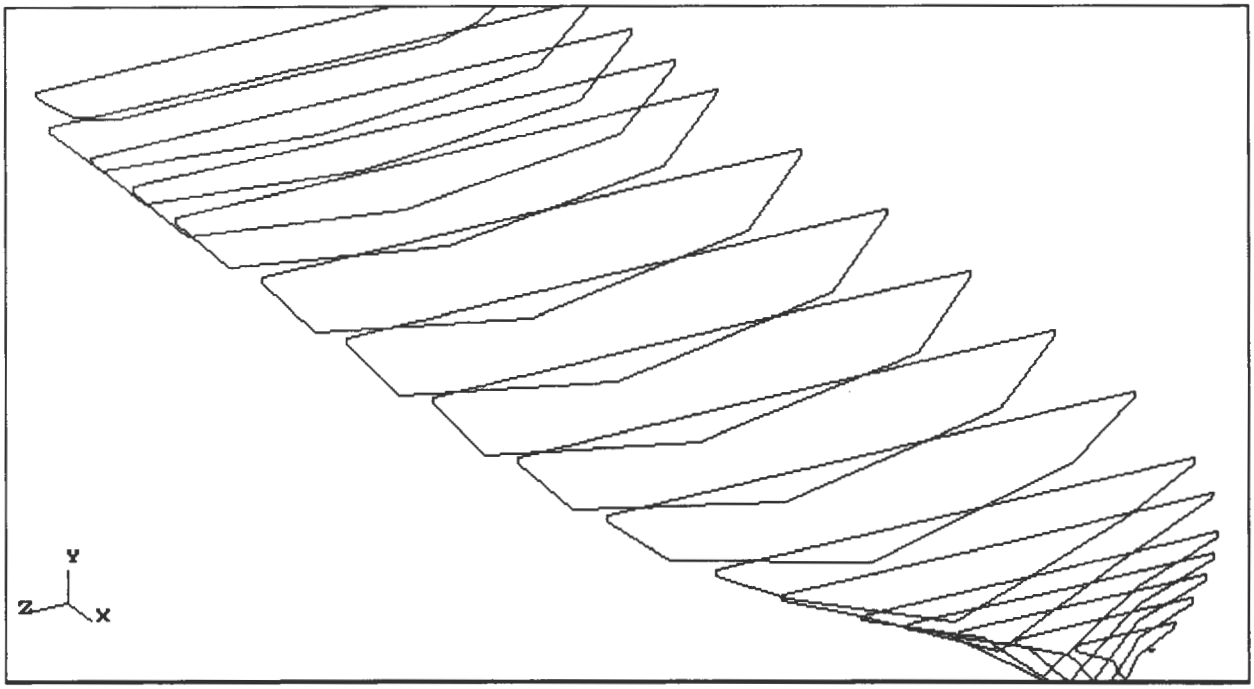


Heel resulting from steady wind pressure:

GMt (corrected)	=	2.693 ft
Mean Draft	=	3.745 ft
Projected Area (Hull)	=	1387.523 ft2
Vertical Arm (Hull)	=	10.682 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0032 LT/ft2
Displacement	=	94.78 LTons
Wind Heeling Lever	=	0.413 ft
Angle of Heel	=	8.71 deg (based on GMt)
Angle of Heel	=	10.72 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	5.205 ft
Heel to 1/2 freeboard	=	12.75 deg
Permissible heel angle	=	12.75 deg


Y
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DAMAGE STABILITY SUMMARY
RETURN W/ELEVATOR

RUN			---Intact Condition---			---------Equilibrium Condition After Damage----------					
No.	FILE NAME	DAMAGED COMP. LISTING	MN.DRAFT (ft)	VCG (ft)	GMt (ft)	HEEL (deg)	MAX.GZ (ft)	RANGE (deg)	AREA (ft-deg)	DAM.GMt (ft)	SURVIVAL
1	RETU001A	1	6.600	14.100	16.361	0.0	3.556	43.86	54.87	16.282	Yes
2	RETU002A	1,2	6.600	14.100	16.361	0.0	3.460	42.38	54.16	16.683	Yes
3	RETU003A	2	6.600	14.100	16.361	0.0	3.473	42.76	54.26	16.609	Yes
4	RETU004A	3	6.600	14.100	16.361	0.0	3.246	41.43	51.13	16.056	Yes
5	RETU005A	4	6.600	14.100	16.361	0.0	2.062	32.02	33.62	14.819	Yes
6	RETU006A	5	6.600	14.100	16.361	0.0	3.255	41.45	51.08	15.673	Yes
7	RETU007A	5,7	6.600	14.100	16.361	0.3S	3.008	39.72	46.71	----	Yes
8	RETU008A	10	6.600	14.100	16.361	0.0	2.357	34.96	38.25	14.199	Yes
9	RETU009A	11	6.600	14.100	16.361	0.0	2.853	39.13	45.18	14.479	Yes
10	RETU010A	12	6.600	14.100	16.361	0.0	2.915	39.65	45.77	14.240	Yes

TRIM & STABILITY SUMMARY
DEPART, NO ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	222.00	13.250	58.610A	0.000	
Constant	37.90	20.610	52.600A	0.000	0.00
Misc. Weight	10.00	6.000	39.000A	0.000	0.00
Diesel Oil	10.06	7.315	59.007A	0.000	7.22
Fresh Water	11.01	5.725	53.000A	0.000	0.00
Misc.	1.61	5.097	61.000A	0.000	88.20
TOTALS	292.58	13.424	56.977A	0.000	95.42

STABILITY CALCULATION

KMt	30.880	ft
VCG	13.424	ft
GMt	17.457	ft
F.S. Correction	0.326	ft
GMt Corrected	17.130	ft

TRIM CALCULATION

LCF Draft	6.481	ft
LCB (even keel)	56.63	ft-AFT
LCF	59.050	ft-AFT
MT1in	50	ft-LT/in
Trim	0.172	ft-AFT
List	0.00	deg

DRAFTS

A.P. 6ft- 6.68in (1.998m)
M.S. 6ft- 5.65in (1.972m)
F.P. 6ft- 4.61in (1.946m)

TRIM & STABILITY SUMMARY
DEPART, NO ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	222.00	13.250	58.610A	0.000	
Constant	37.90	20.610	52.600A	0.000	0.00
Misc. Weight	10.00	6.000	39.000A	0.000	0.00
Diesel Oil	10.06	7.315	59.007A	0.000	7.22
Fresh Water	11.01	5.725	53.000A	0.000	0.00
Misc.	1.61	5.097	61.000A	0.000	88.20
TOTALS	292.58	13.424	56.977A	0.000	95.42

STABILITY CALCULATION

KMt	30.880	ft
VCG	13.424	ft
GMt	17.457	ft
F.S. Correction	0.326	ft
GMt Corrected	17.130	ft

TRIM CALCULATION

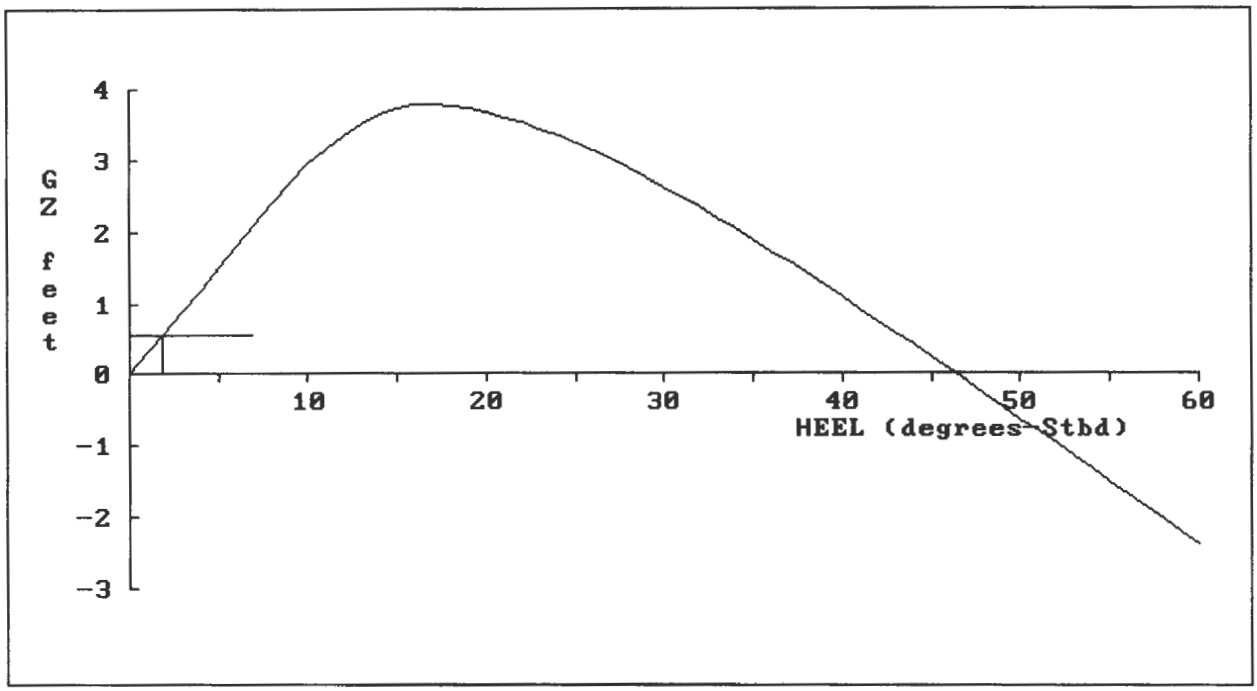
LCF Draft	6.481	ft
LCB (even keel)	56.63	ft-AFT
LCF	59.050	ft-AFT
MT1in	50	ft-LT/in
Trim	0.172	ft-AFT
List	0.00	deg

DRAFTS

A.P. 6ft- 6.68in (1.998m)
M.S. 6ft- 5.65in (1.972m)
F.P. 6ft- 4.61in (1.946m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART, NO ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	17.130	ft
Mean Draft	=	6.471	ft
Projected Area (Hull)	=	2802.889	ft2
Vertical Arm (Hull)	=	19.495	ft
Projected Area (Cargo)	=	0.000	ft2
Vertical Arm (Cargo)	=	0.000	ft
Steady Wind Pressure	=	0.0035	LT/ft2
Displacement	=	292.58	LTons
Wind Heeling Lever	=	0.545	ft
Angle of Heel	=	1.82	deg (based on GMt)
Angle of Heel	=	1.84	deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	4.029	ft
Heel to 1/2 freeboard	=	6.76	deg
Permissible heel angle	=	6.76	deg

TRIM & STABILITY SUMMARY
DEPART, W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	222.00	13.250	58.610A	0.000	
Constant	37.90	20.610	52.600A	0.000	0.00
Misc. Weight	22.50	15.444	46.500A	0.000	0.00
Diesel Oil	10.06	7.315	59.007A	0.000	7.22
Fresh Water	11.01	5.725	53.000A	0.000	0.00
Misc.	1.61	5.097	61.000A	0.000	88.20
TOTALS	305.08	13.816	56.793A	0.000	95.42

STABILITY CALCULATION

KMt	30.472	ft
VCG	13.816	ft
GMt	16.656	ft
F.S. Correction	0.313	ft
GMt Corrected	16.343	ft

TRIM CALCULATION

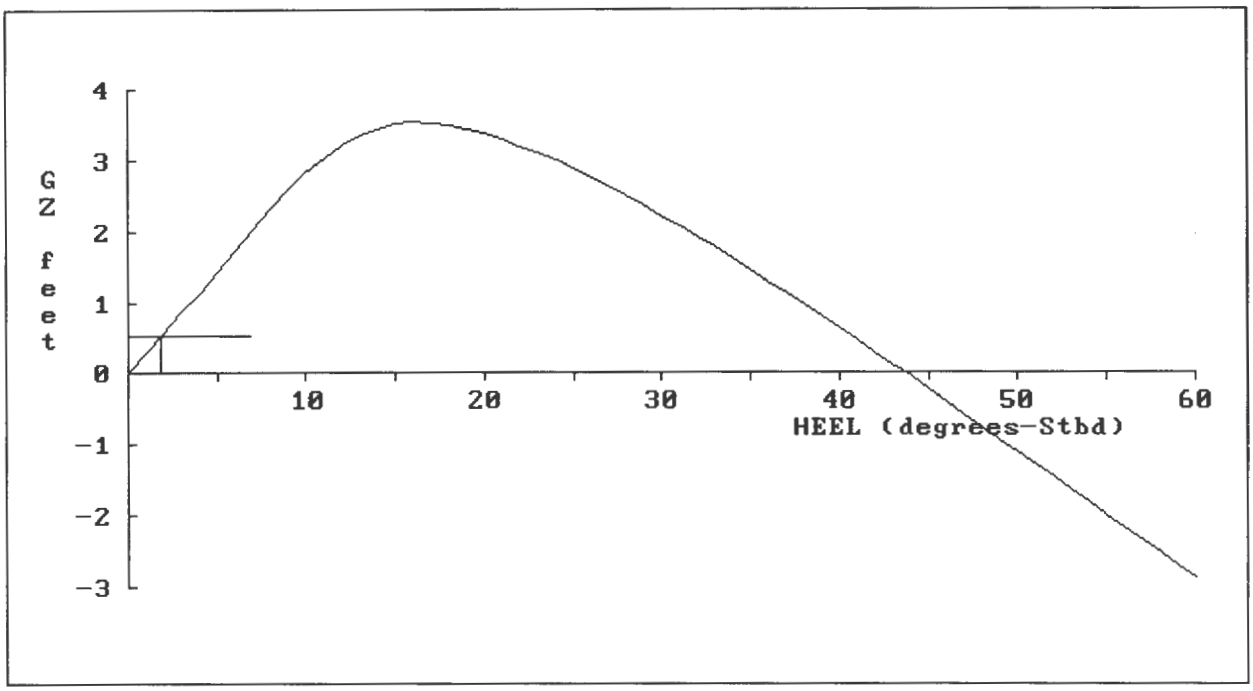
LCF Draft	6.621	ft
LCB (even keel)	56.71	ft-AFT
LCF	58.964	ft-AFT
MT1in	50	ft-LT/in
Trim	0.040	ft-AFT
List	0.00	deg

DRAFTS

A.P. 6ft- 7.67in (2.024m)
M.S. 6ft- 7.43in (2.017m)
F.P. 6ft- 7.19in (2.011m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART, W/ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	16.343 ft
Mean Draft	=	6.619 ft
Projected Area (Hull)	=	2802.016 ft2
Vertical Arm (Hull)	=	19.499 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0035 LT/ft2
Displacement	=	305.08 LTons
Wind Heeling Lever	=	0.520 ft
Angle of Heel	=	1.82 deg (based on GMt)
Angle of Heel	=	1.85 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	3.881 ft
Heel to 1/2 freeboard	=	6.51 deg
Permissible heel angle	=	6.51 deg

TRIM & STABILITY SUMMARY
RETURN, NO ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	222.00	13.250	58.610A	0.000	
Constant	37.90	20.610	52.600A	0.000	0.00
Misc. Weight	1.00	6.000	39.000A	0.000	0.00
Diesel Oil	1.06	7.315	59.007A	0.000	7.22
Fresh Water	1.10	5.725	53.000A	0.000	86.03
Misc.	16.06	5.097	61.000A	0.000	0.00
TOTALS	279.12	13.702	57.841A	0.000	93.26

STABILITY CALCULATION

KMt	31.491 ft
VCG	13.702 ft
GMt	17.789 ft
F.S. Correction	0.334 ft
GMt Corrected	17.455 ft

TRIM CALCULATION

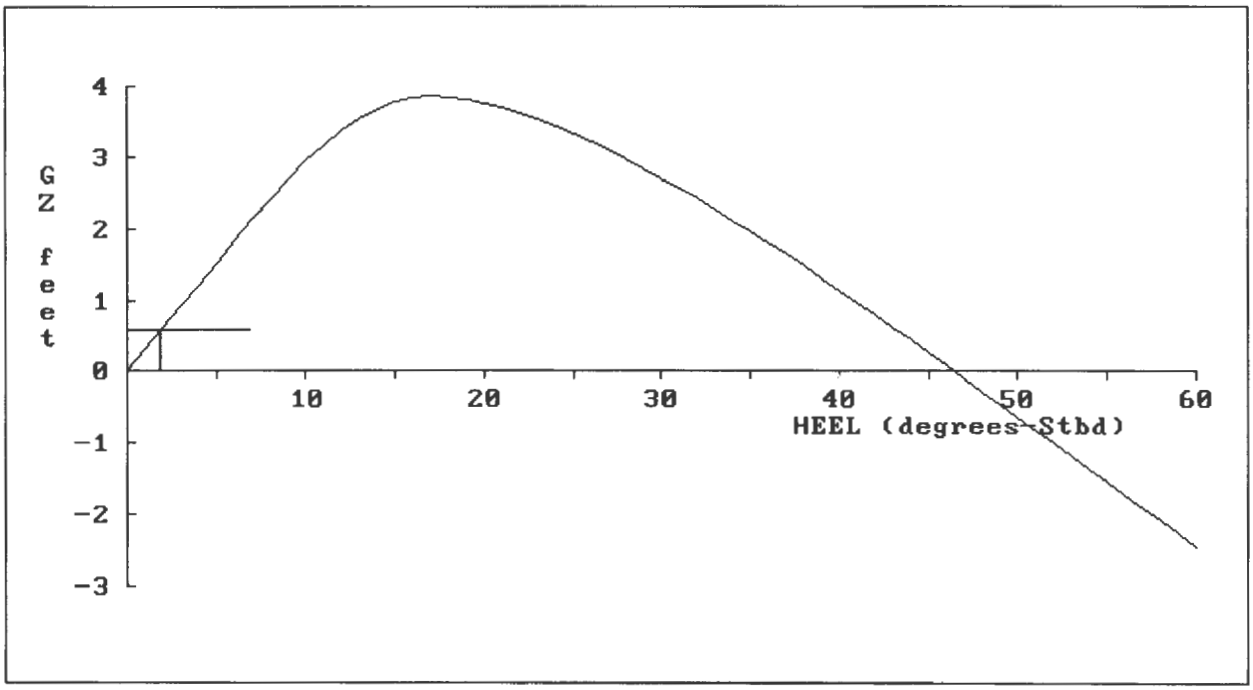
LCF Draft	6.326 ft
LCB (even keel)	56.49 ft-AFT
LCF	59.137 ft-AFT
MT1in	49 ft-LT/in
Trim	0.642 ft-AFT
List	0.00 deg

DRAFTS

A.P.	6ft- 7.29in (2.014m)
M.S.	6ft- 3.43in (1.916m)
F.P.	5ft-11.58in (1.818m)

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN, NO ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	17.455 ft
Mean Draft	=	6.286 ft
Projected Area (Hull)	=	2804.433 ft2
Vertical Arm (Hull)	=	19.488 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0035 LT/ft2
Displacement	=	279.12 LTons
Wind Heeling Lever	=	0.575 ft
Angle of Heel	=	1.89 deg (based on GMt)
Angle of Heel	=	1.90 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	4.214 ft
Heel to 1/2 freeboard	=	7.07 deg
Permissible heel angle	=	7.07 deg

TRIM & STABILITY SUMMARY
RETURN, W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	222.00	13.250	58.610A	0.000	
Constant	37.90	20.610	52.600A	0.000	0.00
Misc. Weight	13.50	21.741	51.500A	0.000	0.00
Diesel Oil	1.06	7.315	59.007A	0.000	7.22
Fresh Water	1.10	5.725	53.000A	0.000	86.03
Misc.	16.06	5.097	61.000A	0.000	0.00
TOTALS	291.62	14.100	57.612A	0.000	93.26

STABILITY CALCULATION

KMt	30.924	ft
VCG	14.100	ft
GMt	16.823	ft
F.S. Correction	0.320	ft
GMt Corrected	16.503	ft

TRIM CALCULATION

LCF Draft	6.470	ft
LCB (even keel)	56.62	ft-AFT
LCF	59.057	ft-AFT
MT1in	50	ft-LT/in
Trim	0.488	ft-AFT
List	0.00	deg

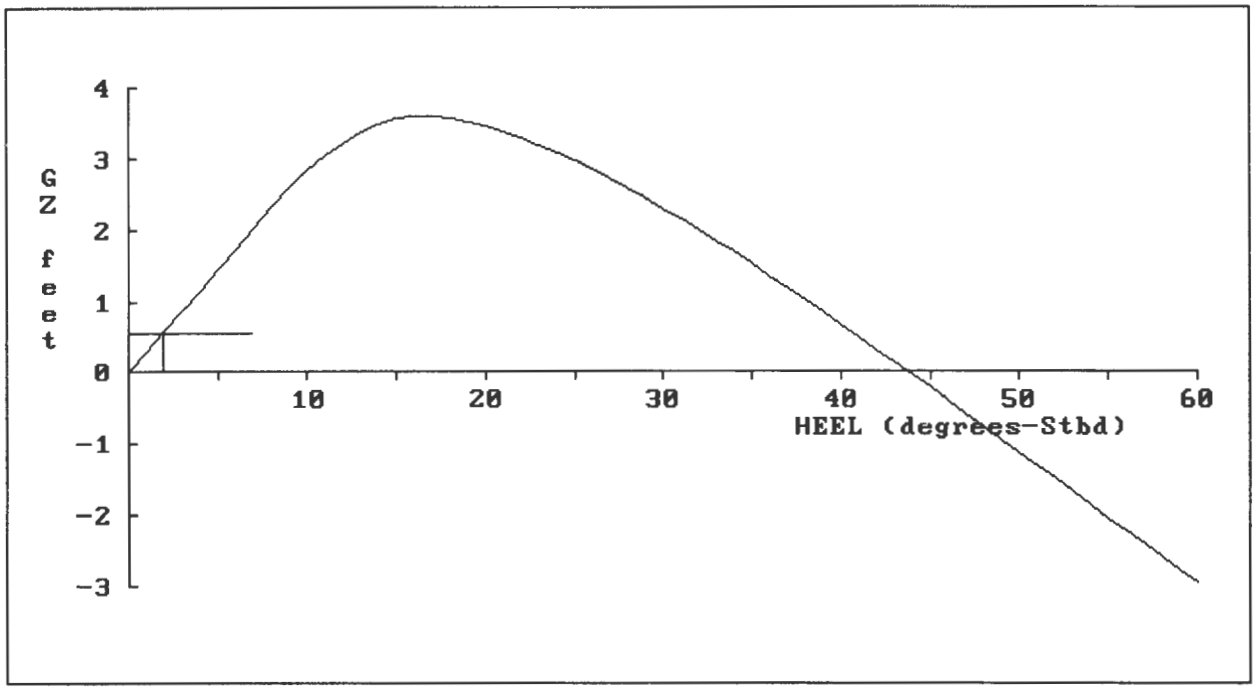
DRAFTS

A.P.	6ft- 8.20in	(2.037m)
M.S.	6ft- 5.28in	(1.963m)
F.P.	6ft- 2.35in	(1.889m)

Volpe, NTSC -- 105' DINNER BOAT HEC-LOAD V5.00
Project No. ADA STAB CHEK (by: MDYER) 02-20-1996

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN, W/ELEVATOR

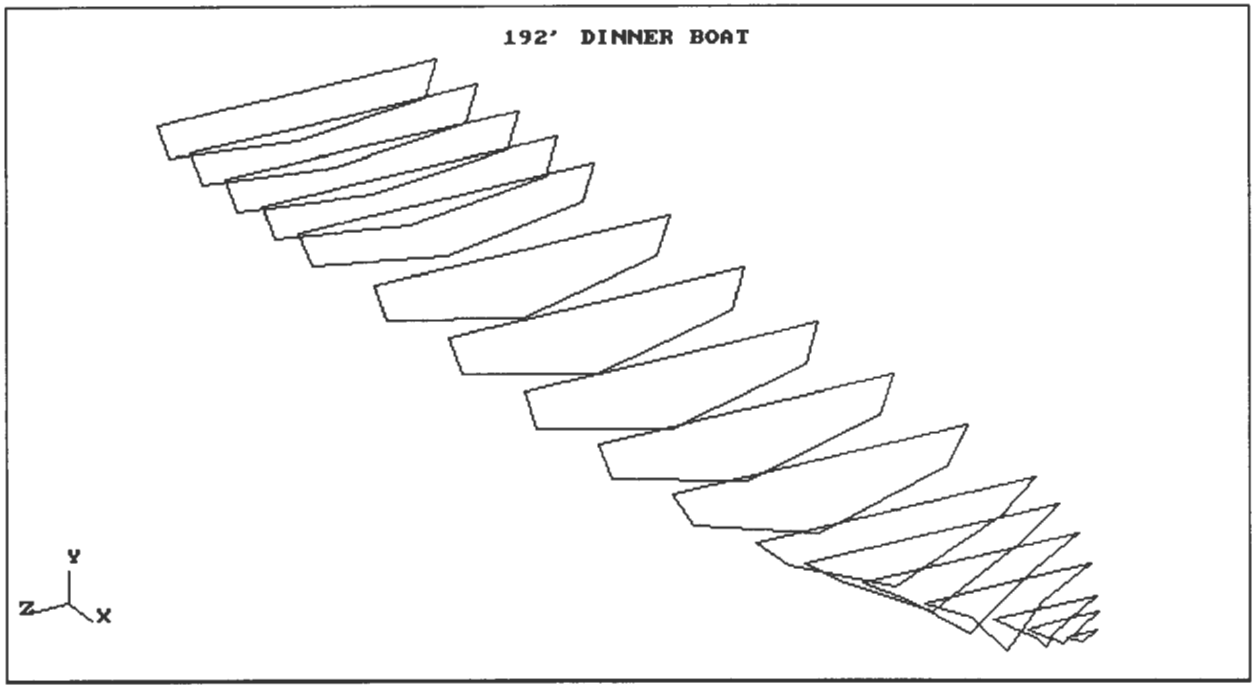


Heel resulting from steady wind pressure:

GMt (corrected)	=	16.503	ft
Mean Draft	=	6.440	ft
Projected Area (Hull)	=	2802.962	ft2
Vertical Arm (Hull)	=	19.495	ft
Projected Area (Cargo)	=	0.000	ft2
Vertical Arm (Cargo)	=	0.000	ft
Steady Wind Pressure	=	0.0035	LT/ft2
Displacement	=	291.62	LTons
Wind Heeling Lever	=	0.547	ft
Angle of Heel	=	1.90	deg (based on GMt)
Angle of Heel	=	1.91	deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	4.060	ft
Heel to 1/2 freeboard	=	6.81	deg
Permissible heel angle	=	6.81	deg


192' DINNER BOAT
Y
Z
X

DAMAGE STABILITY SUMMARY

RUN No.	FILE NAME	DAMAGED COMP. LISTING	---Intact Condition--- MN.DRAFT (ft)	VCG (ft)	GMt (ft)	---------Equilibrium Condition After Damage---------- HEEL (deg)	MAX.GZ (ft)	RANGE (deg)	AREA (ft-deg)	DAM.GMt (ft)	SURVIVAL
1	RTRN001A	1	6.960	16.950	11.558	0.0	2.161	34.31	33.95	11.515	Yes
2	RTRN002A	1,2	6.960	16.950	11.558	0.0	2.068	32.20	32.54	11.660	Yes
3	RTRN003A	2	6.960	16.950	11.558	0.0	2.097	33.03	32.96	11.551	Yes
4	RTRN004A	3	6.960	16.950	11.558	0.0	1.799	30.78	28.32	10.372	Yes
5	RTRN005A	4	6.960	16.950	11.558	0.0	1.496	27.22	22.72	8.437	Yes
6	RTRN006A	5	6.960	16.950	11.558	0.0	2.024	32.32	31.29	10.259	Yes
7	RTRN007A	5,7	6.960	16.950	11.558	0.3S	1.885	31.13	28.73	----	Yes
8	RTRN008A	10	6.960	16.950	11.558	0.0	1.587	28.36	23.91	8.030	Yes
9	RTRN009A	11	6.960	16.950	11.558	0.0	1.834	31.17	28.07	9.080	Yes
10	RTRN010A	12	6.960	16.950	11.558	0.0	1.838	31.27	28.18	9.148	Yes

TRIM & STABILITY SUMMARY
DEPART, NO ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	347.83	14.930	80.470A	0.000	
Constant	0.00	0.000	76.665A	0.000	0.00
Misc. Weight	53.20	26.567	76.695A	0.000	0.00
Diesel Oil	10.14	7.836	91.327A	0.000	0.00
Fresh Water	9.02	7.200	81.330A	0.000	0.00
Misc.	0.97	6.225	93.330A	0.000	55.54
TOTALS	421.16	16.044	80.303A	0.000	55.54

STABILITY CALCULATION

KMt	28.665 ft
VCG	16.044 ft
GMt	12.621 ft
F.S. Correction	0.132 ft
GMt Corrected	12.489 ft

TRIM CALCULATION

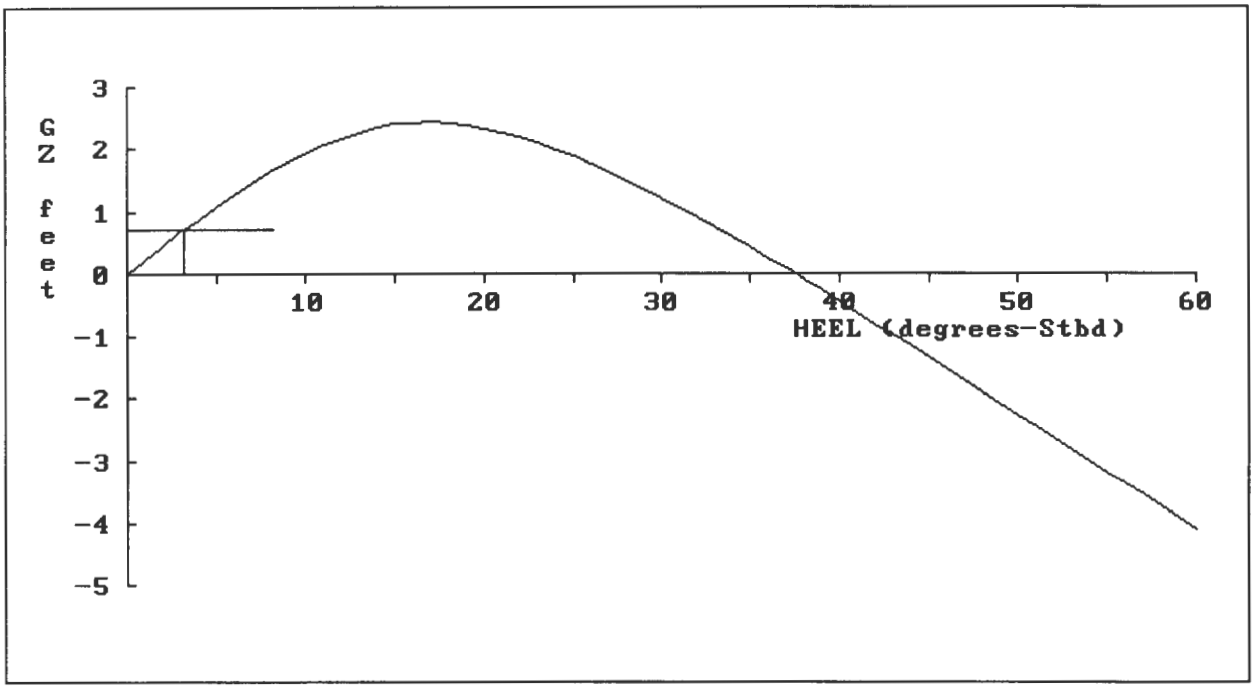
LCF Draft	6.831 ft
LCB (even keel)	83.21 ft-AFT
LCF	86.574 ft-AFT
MT1in	102 ft-LT/in
Trim	1.001 ft-FWD
List	0.00 deg

DRAFTS

A.P. 6ft- 4.74in (1.949m)
M.S. 6ft-10.74in (2.102m)
F.P. 7ft- 4.75in (2.254m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART, NO ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	12.489 ft
Mean Draft	=	6.895 ft
Projected Area (Hull)	=	4300.913 ft2
Vertical Arm (Hull)	=	22.788 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0035 LT/ft2
Displacement	=	421.16 LTons
Wind Heeling Lever	=	0.691 ft
Angle of Heel	=	3.17 deg (based on GMt)
Angle of Heel	=	3.15 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	3.855 ft
Heel to 1/2 freeboard	=	6.28 deg
Permissible heel angle	=	6.28 deg

TRIM & STABILITY SUMMARY
DEPART, W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	347.83	14.930	80.470A	0.000	
Constant	0.00	0.000	76.665A	0.000	0.00
Misc. Weight	75.50	27.699	76.686A	0.000	0.00
Diesel Oil	10.14	7.836	91.327A	0.000	0.00
Fresh Water	9.02	7.200	81.330A	0.000	0.00
Misc.	0.97	6.225	93.330A	0.000	55.54
TOTALS	443.46	16.765	80.120A	0.000	55.54

STABILITY CALCULATION

KMt	27.918 ft
VCG	16.765 ft
GMt	11.152 ft
F.S. Correction	0.125 ft
GMt Corrected	11.027 ft

TRIM CALCULATION

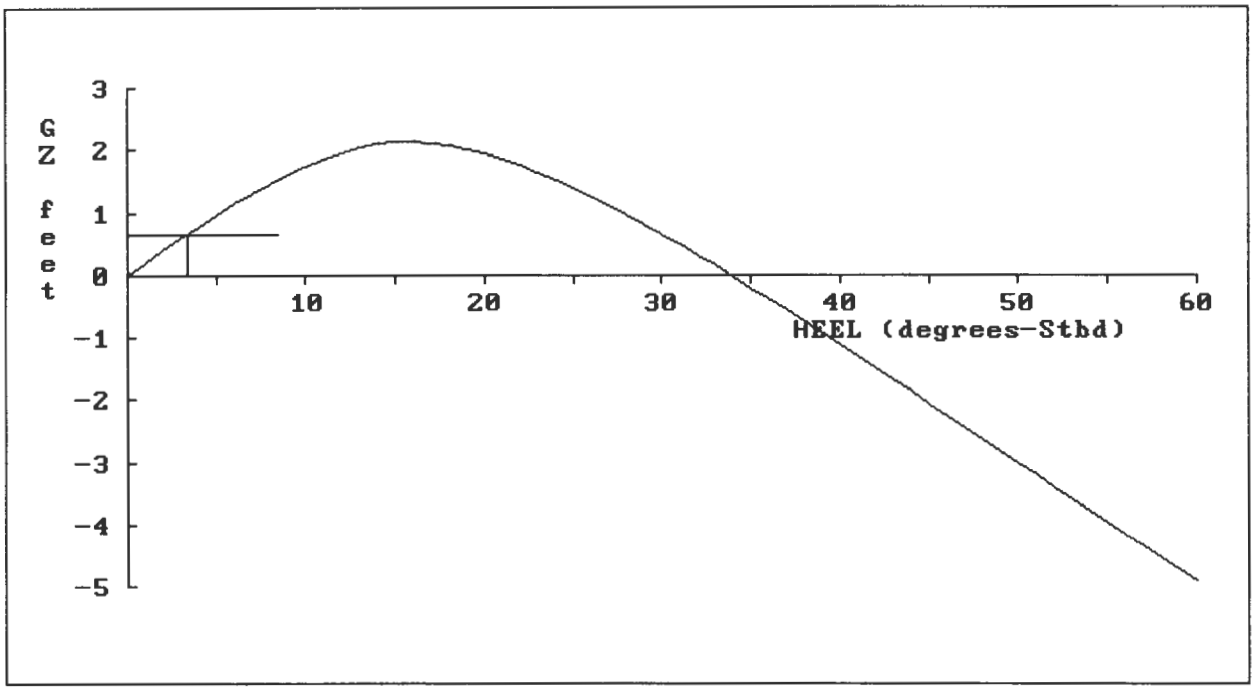
LCF Draft	7.009 ft
LCB (even keel)	83.35 ft-AFT
LCF	86.372 ft-AFT
MT1in	103 ft-LT/in
Trim	1.158 ft-FWD
List	0.00 deg

DRAFTS

A.P. 6ft- 6.04in (1.982m)
M.S. 7ft- 0.99in (2.159m)
F.P. 7ft- 7.94in (2.335m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART, W/ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	11.027 ft
Mean Draft	=	7.083 ft
Projected Area (Hull)	=	4312.066 ft2
Vertical Arm (Hull)	=	22.747 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0035 LT/ft2
Displacement	=	443.46 LTons
Wind Heeling Lever	=	0.654 ft
Angle of Heel	=	3.39 deg (based on GMt)
Angle of Heel	=	3.41 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	3.667 ft
Heel to 1/2 freeboard	=	5.98 deg
Permissible heel angle	=	5.98 deg

TRIM & STABILITY SUMMARY
RETURN, NO ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	347.83	14.930	80.470A	0.000	
Constant	0.00	0.000	76.665A	0.000	0.00
Misc. Weight	48.70	27.728	76.698A	0.000	0.00
Diesel Oil	1.01	7.836	91.327A	0.000	3.84
Fresh Water	0.90	7.200	81.330A	0.000	16.05
Misc.	9.67	6.225	93.330A	0.000	0.00
TOTALS	408.12	16.216	80.354A	0.000	19.90

STABILITY CALCULATION

KMt	29.284 ft
VCG	16.216 ft
GMt	13.068 ft
F.S. Correction	0.049 ft
GMt Corrected	13.019 ft

TRIM CALCULATION

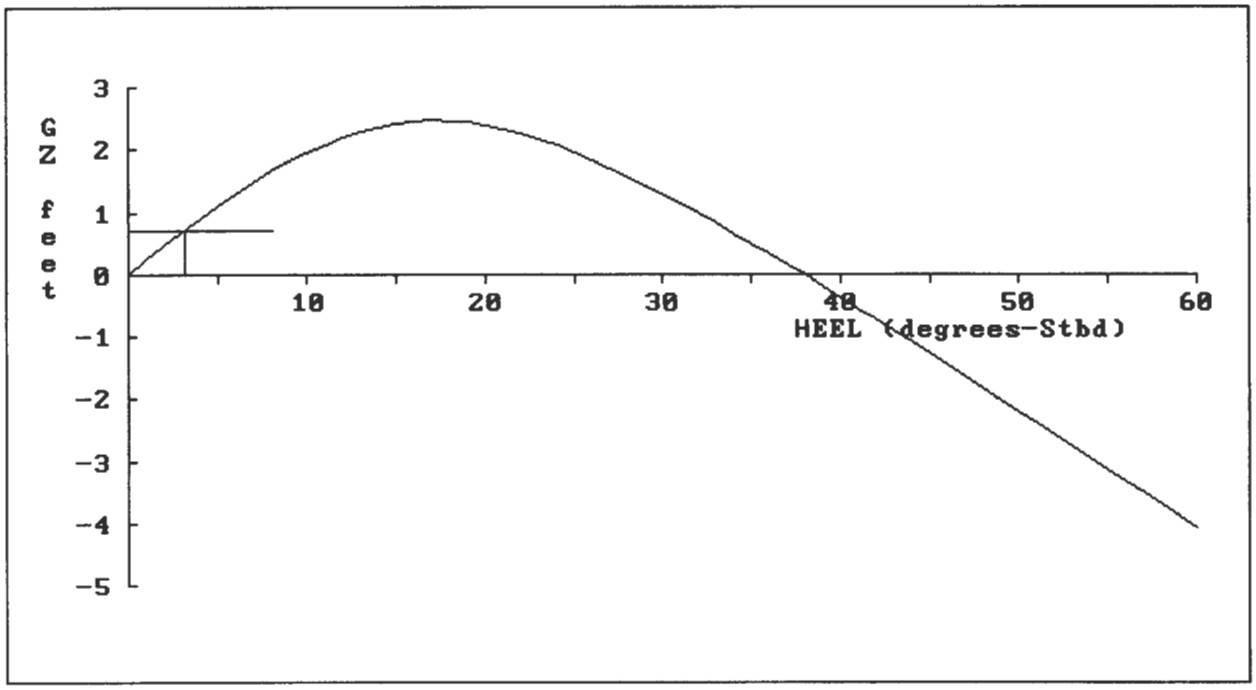
LCF Draft	6.724 ft
LCB (even keel)	83.07 ft-AFT
LCF	86.712 ft-AFT
MT1in	101 ft-LT/in
Trim	0.913 ft-FWD
List	0.00 deg

DRAFTS

A.P.	6ft- 3.93in (1.929m)
M.S.	6ft- 9.41in (2.068m)
F.P.	7ft- 2.89in (2.207m)

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN, NO ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	13.019 ft
Mean Draft	=	6.784 ft
Projected Area (Hull)	=	4304.178 ft2
Vertical Arm (Hull)	=	22.776 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0035 LT/ft2
Displacement	=	408.12 LTons
Wind Heeling Lever	=	0.716 ft
Angle of Heel	=	3.15 deg (based on GMt)
Angle of Heel	=	3.14 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	3.966 ft
Heel to 1/2 freeboard	=	6.46 deg
Permissible heel angle	=	6.46 deg

TRIM & STABILITY SUMMARY
RETURN, W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	347.83	14.930	80.470A	0.000	
Constant	0.00	0.000	76.665A	0.000	0.00
Misc. Weight	71.00	28.567	76.688A	0.000	0.00
Diesel Oil	1.01	7.836	91.327A	0.000	3.84
Fresh Water	0.90	7.200	81.330A	0.000	16.05
Misc.	9.67	6.225	93.330A	0.000	0.00
TOTALS	430.42	16.951	80.162A	0.000	19.90

STABILITY CALCULATION

KMt	28.320 ft
VCG	16.951 ft
GMt	11.369 ft
F.S. Correction	0.046 ft
GMt Corrected	11.322 ft

TRIM CALCULATION

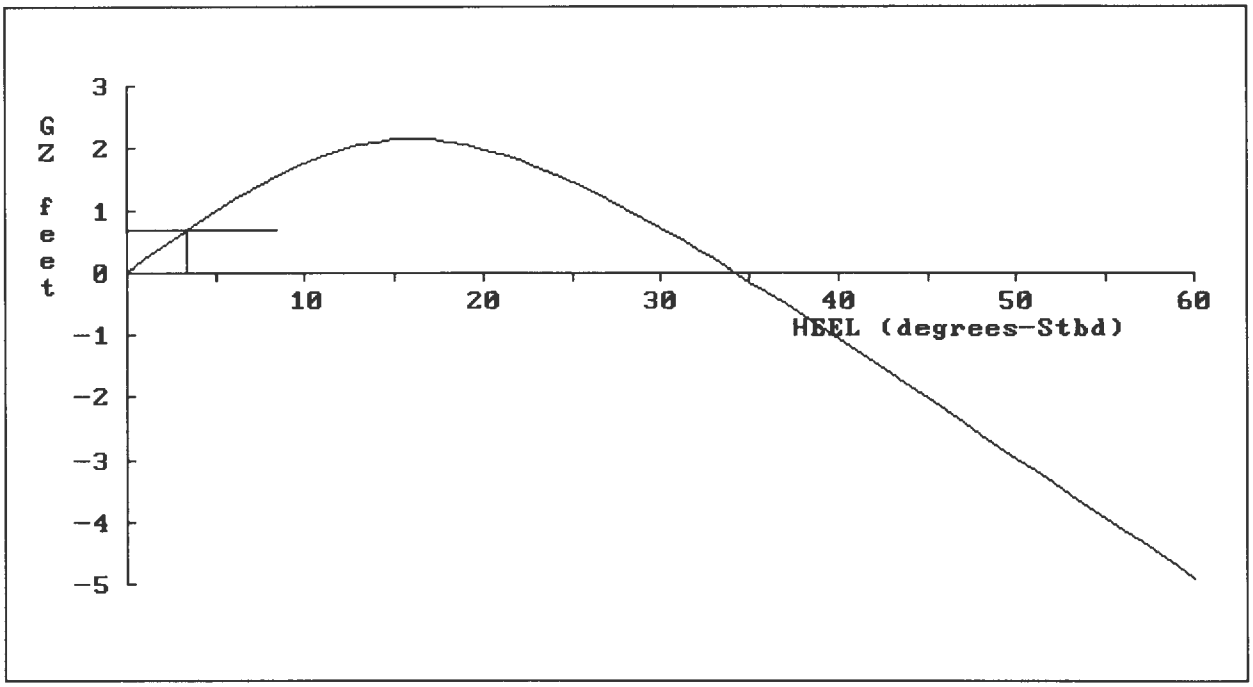
LCF Draft	6.905 ft
LCB (even keel)	83.28 ft-AFT
LCF	86.487 ft-AFT
MT1in	103 ft-LT/in
Trim	1.091 ft-FWD
List	0.00 deg

DRAFTS

A.P. 6ft- 5.16in (1.960m)
M.S. 6ft-11.70in (2.126m)
F.P. 7ft- 6.25in (2.292m)

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN, W/ELEVATOR

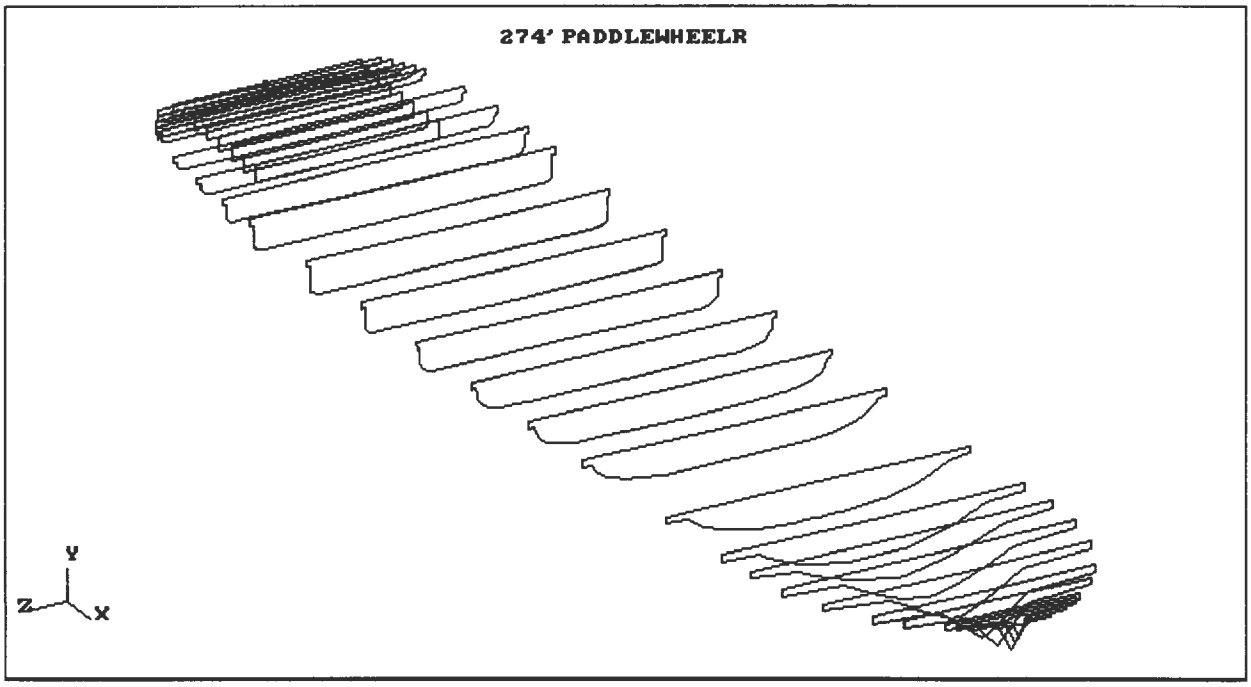


Heel resulting from steady wind pressure:

GMt (corrected)	=	11.322 ft
Mean Draft	=	6.975 ft
Projected Area (Hull)	=	4314.749 ft2
Vertical Arm (Hull)	=	22.737 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0035 LT/ft2
Displacement	=	430.42 LTons
Wind Heeling Lever	=	0.675 ft
Angle of Heel	=	3.41 deg (based on GMt)
Angle of Heel	=	3.40 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	3.775 ft
Heel to 1/2 freeboard	=	6.16 deg
Permissible heel angle	=	6.16 deg


274' PADDLEWHEELR
Y
Z
X

DAMAGE STABILITY SUMMARY

RUN			---Intact Condition---			---------Equilibrium Condition After Damage----------					
			MN.DRAFT	VCG	GMt	HEEL	MAX.GZ	RANGE	AREA	DAM.GMt	
No.	FILE NAME	DAMAGED COMP. LISTING	(ft)	(ft)	(ft)	(deg)	(ft)	(deg)	(ft-deg)	(ft)	SURVIVAL
1	RTRN001A	1,2	6.215	20.340	43.732	0.0	7.297	40.62	119.50	43.182	Yes
2	RTRN002A	2,3	6.215	20.340	43.732	0.0	6.479	38.60	108.27	42.115	Yes
3	RTRN003A	3,7	6.215	20.340	43.732	0.0	5.942	37.24	98.83	40.787	Yes
4	RTRN004A	7,10	6.215	20.340	43.732	0.0	5.242	35.02	87.43	40.115	Yes
5	RTRN005A	10,11	6.215	20.340	43.732	5.0S	1.477	16.63	15.99	----	Yes
6	RTRN006A	11,15	6.215	20.340	43.732	4.5S	1.693	18.56	20.46	----	Yes
7	RTRN007A	15,16,17	6.215	20.340	43.732	0.2S	5.237	35.33	87.05	----	Yes
8	RTRN008A	16,17,19	6.215	20.340	43.732	0.1S	5.842	37.29	97.47	----	Yes
9	RTRN009A	16,17,19,18	6.215	20.340	43.732	0.3S	3.674	28.97	60.17	----	Yes

TRIM & STABILITY SUMMARY
DEPART

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	1450.20	20.400	144.760A	0.000	
Constant	48.10	9.190	4.620A	0.000	0.00
Misc. Weight	95.26	24.491	124.175A	0.000	0.00
Diesel Oil	18.28	6.951	24.956A	0.000	21.37
Fresh Water	54.25	6.648	44.941A	0.000	627.07
Misc.	1.67	5.500	55.000A	0.000	60.46
TOTALS	1667.76	19.701	134.892A	0.000	708.90

STABILITY CALCULATION

KMt	63.009 ft
VCG	19.701 ft
GMt	43.308 ft
F.S. Correction	0.425 ft
GMt Corrected	42.883 ft

TRIM CALCULATION

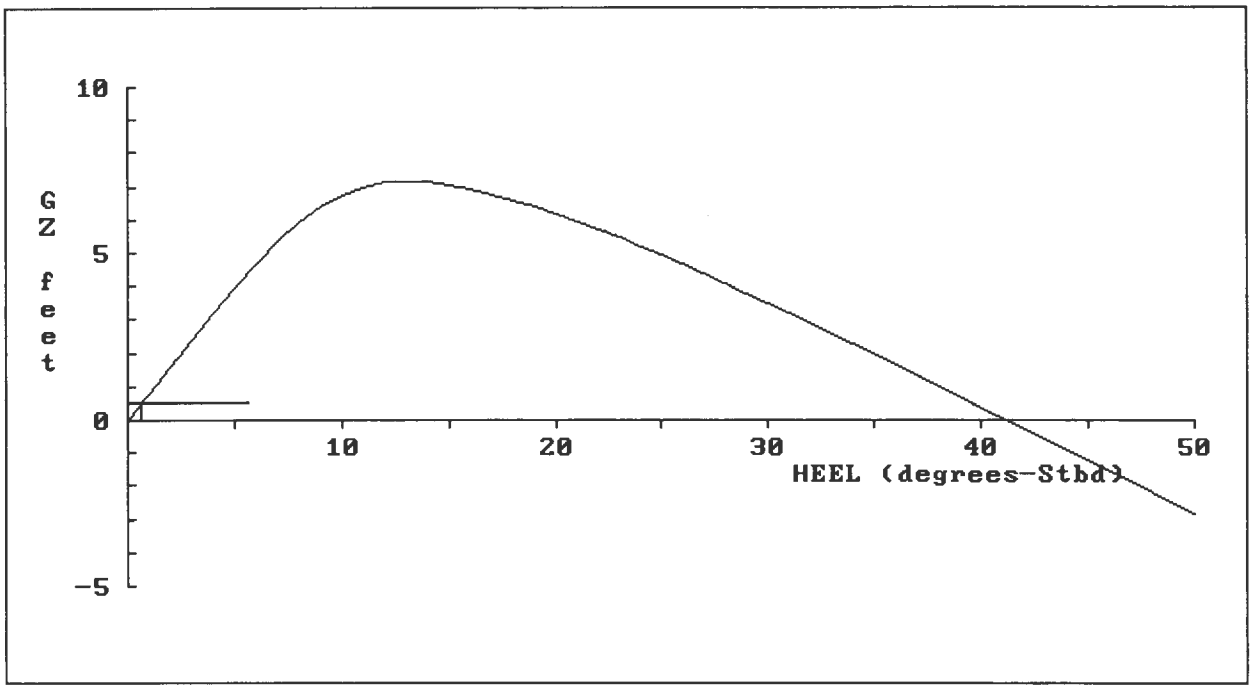
LCF Draft	6.365 ft
LCB (even keel)	134.87 ft-AFT
LCF	135.077 ft-AFT
MT1in	464 ft-LT/in
Trim	0.006 ft-AFT
List	0.00 deg

DRAFTS

A.P. 6ft- 4.41in (1.941m)
M.S. 6ft- 4.37in (1.940m)
F.P. 6ft- 4.33in (1.939m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART



Heel resulting from steady wind pressure:

GMt (corrected)	=	42.883	ft
Mean Draft	=	6.364	ft
Projected Area (Hull)	=	9823.984	ft2
Vertical Arm (Hull)	=	27.232	ft
Projected Area (Cargo)	=	0.000	ft2
Vertical Arm (Cargo)	=	0.000	ft
Steady Wind Pressure	=	0.0035	LT/ft2
Displacement	=	1667.76	LTons
Wind Heeling Lever	=	0.496	ft
Angle of Heel	=	0.66	deg (based on GMt)
Angle of Heel	=	0.64	deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	5.636	ft
Heel to 1/2 freeboard	=	5.19	deg
Permissible heel angle	=	5.19	deg

TRIM & STABILITY SUMMARY
DEPART W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	1450.20	20.400	144.760A	0.000	
Constant	48.10	9.190	4.620A	0.000	0.00
Misc. Weight	117.56	26.579	127.367A	0.000	0.00
Diesel Oil	18.28	6.951	24.956A	0.000	21.37
Fresh Water	54.25	6.648	44.941A	0.000	627.07
Misc.	1.67	5.500	55.000A	0.000	60.46
TOTALS	1690.06	19.909	134.973A	0.000	708.90

STABILITY CALCULATION

KMt	62.664	ft
VCG	19.909	ft
GMt	42.754	ft
F.S. Correction	0.419	ft
GMt Corrected	42.335	ft

TRIM CALCULATION

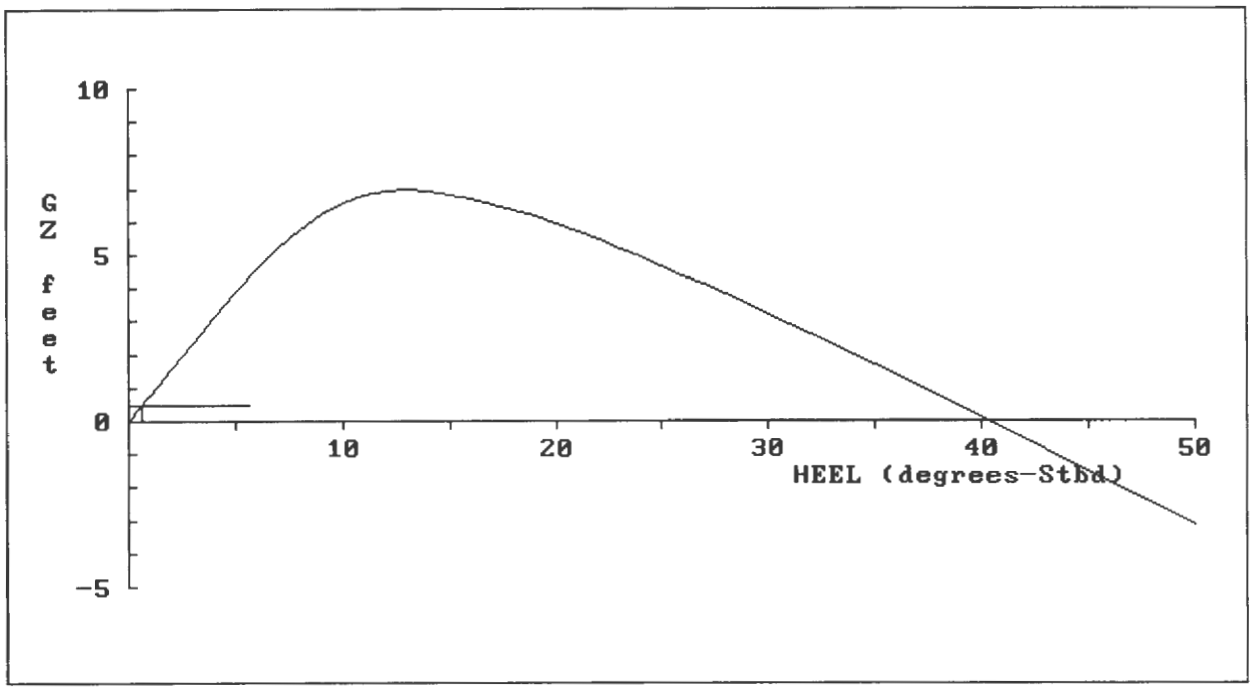
LCF Draft	6.426	ft
LCB (even keel)	134.89	ft-AFT
LCF	135.431	ft-AFT
MT1in	471	ft-LT/in
Trim	0.025	ft-AFT
List	0.00	deg

DRAFTS

A.P. 6ft- 5.25in (1.962m)
M.S. 6ft- 5.10in (1.958m)
F.P. 6ft- 4.95in (1.954m)

STATICAL STABILITY
per USCG Modified Weather Criterion

DEPART W/ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	42.335	ft
Mean Draft	=	6.425	ft
Projected Area (Hull)	=	9826.252	ft2
Vertical Arm (Hull)	=	27.227	ft
Projected Area (Cargo)	=	0.000	ft2
Vertical Arm (Cargo)	=	0.000	ft
Steady Wind Pressure	=	0.0035	LT/ft2
Displacement	=	1690.06	LTons
Wind Heeling Lever	=	0.489	ft
Angle of Heel	=	0.66	deg (based on GMt)
Angle of Heel	=	0.64	deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	5.575	ft
Heel to 1/2 freeboard	=	5.14	deg
Permissible heel angle	=	5.14	deg

TRIM & STABILITY SUMMARY
RETURN

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	1450.20	20.400	144.760A	0.000	
Constant	48.10	9.190	4.620A	0.000	0.00
Misc. Weight	90.76	25.110	120.912A	0.000	0.00
Diesel Oil	1.92	6.951	24.956A	0.000	21.37
Fresh Water	5.71	6.648	44.941A	0.000	627.07
Misc.	15.02	5.500	55.000A	0.000	60.46
TOTALS	1611.72	20.127	137.901A	0.000	708.90

STABILITY CALCULATION

KMt	64.065 ft
VCG	20.127 ft
GMt	43.938 ft
F.S. Correction	0.440 ft
GMt Corrected	43.498 ft

TRIM CALCULATION

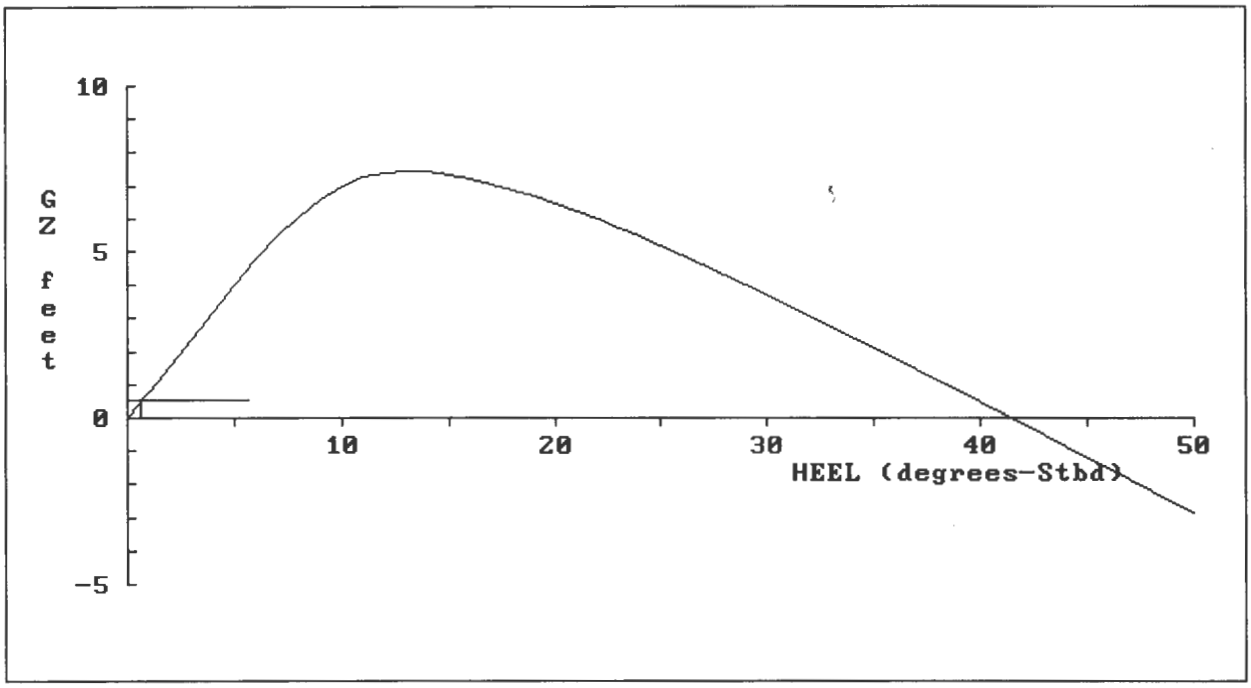
LCF Draft	6.209 ft
LCB (even keel)	134.83 ft-AFT
LCF	134.457 ft-AFT
MT1in	449 ft-LT/in
Trim	0.919 ft-AFT
List	0.00 deg

DRAFTS

A.P.	6ft- 7.40in (2.017m)
M.S.	6ft- 1.89in (1.877m)
F.P.	5ft- 8.37in (1.737m)

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN



Heel resulting from steady wind pressure:

GMt (corrected)	=	43.498	ft
Mean Draft	=	6.157	ft
Projected Area (Hull)	=	9825.620	ft2
Vertical Arm (Hull)	=	27.229	ft
Projected Area (Cargo)	=	0.000	ft2
Vertical Arm (Cargo)	=	0.000	ft
Steady Wind Pressure	=	0.0035	LT/ft2
Displacement	=	1611.72	LTons
Wind Heeling Lever	=	0.515	ft
Angle of Heel	=	0.68	deg (based on GMt)
Angle of Heel	=	0.66	deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	5.843	ft
Heel to 1/2 freeboard	=	5.38	deg
Permissible heel angle	=	5.38	deg

TRIM & STABILITY SUMMARY
RETURN W/ELEVATOR

ITEM	WEIGHT LTons	VCG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	1450.20	20.400	144.760A	0.000	
Constant	48.10	9.190	4.620A	0.000	0.00
Misc. Weight	113.06	27.160	124.874A	0.000	0.00
Diesel Oil	1.92	6.951	24.956A	0.000	21.37
Fresh Water	5.71	6.648	44.941A	0.000	627.07
Misc.	15.02	5.500	55.000A	0.000	60.46
TOTALS	1634.02	20.337	137.944A	0.000	708.90

STABILITY CALCULATION

KMt	63.531 ft
VCG	20.337 ft
GMt	43.194 ft
F.S. Correction	0.434 ft
GMt Corrected	42.760 ft

TRIM CALCULATION

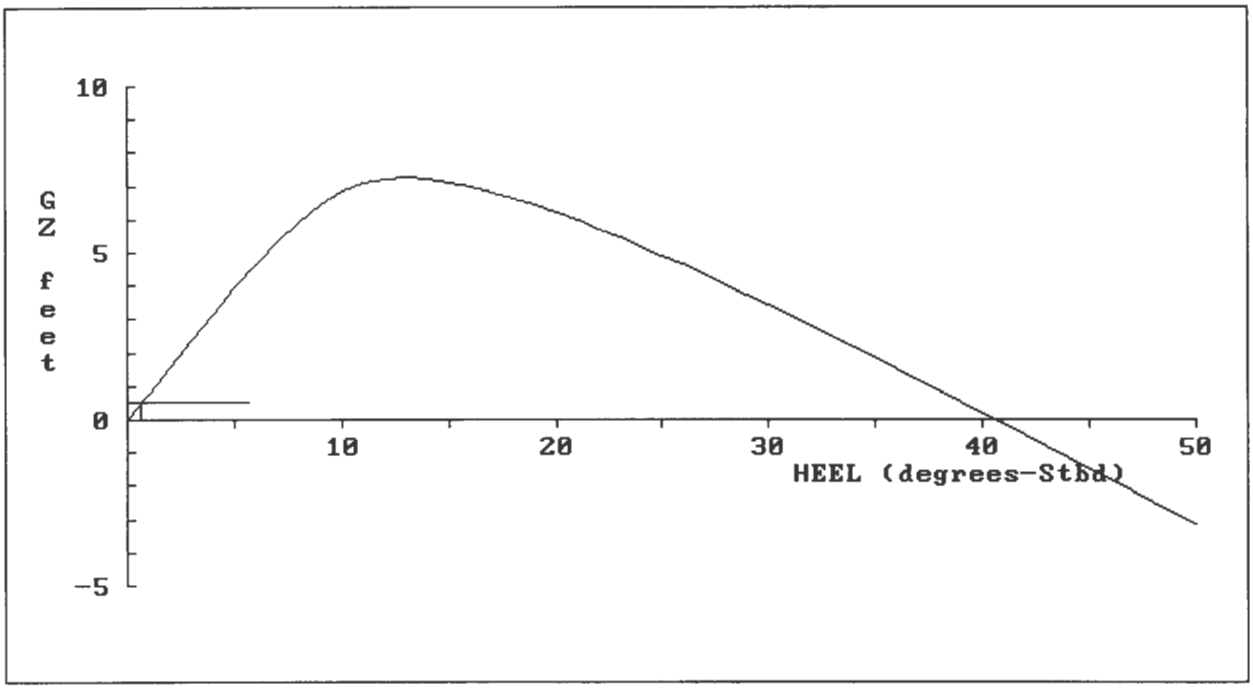
LCF Draft	6.271 ft
LCB (even keel)	134.85 ft-AFT
LCF	134.542 ft-AFT
MT1in	453 ft-LT/in
Trim	0.931 ft-AFT
List	0.00 deg

DRAFTS

A.P. 6ft- 8.21in (2.037m)
M.S. 6ft- 2.62in (1.895m)
F.P. 5ft- 9.04in (1.754m)

STATICAL STABILITY
per USCG Modified Weather Criterion

RETURN W/ELEVATOR



Heel resulting from steady wind pressure:

GMt (corrected)	=	42.760 ft
Mean Draft	=	6.219 ft
Projected Area (Hull)	=	9827.732 ft2
Vertical Arm (Hull)	=	27.224 ft
Projected Area (Cargo)	=	0.000 ft2
Vertical Arm (Cargo)	=	0.000 ft
Steady Wind Pressure	=	0.0035 LT/ft2
Displacement	=	1634.02 LTons
Wind Heeling Lever	=	0.508 ft
Angle of Heel	=	0.68 deg (based on GMt)
Angle of Heel	=	0.66 deg (based on GZ curve)

Permissible angle of heel:

Freeboard to deck edge	=	5.781 ft
Heel to 1/2 freeboard	=	5.33 deg
Permissible heel angle	=	5.33 deg

APPENDIX G

STATUTORY ISSUES FOR PASSENGER VESSEL ACCESS

Accessibility Planning
Facilities
Transportation
Research

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617.647.0809
Fax
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Aventura,
FL 33180

V/TDD
305.931.7721

WATER ACCESS: EXEMPTIONS REPORT

13 June1995

Following are concepts from the ADA and the ACAA which may provide useful antecedents to set access standards for new construction or alterations of vessels and/or marine facilities. It is important to note that many of these exceptions are explicitly included in the statutory language. We will need to consider whether such exceptions are consistant with the language of the ADA in the context of water transportation.

1. ACAA

In reviewing ADA "exceptions", the Air Carriers Access Act (ACAA)offers some important parallels and antecedents for USDoT in addition to other parts of the ADA.

Air carriers operate the airplanes, but do not necessarily own or operate the landside facility (i.e., airport). This is analogous to vessel operators who may not run or operate dockside facilities (and vice versa).

The ACAA permits different means of providing access for smaller aircraft and larger aircraft and excludes coverage altogether for the smallest planes. (This derives from language in the ACAA which does not exist in the ADA.) In general, three categories of aircraft are established based on the number of passengers they carry > 30, >60 and >100 passengers. Accessible boarding is required, but it may be achieved through various means, including: loading bridges, mobile

lounges, and self propelled wheelchair lifts. Boarding bridges are standard for boarding and disembarking larger aircraft at most airports. Lifts are more commonly utilized at smaller airports or when boarding smaller planes.

Airline passengers who use wheelchairs are generally not able to use their own chairs on board the aircraft. "Straight-back boarding chairs" are used for passengers who cannot walk on-board to their seats. An on-board wheelchair is not required unless the aircraft has an accessible lavatory or if advance notice is provided by an individual for aircraft with 60+ seats. Aircraft with 100+ seats are required to have a priority space in the cabin designated for stowage of at least one standard wheelchair, as well as the one designed for on-board use.

An individual wishing to receive a variety of assistance may be required to provide up to 48 hours advance notice and 1 hour advance check-in. Services that can require advance notice include transportation of an electric wheelchair on an aircraft with fewer than 60 seats and group travel by ten or more qualified individuals with a disability.

The ACAA provides an antecedent by establishing different levels of access in reservations, boarding, and on-plane accommodations, many of which may be useful to DOT's development of water transportation regulations and design guidelines. The precise use of this antecedent, however, may depend upon whether the statutory language of the ADA permits the same types of distinctions as the ACAA.

Like air carriers, water transportation providers have unique factors in their business that may not allow for standard application of existing regulations and accessibility guidelines.

2. Dining & 2-Level Cars

The ADA does not require access to all levels of vehicles in rail dining cars. Typically, two-level commuter rail cars provide access to only one level, and that may be a small "mid-level" with room for only a limited number of seats and tie-downs. These standards provide some antecedent for limiting vessel access to certain parts of the vessel, particularly where the primary purpose is transportation versus recreation. Dinner cruise vessels and cruise ships are probably more analogous to restaurants and hotels than train cars. In these environments, relying on the vehicle access standards may not make sense. It will be necessary to determine if the statutory language of the ADA will support such distinctions regarding vessels.

3. Undue Burden

Consideration of "undue burden" and "undue hardship" provide similar protections for employers, public accommodations, and public entities otherwise required to provide access to accommodations. For the most part, these do not apply to specific elements of ADAAG for new construction or alterations. That is, a transportation provider cannot claim that providing an elevator is an "undue hardship", unless the elevator is being proposed only because of a specific employee's need for a reasonable accommodation.

Moreover, the ADA establishes an overall requirement that all newly acquired or re-manufactured vehicles to be used in providing fixed route transportation services must be accessible. The only exception that can be made in this regard is when an entity can demonstrate that after making a good-faith effort to find such vehicles, none were available. Additional cost is not a consideration in determining this exception; only whether the vehicles can be bought or manufactured. In actual practice, the ADA provides no exception for providing some access to vehicles to be used in fixed route service. As regards the concept of undue burden, Congress has implicitly recognized that some burden of cost and effort is required.

4. Elevator Exemption

Private entities are exempted from installing elevators in facilities that are less than 3 stories or less than 3,000 square feet per floor. This exemption is not allowed for transportation facilities, shopping malls, health care, or publicly owned facilities. Note: All other access requirements apply, even when no elevator connects different levels.

This exemption acknowledges both cost and complexity issues. But that exemption is limited to the private sector, and does not apply at all to transportation facilities. The fact that the ADA excludes transportation facilities from this provision is an indication of the especially high level of importance Congress places on transportation access.

5. New Construction vs. Alterations

In new construction, access must be provided unless it is "technically infeasible." In new construction, the standards for determining technical infeasibility are very high. Cost is not the determinant. In alterations, technical infeasibility includes modifying or moving structural (i.e., load bearing) members. The federal Access Board and USDoJ consistently have advised that adding elevators to existing facilities is generally not considered to be technically feasible, and therefore not required.

Alterations generally must meet new construction standards "to the maximum extent feasible." Again, this test is based upon technical ability, not on cost.

DoT should address what "to the maximum extent feasible" might mean in marine facilities and vessels.

6. Taxis

Surface vehicles carrying less than 16 people (including the driver) are not required to have lift or ramped access. The concept of smaller vehicles - and, perhaps, smaller vessels - being exempted from some ADA requirements has some antecedent if it is supported by the statutory language.

Taxi service providers cannot discriminate based on disability, i.e., taxi drivers cannot refuse a person using a service dog or a person using a wheelchair. However, there are no accessible vehicle requirements for vehicles carrying less than 16 people. Because sedan taxis carry less than 16 people, they are not required to accommodate a person in a wheelchair. If, however, an individual

is able and willing to transfer out of her wheelchair and into the sedan, and the chair can be placed in the trunk of the sedan, the taxi operator is required to provide these services. No charge for stowing the wheelchair is permitted unless there is a common charge for all luggage stowage.

The relevance to water transportation may be two fold. DoT may be able to consider what size or type of service or vessel is comparable to that offered by a taxi. Here DoT might propose exempting specific, smaller vessels from access design standards. At the same time the the non-discrimination service requirements would be maintained. Thus, a particular vessel might not be adapted to accommodate a person in a wheelchair, but would permit a person with lower-body weakness to board with assistance, and stow the wheelchair during the voyage. Again, it will be necessary to determine when such distinctions are supported by the statutory language of the ADA.

7. Other Demand Responsive Services

The ADA does not require that every vehicle acquired or used solely in demand response service be accessible. The USDoT regulations establish six criteria for measuring "equivalence" of service and, when these standards have been met, an inaccessible vehicle may be obtained. Generally speaking, this means that where equivalence has been established, and demand for accessible service is stable, it is permissible to replace an old inaccessible vehicle with a new inaccessible vehicle. Given the nature of water transportation services, and

because the definition of equivalence is quite specific, the applicability of this exception is probably quite limited.

8. Transportation vs. Non-transportation Providers

There are different ADA requirements regarding service provision and governing the acquisition of accessible vehicles for entities that are primarily transportation providers versus those for which transportation is not the primary business. The former are governed by USDoT regulations, the latter by USDoJ. There is an antecedent, then, for different service standards for services operated by a ferry operator and another operated, for example, by a restaurant or hotel. However, the standards defining an accessible vehicle are the same -- written by the ATBCB -- whether USDoT or USDoJ regulations apply.

9. Non-occupiable Spaces, etc.

ADAAG exempts the following spaces from elevator requirements:

- observation galleries used primarily for security purposes; or
- in non-occupiable spaces accessed only by ladders, catwalks, crawl spaces, very narrow passageways, or freight (non-passenger) elevators, and frequented only by service personnel for repair purposes; such spaces include, but are not limited to, elevator pits, elevator penthouses, piping or equipment catwalks. This exemption opens the door to exemption of some areas on vessels.

10. Employee vs. Public or Common Use Areas

For the most part, ADAAG does not distinguish between public and employee areas. However, employee "work areas" need only to be on an accessible route, and be "approachable, enterable, exitable." Maneuvering space within an

employee's work area is not necessarily required.

Furthermore, there are no accessible design standards for new construction or alteration of vehicles that are mandated by the potential needs of bus drivers or train engineers. These would be mandated only as an after-the-fact reasonable accommodation for a specific, qualified employee. If train engines do not need to be built accessible for the engineer, then there is clear precedence for exempting vessel captains' areas and vessel areas used for occasional maintenance and repair.

These types of exemptions do not appear to exist in facilities - except for the "non-occupiable" spaces, etc. (see the section "Non-occupiable Spaces" above). Thus, water transportation facilities such as those used by Boston Harbor Island/Third Harbor Tunnel workers have no precedence for a general exemption.

11. Key Station Requirements & One-Car-Per-Train Rule

Rail service providers (excluding Amtrak)
were required to identify "key stations" within their systems and make them accessible by 1993. Key stations are determined through a public process by the transit provider, using criteria established by the USDoT regulations. Where stations required structural modifications, additional time to complete these modifications for compliance could be approved by USDoT. Stations that were not designated as "key stations" have no barrier removal requirements unless they are altered. Then those improvements have to be accessible,

as well as specific "path of travel" barrier removal undertaken.

The key station concept addresses several concerns. Rail stations undergo significant alterations very infrequently and are therefore analogous to most water transportation facilities. For the ADA's transportation provisions to have any significant impact, pro-active barrier removal is required. The key station approach provides a balance between immediate access needs, with provision for the difficulty involved in accomplishing barrier removal. Where cost and difficulty is great, accessibility requirements may be delayed, but only according to an approved plan. Delays in compliance must be justified to USDoT. Except where extensions were granted by USDoT, all key stations are now required to be accessible. This is the case even though it will not be until later this year that every train will be required to include an accessible coach under the one-car-per-train rule. (Other stations will be made accessible in the course of planned new construction and alterations.) Key stations typically represent approximately 25%-33% of a system's stations.

Congress established the "one-car-per-train" rule to guarantee access to every train. Effective the summer of 1995, every train must be accessible through at least one car when that train is at a key station. This requires that a rail service must either modify its current rolling stock or purchase new cars. There is no provision in the law for delaying compliance with this requirement. The rule does, however, establish the idea that not all parts

(cars) of a train must be accessible for the train to be accessible. Conversely, the rule does not permit a rail transit provider to acquire inaccessible vehicles even after one-car-per-train is accessible. All newly built or re-manufactured rail cars must be accessible.

The relevance of the key station requirement is probably limited in our discussion of water transportation access. The key station concept is based on the fact that rail transit systems typically have a number of stations, relatively close together. If one station is not accessible, presumably another, not too far-off, will be. And wherever that key station is, one will know that the trains serving it will all be accessible. One's choice in water transportation service is rarely so great.

A more relevant antecedent may be the ADA's requirements regarding AMTRAK. AMTRAK stations, except in some larger downtown areas, are relatively far apart. The ADA requires that all AMTRAK stations must be made accessible, but provides a very long period of time to accomplish this task. This long time frame is explicit in the law itself, however, and so this approach may not be available in considering water transportation facility access.

These requirements - as both minimum standards and exemptions - suggest that while all vessels providing transportation services probably need to be accessible, it may not be necessary for every part of the vessel to accommodate persons in

wheelchairs or provide full accessibility. If it is possible to identify a type of water transportation service that is truly demand responsive, however, it may be argued that, so long as equivalent service is available to persons with disabilities, then not all vessels need to be accessible. We would need to consider whether truly demand responsive service exists in this context.

12. Paratransit

The ADA requires public transit providers of fixed route services to provide paratransit (demand-response curb-to-curb) service to individuals who, because of their disability, cannot use the fixed route service. Although commuter service is not required to include such complementary paratransit, the definition of such commuter service in the USDoT regulations does not include water transportation, despite the fact that most water transportation services would appear to otherwise meet the definition included in the regulation. (No water transportation provider has submitted a paratransit plan required by the ADA of public transit providers for providing the complementary paratransit.) Nevertheless, it would appear that public entities currently providing water transportation services may have some obligations under this provision of the law.

If water transportation is not determined to be a commuter service (like commuter rail or express buses), there would be a requirement to provide paratransit service. This requirement would extend to an area 3/4 of a mile around each dock served, and need to be provided to anyone

who because of his disability cannot get to or from the dock, onto or off the vessel or cannot safely ride the vessel.

The provision of this paratransit service does not exempt the fixed route provider from other ADA requirements discussed above to make its vehicles and facilities accessible. Feeder service to persons with disabilities to and from a dock to origins or destinations no more than 3/4 of a mile away might be required in some cases. Nevertheless, for the same reasons that paratransit service is not regarded as an effective alternative to providing accessible service on commuter rail lines, it is unlikely that paratransit would be an effective alternative to the water transportation service itself, even if it turns out that USDoT intends for such service to be covered by this requirement.

13. Historic Preservation

The ADA exempts truly historic (not new vehicles made to look old) vehicles from access requirements. The ADA limits access requirements in historic properties (buildings, landscapes) to one entrance, one level, and one bathroom. Are there historic vessels still providing water transportation, and historic marine facilities? If so, what entity certifies them as historic?

14. Lifts vs. Elevators

Lifts are a commonly accepted means of providing access to vehicles. The lifts are typically on the vehicle, but may also be in the facility. In the facilities, however, lifts are the least preferred means of access. Ramps and elevators are almost always preferred by individuals who need them. For the most part, lifts are accepted only when there is no alternative.

All lifts have inherent problems, such as:

- Lifts are given to mechanical failure
- Lifts require more regular maintenance than they typically get
- When not available, there is usually no alternate means of access
- They often require assistance (always on vehicles)
- Human failure -lost keys, lack of training in use, make lifts less reliable than they might otherwise be
- Even under the best of circumstances, lifts are slow. Boarding one person is slow. Boarding more than one person can wreak havoc with headways and schedules.

The transportation environment assumes assistance to persons with disabilities in boarding the vehicle - by bus drivers, conductors, or station personnel. In fact, USDoT regulations require that this assistance be provided and that transit personnel be trained in the operation and use of the equipment.

At most facilities, however, the assumption is that lifts should be independently operable by the individual who needs it.

In the water transit environment, lifts have proved unreliable in many settings because they have not typically been designed to withstand the rigors of salt, water, and marine weather conditions. Such problems were also commonplace in the early days of bus-lift design and use, however. As vendors developed their product, and transit providers gained experience in their use, these problems have largely disappeared.

There is some evidence that if the market were there, the problems inherent with the use of lifts in the marine environment could be solved. Without a regulatory incentive, and addressing other conflicting standards (ASME, for example), there would be little incentive for lift product manufacturers to address the marine transit market. There is, however, adequate and widespread precedent for the use of lifts in the transit- particularly vehicle- environment.

The ADA specifically allows alternate means of access through "equivalent facilitation"- where the alternate means provides "equal or greater access". Within transportation, USDoT considers (grants and denies) equivalent facilitation requests. Public accommodations and commercial facilities can employ equivalent facilitation without any approval process through DoJ or the ATBCB.

Equivalent facilitation would allow marine facility and vessel operators to meet the performance standards of ADAAG through alternative means. This provision was included specifically in anticipation of new products and new technologies to address access issues. With this provision, USDoT can set performance standards for access (like the elevator cab size standards) without specifying the means of meeting that standard. Although USDoT will probably want to know that meeting new regulations and design guidelines is feasible with current methods and technologies, it can also reasonably expect the ingenuity of water transportation providers,

designers, and product manufacturers to find "better ways" to meet these new standards.

15. Fundamental Nature

The ADA does not ask employers, public accommodations, or public entities to provide any access accommodations that would "alter the fundamental nature" of the business or activity. Thus, USDoT regulations and accessibility guidelines cannot require, for example, handrails at dock edges that would interfere with boat dockings. Presumably, boat docking is part of the fundamental nature of water transportation.

This is a similar concept to "technical infeasibility", whereby ADAAG standards need not be strictly applied.

16. Security

Design requirements that interfere with general security need not be implemented. In this case access requirements are not waived. Rather, alternate means of access are allowed. For example, thick bullet-proof glass may inhibit communication between a bank teller and customer, but may remain for security purposes. However, a two-way communication system could be provided.

The USCG has substantial safety and security requirements on vessels. This provision - along with the "fundamental nature" provision - provides impetus for alternative access.

17. Training

USDoT regulations require each public or private entity that operates a fixed route or demand responsive system to train its personnel regarding both the safe and effective operation of equipment and vehicles as well as how

to properly assist and treat individuals with disabilities.

Training of transit personnel- for general protocol and operations as well as emergency procedures- is routine. So, too, for water transportation personnel. USDoT might add performance standards for training water transportation personnel who assist passengers so that they provide assistance to passengers with disabilities (vs. denying it), and so that assistance is appropriate. Whenever water transportation access depends on assistance, then USDoT has precedent for requiring personnel training.

18. Levels of Access

In the advanced notice of proposed rulemaking for ADAAG for recreation facilities, the ATBCB is soliciting comments on levels of access. This concept allows for greater and lesser degrees of physical access based on a number of factors (level of development, user expectation, etc.)

Like outdoor recreation environments, the marine environment poses unique challenges to provide physical access. The concept of tiers of access to marine facilities has been proposed in Massachusetts and in the Federal Recreation ADAAG. It is a controversial approach, but one which is worth pursuing in the marine environment.

APPENDIX H

POINTS OF CONTACT FOR THIS STUDY

APPENDIX H

Points of Contact for ADA Waterborne Transportation Access Study

GOVERNMENT

OFFICE OF THE SECRETARY OF TRANSPORTATION (OST)

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APPENDIX H

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Note: Coast Guard local Marine Safety Office contacts are listed in Appendix A with fleet data spreadsheet.

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APPENDIX H

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APPENDIX H

OPERATORS

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APPENDIX I

MINUTES OF THE APRIL 15, 1996 ADA/ WATERCRAFT ACCESS MEETING

April 15 ADA Watercraft Access Meeting
Minutes of the Meeting

The meeting was held in the Nassif Headquarters Building of the Department of Transportation in Washington, D.C. Its purpose was to bring together representatives of the passenger vessel industry, government and national advocacy groups to consider in depth the safety and technical issues of access onboard passenger vessels. The goal was to produce sensible solutions relative to passenger safety and to recommend topics for further research by fostering a cooperative approach with attention to the views of all parties. We believe that the meeting fostered better understanding by industry of the access needs of passengers with disabilities, insight for the disability community into the constraints of this unique mode of transport, and improved knowledge for the Government on which to base a valid decision making process.

We followed the prepared agenda (enclosure 1) with some changes in sequencing made to allow for the early departure of several attendees for a prior commitment. The list of attendees is attached as enclosure 2, including addresses and telephone numbers.

Proceedings commenced at 9:30 am with a brief address by Don Trilling of the Office of the Secretary of Transportation (OST). Don recounted the background of OST's work in ADA related rulemakings and the particulars of the watercraft access project with the Volpe Center. The attendees then introduced themselves. We were, generally, representatives of: several concerned Government agencies, including the Department of Transportation and the Architectural and Transportation Barriers Compliance Board (ATBCB); private disability advocacy groups; and ten or so passenger vessel operating companies. The latter were members of the Regulatory Committee of the Passenger Vessels Association.

The following were opening remarks made by others:

- Morgan Hurley (Coast Guard) stated that the Coast Guard's role in this process is advisory to the DOT, mainly on the safety aspects of access on passenger vessels. He stated that his involvement would be in the area of emergency egress.
- David Yanchulis (ATBCB) stated that the meeting was to address nuts and bolts issues. He explained that the thrust of the Access Board's mission is to provide independent access, aiming primarily at new construction. The Board will participate jointly with the DOT in a future rulemaking, some aspects of which would overlap with the Board's outdoor recreation rulemaking.
- Elmer Schmidt spoke for the Passenger Vessels Association, which represents the operators of about 1000 passenger vessels. He said that their members were present to listen and learn.
- Bob Ashby, legal counsel for OST recounted the 1991 DOT/DOJ rulemaking process, which stated that passenger vessels were subject to the ADA. Input from industry is important in what will be an open rulemaking process. He stated that determining which classes of vessels are covered is still open and that some resolution is needed on the matter of public transport versus public accommodations.

- Steven Bers, legal counsel for the Passenger Vessels Association, said that the public accommodation aspects of ADA are not tantamount to Coast Guard inspected vessels. Pointing out that industry is at the crossroads of many regulatory bodies, he expressed the desire that one agency coordinate compliance matters for passenger vessels, preferably the Coast Guard. Mr. Ashby replied that the Department must avoid regulatory conflict. He felt that the Coast Guard would lead inspection and certification efforts for the Government as the Federal Transit Administration and the Federal Rail Administration have in their respective modes.
- K.C. Stanley (Passenger Vessels Association) felt that regulatory flexibility is important because of the diversity of design and service in the industry, as well as in the operators' ability to pay for new access accommodations.

Michael Dyer of the Volpe Center, U.S.D.O.T. then gave a brief opening talk, centered on the development of the cost impact analysis prepared for the OST. He agreed with Ms. Stanley's assessment of the fleet diversity matter and stated that the two biggest issues to emerge were onboard wheelchair access and emergency egress and evacuation. Several slides illustrated the problems uniquely inherent in the marine environment and among a diverse fleet. The study (not released at the time of the meeting) proposed a flexible approach to access solutions accounting for the variables of size, new construction versus alteration, and public transport versus public accommodation. That model was used as the baseline for subsequent discussions.

The main portion of the meeting was devoted to discussion of the particulars of the many access features needed. The following paragraphs are structured with brief summations of each topic, with specific speakers' comments as sub-bullets.

Elevators

The group discussed a wide range of technical and interpretive issues here, probably because an elevator is the most costly and technically difficult item and because it was first on the agenda. ADA philosophy and the practical matters of elevators on small vessels, and the available alternatives, were the main points

- Chris Hendricks (Passenger Vessels Association) asked what constitutes an alteration for purposes of ADA applicability. Mr. Cannon explained the specific language for the "you touch it, you fix it" approach. Maintenance activities such as painting, carpet replacement, and electrical upgrades do not constitute alterations. In cases which do (service modifications, total remodeling and the like), the cost of access accommodations is compared to the operator's resources for existing vehicles and cannot exceed specific amounts.
- Messrs. Ashby and Dyer explained event-related issues, i.e. how public accommodation access must account for the different activities which may take place on different decks. Mr. Ashby stated that previous experience would serve as a guide. Mr. Yanchulis added that access to all levels in public accommodations is hard to deny.

- Mr. Cannon pointed out that ADA provides a civil right but allows different standards for different situations. While the ADA Access Guidelines (ADAAG) is the ideal, we must consider carefully how to craft specific standards for specific elements.
- Mr. Schmidt pointed out that bridges, particularly on the rivers, can limit available height for some operators when building elevators to the topmost deck.
- Mr. Dyer asked what alternative or new technologies might be available for limiting impact of shipboard elevator installations. Robert Herman (Paralyzed Veterans of America) identified hydraulic elevators which are operated from below and therefore might limit topside height problems. Mr. Cannon mentioned screw-column elevators, which are driven from the side and are smaller. Elevators can be as small as 48" x 48" with a "walk straight-through" design.
- Mr. Cannon made several points about alternatives for certain cases:
  -For alterations, lifts are always permitted as substitutes. The attendant problems are required stairway widths vis-a-vis fire regulations, a record of poor maintenance, and frequent design flaws. In addition, they are not "universal design" and often are set up for operation with keys.
  -The ADA "elevator exception" for a limited category of buildings may be an avenue for solving the problems of smaller boats.
  -Limited use/limited access elevators are now under investigation for certain buildings and may also provide the basis for some relief for small vessel designs.
- Mr. Dyer summarized the results of a stability analysis including five existing designs with added elevators. There was a clear correlation between vessel size and the ability to sustain the added weight. One "T boat" with a capacity of 150 passengers failed both intact and damage stability requirements from the Coast Guard regulations.
- Mr. Schmidt pointed out that elevator shafts must be constructed with A-60 (a Coast Guard structural fire protection standard) bulkheads and that added weight might be critical for some designs. He cited an analysis of a dinner boat on which an added elevator caused a reduction of passenger capacity from 400 to about 300, due to Coast Guard passenger crowding requirements in the stability standards.
- Mr. Dyer stated that the cost analysis found potential revenue losses due to alterations of existing vessels. These would result from deck space lost to access accommodations and would occur during the estimated 40% of the time when they operate at capacity. Reg White (Passenger Vessels Association) remarked that the stated 40% of the time is when profits are made. Most boats are at other times "trading pennies".

Lifts

Mr. Dyer stated that lifts have been seen as a potential substitute for elevators particularly for passenger vessels where the weight, cost and engineering impacts are much reduced. Their use in stairwells has obvious fire egress implications. The group concluded that there is a need to define some limited situations where lifts would be permissible. Mr. Cannon made the following specific points about lifts:

- Vertical and stairway lifts need much maintenance and often don't get it.
- They are designed for home market and often fail in intensive commercial applications.
- Lifts are not regulated or inspected.
- Some building codes prohibit their use or require key operation (in violation of ADAAG).
- ADAAG occasionally permits them for small new construction; otherwise they are allowed only for alterations.
- Lifts often have limited travel.
- Lift construction is covered in ASME A17 Elev. code Chapter. 20 - Lifts

Emergency egress/evacuation/lifesaving appliances

Onboard response to emergency situations is probably the most important safety issue for accessible vessels. The group discussed the approaches of both shoreside and marine safety regimes, the present state of marine lifesaving appliances, and the pertinent operational and human factors aspects. The group concluded that 1) present day arrangements have a significant element of "universality", 2) providing accessible egress from within the vessel to muster or lifejacket storage areas is the important design issue, and 3) crew training and evacuation procedures are the critical pieces for safe evacuation in an emergency.

- Mr. Hurley discussed two approaches to evacuation in case of fire: 1) "area of refuge" designed to offer passengers fire protection, and 2)egress by use of elevators operating on emergency power. Mr. Cannon stated that shoreside evacuation elevators are constructed with protected shafts and machinery.
- Mr. Cannon reported that ADAAG requires that buildings have accessible means of egress in the same number as applicable fire codes, applying to new construction only. The issue of egress is a big problem shoreside and may be no worse on vessels.
- Present day egress and evacuation arrangements onboard were discussed as follows:
  -The group agreed that lifesaving appliances were substantially of universal design and that future developments would continue progress on that line.
  -Mr. Hendricks stated that the domestic passenger vessel industry has an excellent casualty record, i.e. no major fire/sinking incidents.
  -Evacuation procedures are in place for all Coast Guard inspected vessels. Ken Stein (Passenger Vessels Association) noted that the procedures are vessel specific. Mr. White stated that the station bill assigns specific places and duties to all crew members, and that the procedures are checked annually by the Coast Guard. Mr. Bers added that the Coast Guard goes ship by ship with live drill inspections.
  -Ms. Stanley stated that her vessel crews had never been tested for evacuation of a disabled person. Mr. Cannon offered that an unconscious person was the same as a quadriplegic.

-Mr. Ashby suggested that a document of "best practices" be prepared. This may be useful for all aspects of vessel accessibility.

- The following comment were pertinent to providing accessible egress from within the vessel to the muster or evacuation station:

  -Katherine MacGuiness (Katherine MacGuiness & Associates) inquired about transport hardware for the mobility challenged. There seems to be no experience in this area as even such devices in use shoreside have their problems.

  -Mr. White stated that any such devices or arrangements would have to work in list conditions up to 14°.

  -Messrs. Yanchulis and Cannon emphasized the importance of access to the muster station, and that crew assistance is an improvement over the situation in most buildings. ADA contains no mandatory language on emergency egress.

  -Ms. Ebersole stated that the Air Carriers Access Act specifically addressed neither how to get persons with disabilities to the emergency egress nor what happens once those passengers are out the door.

- The group agreed that operational egress issues and training needs are the crux of the matter. Many specific suggestions were considered, and finally the issue of crew manning for large groups of persons with disabilities. In the end, we agreed that no extra crew should be necessary and that proper training and procedures are the key. Robert Herman (Paralyzed Veterans of America) summed up these discussions neatly by suggesting that this should be a unifying rather than a wedge issue. Specific statements follow:

  -Mr. Eastman said that the Center for Naval Analysis (U.S. Navy) should have well developed evacuation procedures for injured and unconscious people.

  -Mr. Hurley stated that human factors and training are especially important for the transition from the vessel into a lifeboat or raft.

  -Ms. Ebersole stated that special training would not be a small expense.

  -Ms. Gedney (Passenger Vessels Association) said that crew training is now well structured, but that more specificity may be needed for dealing with persons with disabilities.

  -Ms. Ebersole asked about large groups of wheelchairs and the possibility of assigning additional crew, as some operators now do.

  -Mr. Cannon suggested that training be highlighted in the rulemaking preamble and that a technical guide for operators would be invaluable.

Passage

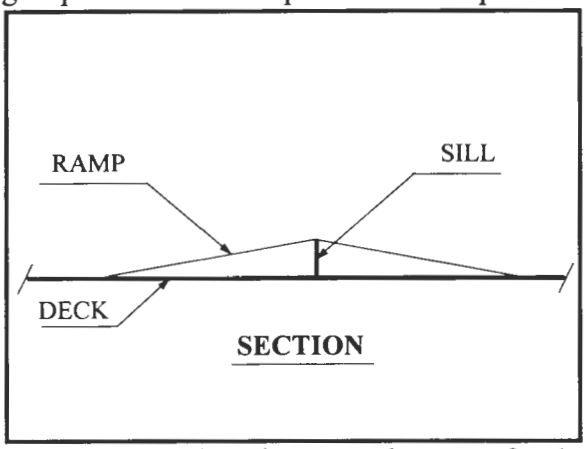
Several specific items identified in the agenda and addressed by the group. We agreed that these needs can met on most new boat designs with proper knowledge and design. Sills (coamings) on exterior doors are the most vexing problem, because of their various heights and the (often) limited space in which to properly design the sloped transitions. The specific comments follow:

- Mr. Dyer showed slides of several examples of accessible passage on recently built or modified vessels. He commented that most larger vessels already have adequate

corridor passage in the main accommodation areas. Some clever approaches to sill ramps were seen in the field, but these could still be improved. Exterior doors generally have the ADAAG-required width, but none were observed with powered opening devices (some study of the safety of these on passenger vessels may be needed).

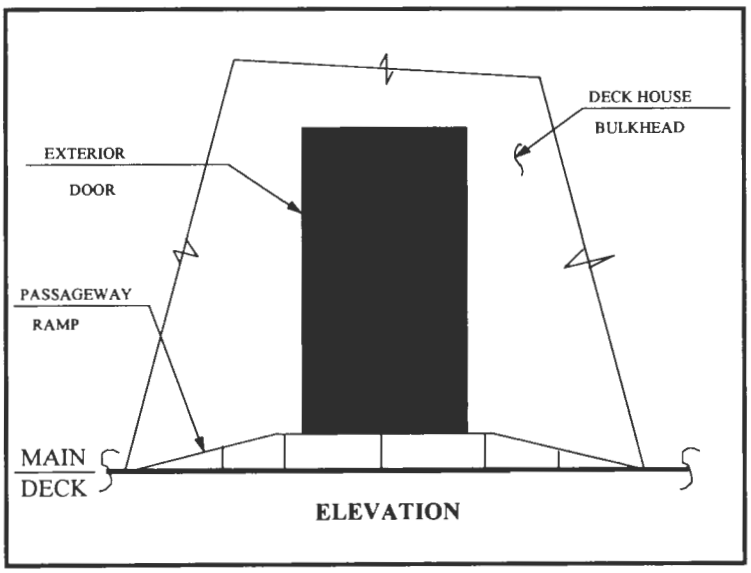
The transition at the point of embarkation is a matter of good detail design and integration with accessible gangway design. One good example was shown to the group.

- One of the group asked what the permissible slope would be for an



"apex" situation, pictured above? There is no good answer for that at present, except that it's best to avoid this configuration, particularly since the design of all the vehicles for the mobility impaired cannot be known. These would have to be able to negotiate two ramps meeting at a point and could hang up on the apex.

- One of the group suggested the approach following, that exterior door sills be ramped along the length of the adjoining passageway providing a level platform outside the door and avoiding the apex situation previously referred to:



- Ms. MacGuiness asked if portable sills could be designed. Mr. White replied that one of his boats has one and that the station bill identifies a crew member responsible for removing it when the need arises.
- The was some discussion on the opening of exterior doors. Mr. Cannon stated that power-operated doors eliminate many of the other requirements. There is no ADA force limit for such doors; the shoreside approach is that force and other specifications must meet fire door requirements (a similar safety override may apply here).
- The group felt that proper design of embarkation stations could be achieved with little problem.
- Mr. White felt that the new design of small vessels could be done without fundamentally changing their size or function. Cockpit boats, where access down to the deck is needed, could be a problem.
- Stairs and rails need design for the mobility impaired. Extension past the end of the stairs can be a problem with gangways since it impinges on other passageways. The operators felt that some relief should be possible here because embarkation of passengers is always assisted by the crew.
- Ms. MacGuiness asked if shallower slopes might be needed for moving gangways, based on comments at the Massachusetts negotiated regulation. There is no answer for this at present (it is not an onboard access issue). Mr. Cannon commented that the 1:12 slope standard is currently under review because it may be too steep for some users. Ms. MacGuiness also inquired whether there is a maximum ramp slope for assisted access. There is none at present.
- Peg Greenwell (ATBCB) asked whether passageway protrusions were addressed in the study and commented that this is an important consideration for the sight impaired. Mr. Dyer replied that the study did not specifically include this design need in the cost model and agreed that new designs in particular must account for it. He also noted that all operators and designers should have the ADAAG document, which is full of details for the designer's consideration.
- Ms. MacGuiness inquired about slip resistant flooring. Mr. White said insurance companies require passenger vessels to have it, but that there are no Coast Guard standards. Mr. Cannon added that ADA standards on this topic are vague and that the friction can be too high for some people with mobility impairments.

Heads

- Mr. Dyer discussed the main issues and suggested that unisex heads and opportunities for other special designs could be useful for the industry. The group agreed that integrated stateroom head/lav./shower units on some cruise vessels have been insufficient, but have improved (e.g. QUEEN OF THE WEST).
- The group agreed that unisex heads for all passengers area good solution for many passenger vessels.

- Mr. Cannon cited a study on bathroom design for airplanes which might assist small vessel design.
- Mr. White mentioned that the "Technical Standards Task Force" at Passenger Vessels Association has issued a letter on modular head design.

State rooms

- The only issue brought up by the group was that accessible state rooms must be included in each price class available on a cruise vessel.

Signage and alarms

- The group agreed that emergency alarm standards must be harmonized between the ADAAG and the Coast Guard. Mr. Cannon stated that ADAAG specified only decibel levels only and that both audio and visual components be included.
- It was suggested that announcements onboard need to be made in audio, then visual modes.

Tactile surfaces

- Mr. Dyer inquired where tactile surfaces as cautionary warnings for the blind might be needed. Mr. White replied "the entire deck", and said that so many warnings could become meaningless. Vision impaired people are generally asked not to move about unassisted.
- Braille signage should be provided to identify doors, rooms, and exits.

Conclusion

The meeting concluded with highlights of the main technical findings and outstanding issues. There is work yet to be done in the areas of alternative elevator design, practicability of lifts, head design (particularly for state rooms), the details of sill/ramp design, several ADAAG/Coast Guard harmonization issues, and generally how to craft the standards for the variety of vessel types affected. The group suggested that two documents would be very helpful for Government and industry: a "best practice" guide for onboard access features and a training manual for emergency situations.

All attendees were thanked for their time and good work. The group considered the possibility of another session in Boston during September to coincide with the next Passenger Vessels Association meeting. The work started here could be continued and expanded to include discussion of access over the docks and piers.

***

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