High Speed Ferry and Coastwise Vessels: Assessment of a New York / Boston Service

(Program Element 3-17, FY01)

Final Report

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I Summary and Conclusions

I.1 Review of Previous Research

This report summarizes Phase IV (FY 02) of the Coastal Shipping project conducted by the National Ports and Waterways Institute (NPWI), University of New Orleans. This research phase is a direct continuation of previous research especially of Phase III (FY 00). Phase III research included a review of recent developments regarding coastal shipping in the US and abroad; the re-definition of the envisioned coastal system; an assessment of three designs of prospective high-speed coastal ferries; and a conceptual design of a coastal terminal, along with review of potential sites. Phase III report also included data on traffic flows in the North Atlantic, based on FHWA data. Phase III research was based, in part, on earlier Phase II research, which was concerned with the coastal system concept, especially with types of freight to be served, operational and cost parameters of the system and military applications. [1]

The entire research effort of coastal shipping has been conducted under the guidance of an Advisory Board consisting of representatives from ports, shipping lines, shipyards, military and governmental agencies. The findings of Phase II and Phase III were presented and discussed in workshops organized by MarAd and NPWI. Likewise, the findings of Phase IV (this phase) will be presented in a similar workshop.

Summary reports of Phase II and III are available on the website of MarAd (*www.marad.dot.gov*).

I.2 Phase IV Objective

The overall objective of the coastal shipping program is to divert truck traffic from the main coastal highways to the water route. The diversion is expected to ease congestion and generate the related environmental benefit. The main question is whether a coastal system could be economically feasible. Related questions are whether the proposed coastal system would also be military-useful and what would be its impact on the US shipbuilding industry and the development of seafaring personnel.

The specific objective, of the current Phase IV research, is to assess the economic feasibility of one actual application, of the envisioned coastal system, most

[1] An even earlier phase, Phase I of this study, was devoted to the development of the research program.

suitable for implementation. The application selected here is a service along the route between New York and Boston, which targets the most congested segment of I-95. Phase IV makes use of the previous phases of the research programs, especially Phase III. Still, as is often happens when concepts are applied to reality, there are several modifications to be made. This also was the case in Phase IV, whereby the coastal service most suitable to the above route was found to involve different vessels and terminals than those reviewed in Phase III.

I.3 Conclusions

The overall conclusion of Phase IV is that the selected New York / Boston service would be feasible; it could provide a truck-like transport at a cost slightly lower than truck cost. In addition: (a) The vessels selected for the services are also military useful; and (b) Removing trucks from a highly congested coastal highway is environmental beneficial.

The feasibility assessment presumes changes in labor practices, mainly enhancement of operational flexibility of port labor and reduction in manning of coastal vessels. These conditions, while presently unavailable, are achievable in the near future, although they mandate the active involvement of the Federal and local governments, especially in the areas of certification and licensing.

The next stage of the research program, Phase V, would be concerned with the implementation of the New York / Boston coastal service, especially with elaboration of the prerequisite institutional conditions, some of which are partially addressed in Phase IV. This will also include a clear definition of the required support from various public agencies. It is expected that Phase V will be followed by an actual demonstration program.

I.4 Report Organization

This report begins with a definition of the proposed service, including route, terminals and vessels. It continues with a review and assessment of demand for the prospective service, which, in turn, is divided into two segments: domestic trailers and domesticized containers. Then, the report focuses on the supply side, especially the competition provided by truck, rail and barge services along the New York – Boston corridor. The report includes a summary assessment of the prospects of the coastal service. Finally, the report concludes with a presentation of the study to the Workshop, conducted on May 29, 2003, and its recommendations. The appendices include summaries of interviews and meetings as related to the analysis along with a sample of coastal vessel designs.

II Description of the New York / Boston Coastal Service

II.1 Elements of the Coastal System

A short review of the coastal system elements, as defined in the previous phases of research, is warranted. The definition of the coastal shipping system, like any shipping system, relates to 3 basic elements:

- ***Cargo or Freight*** – The types of freight that the service is devised to serve;

- ***Route and Ports of Call*** – The service rotation, including end and intermediate ports of call; and

- ***Vessel*** – The types of vessels to be deployed to serve the freight along the selected route.

The following sections review each of the above elements. One reminder is prerequisite; the coastal service assessed here is “pure” freight, with no passengers and/or their cars.

II.2 Targeted Freight

The prospective coastal service is designed to handle 2 types of freight:

- ***Domestic Trailers*** – Trailers of various dimensions, including the 53-ft that is becoming the dominant in inter-city trucking; and

- ***Domesticized International Containers*** – Marine containers mounted on chasses after being released from marine terminals, either cleared from Customs or in-bond.

Hence these two types of freight have similar origin / destination points. Although they have slightly different dimensions, the two types of freight are similar in the way they are presently being handled. Therefore, combining these two types of cargoes into one ferry system is operationally viable.

Combining these two types of freight would create a larger potential freight pool for the envisioned coastal system, which, in turn, could support a higher level of service (e.g., higher frequency). The larger system would also entail cost savings due to scale economies, especially in terminal operation. For convenience, the term trailers will be used in this report to denote both domestic trailers and domesticized containers.

II.3 Service Routes and Ports of Call

End Ports of Call

The planned coastal service is intended to serve the flow of cargo between two metropolitan areas: New York City in the south and Boston in the north. Most of the domestic freight is generated around New York City with a high concentration in northern & central New Jersey. Most of the international freight (containers) is generated in the marine terminals of the Port Authority of New York / New Jersey in the Newark, NJ area. Most of the domestic and international freight in the Boston area is generated south and west of it. Based on the above freight distribution, the two end terminals of the prospective service should be in New Jersey and south of Boston.

The terminals themselves should be selected according to following criteria:

- Unobstructed water access with navigation and depth alongside of at least 15 ft;
- Easy land access to I-95 or related coastal Interstates;
- Availability of a dedicated waterfront terminal with about 3 – 4 acres of parking and independent gate;
- Availability of adjacent area to provide off-terminal parking for truck lines;
- In vicinity to large distribution centers and truck terminals; and
- In vicinity to major intermodal yards.

In accordance with the above criteria, the terminal selected in the New York area is the River Terminal complex; in the Boston area, the terminal selected is the Port of Providence, RI, or Provport. The terminals were found to meet the required location and have sufficient facilities as defined in the criteria above. In addition, both terminals have an appropriate labor organization to support the prospective service. Both terminals were visited, including meetings with their managers.

The following provides a brief description of each terminal. The selected terminals are by no means the only ones that can be used. Their selection here is solely for the purpose of the feasibility assessment, mainly to investigate the conditions and assumption necessary for the implementation of the coastal concept.

River Terminal, NJ

River Terminal has an excellent location especially in terms of transportation connectivity. First, the site is right at the exit of the New Jersey Turnpike in South Kearney. Second, the site is about 1 mile away from the large CSX intermodal yard, the main intermodal yard in the New York area. Third, the site is only 3 miles away from the Port Authority container terminals in Newark. Moreover, the Port Authority of New York / New Jersey is planning to connect the Newark terminals directly to the South Kearney intermodal yard via bridge over the Passaic River. This so-called Portway project will also provide direct connection between the Port Authority terminals and River Terminal and may shorten the distance to about 1 mile.

The site is owned by the River Terminal Development, a private real-estate holding company and a fully owned subsidiary of the Hugo Neu Corporation (HNC). HNC is the largest recycler and exporter of scrap steel in the US and also is involved in shipping. The River Terminal site has a total of 300 acres, of which 40 acres are still unutilized. Currently it hosts several large buildings, mostly used for distribution and warehousing, with a total of 5.5 million sq. ft. The entire area has been designated by the State of New Jersey as an Urban Enterprise Zone, which entitles it to 100% exemption from New Jersey Sales Tax and Net Worth Tax, 50% of the statutory real estate rate and 50% State unemployment insurance tax for workers (for the first 4 years).

River Terminal has no marine activity at the present. In the past, the site was an active center for marine activities. Most recently, the owner used to ship scrap metals, using 16 slips along the western coast. Since then, 14 slips were filled and reclaimed and 2 are still available. The southern slip, the larger of the two remaining slips, is about 1,100 x 225 ft. (length x width) and has about 7 acres of adjacent staging area. The depth presently varies between 11 and 16 ft., following many years of inactivity. The slip has to be cleaned and dredged to make it operational again. Figure 1 presents the general location and aerial picture of River Terminal.

There are at least 2 additional terminals in the New York area that could accommodate the proposed ferry services. However, none of them is located in such close proximity to the Newark container terminal complex as River Terminal.

Figure 1. General Location and Aerial Photo of River Terminal, NJ

Provport

The selection of the northern terminal, in the Boston region, can be made between at least two alternative ports, Providence, RI and Fall River, MA; both can serve well the region. Providence may have a slight advantage over Fall River because:

(a) there is a larger concentration of industry and population with a larger local cargo base;
(b) it is closer to Boston; and
(c) it is closer to Worcester, another place in Massachusetts with substantial cargo generation.

It should also be noted that the option of calling directly in Boston was also reviewed but was rejected at this time. Direct call at Boston harbor requires additional navigational distance for sailing through Cape Cod Channel; also, no available site for a dedicated terminal was identified there.

Provport is a private port, with the property leased on a long-term basis by the City of Providence to a private real estate management company. Still, the terminal maintains its public orientation, with the City and the State each having one representative on Provport board. The port site has about 3,500 ft. of berthage and 105 acres of waterfront land. Depth alongside varies from 20 to 34 ft. The site is located about 1 mile from I-95. Currently, the Port handles about 1 million tons of cargo annually, mainly steel imports, scrap metal exports, salt imports and other bulk cargoes. A rail connection is being rehabilitated inside the port to transport future imports of coal to several regional utilities of New England Power. Even with the new coal activity, the site would only be partially utilized and has sufficient space to accommodate a dedicated ferry terminal. A discussion with Waterson Stevedoring, the sole stevedoring company at the Port, indicated that, since ferry operation is a new activity, local labor could be organized according to the specific requirements of a ferry terminal, including the possibility for permanent terminal personnel.

En-Route Ports of Call

The envisioned ferry system is flexible in terms of requirements for port facilities. The employed vessels, as will be seen in the next section on selected vessels, have shallow draft, allowing it to be handled at smaller regional ports. Likewise, the vessels are equipped with bow thrusters and most likely also with azimuth propulsion (Z-drives). Hence, they are fully independent and do not require tug assistance, which is not always available in small ports. The Ro/Ro handling system requires limited shore facilities since there is no lifting and/or stacking. The yard area required for parking is small and can be provided away from the berth since all the cargo is on wheels. Taking advantage of its flexibility and short port handling time, the prospective service can add 2 – 3 intermediate (or en-route) calls, without a significant impact on the service's transit time. The en-route stops could be included either every voyage, every other voyage or only upon inducement (i.e., based on a minimum accumulation of trailers).

Based upon review of the port system in the area, it seems that the natural en-route ports of call would include Bridgeport and New Haven, CT and a terminal on Long Island.[2] Figure 2 presents the proposed route of the New York – Boston service, including en-route stops. The following provides a short description of the 2 Connecticut ports. No information is available at this stage on a prospective terminal on Long Island.

The Port of Bridgeport

Bridgeport is located 52 NM northeast of New York, in the Long Island Sound. The main terminal is about ¼ mile from I-95. The port consists of 2 terminal areas, the largest of which, Cilco Terminal, has a total area of 27 acres and a 1,100-ft. berth with 33-ft depth alongside. Currently, this terminal handles imports of refrigerated cargo, mainly bananas and citrus along with linerboard, newsprint, autos and others. The terminal has 16 acres of open storage. The second, smaller terminal area is in the Black Rock Harbor, which has little use at present, but could serve as a dedicated ferry terminal.

The Port of Bridgeport was the subject of several studies regarding a barge service from New York (see Appendix C). The studies identified 2 specific potential sites in Bridgeport that could serve as terminals for the barge service – and could also serve as terminal for the ferry service.

The Port of New Haven

New Haven is located 68 NM northeast of New York and 25 NM northeast of Bridgeport. The local port in New Haven is much larger than Bridgeport, both in terms of facilities and operations. The main cargoes handled are imports of steel, non-ferrous metals, lumber and autos. The main New Haven terminal, Coastline, has 54 acres of open storage and 5 general cargo berths totaling 3,540 ft. Depth alongside berths is 35 ft. Because of its current activities, the terminal does not have an area that could be exclusively assigned to handle the prospective ferry service (dedicated terminal). Previous studies regarding barge services for Connecticut also focused on Coastline. In addition, another location, the Gateway Terminal, was identified as suitable for a barge service, although according to these studies this terminal had a limited yard area.

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[2] The decision to stop in one of these intermediate points is driven by demand. Presumably, it could be justified by the availability of at least 10 trailers. Another problem associated with such calls is the lack of freight for the continuing leg. For example, if 10 trailers originating in New York are discharged in New Haven, it leaves 10 unutilized slots, unless they can be used by freight between New Haven and Boston.

Figure 2. Proposed Route for New York / Boston Service

Both Connecticut ports are owned by Coastline Terminals of Connecticut Inc., a private company, which bought the facilities following the bankruptcy of the previous owner, New Haven Terminal Inc. Coastline is an employee-owned company, the owners are the workers employed there. Coastline hired Logistech, a Canadian stevedore, to handle all the activities at the terminal on an exclusive basis for 10 years. The envisioned ferry operation was discussed with Coastline, including the need for a dedicated terminal and flexible operation system, which Coastline observed as possible.

II.4 Vessel System

Ro/Ro Vessels or Ferries

The basic characteristic of the selected vessel system of the New York / Boston service is similar to that already defined in the previous phases, namely Ro/Ro. In a Ro/Ro system, all the cargo is on wheels, mostly trailers, with the trailers being trucked on/off the vessel's decks through a special ramp or bridge. Usually, Ro/Ro vessels carry their bridges on-board. In certain cases, mainly when the vessels serve shorter routes calling the same ports, ramps are provided by shore terminals. In these cases these vessels are commonly called "ferries", which is also the term used in this report.

Another characteristic of the ferries selected here is that they are "pure" freight. That is, these ferries only carry trailers and not passengers and/or cars, as is common in European and Japanese ferry systems, the so-called RoPax systems.[3] The proposed ferries would only carry unaccompanied trailers without the power units (tractors) and without drivers. This is, again, unlike the foreign ferry systems but it is similar to the US system of the 2 short sea services to Alaska (Totem Marine) and Puerto Rico (Crowley Maritime and Trailer Bridge). An elaborate discussion of foreign and US coastal systems is provided in the previous Phase II & III report.

High, Fast and Regular Speed Vessels

The common categorization of ferries is usually according to their speed, including:

- ***High Speed Ferries*** – Ferries with nominal speed equal to or higher than 28 knots;
- ***Fast Ferries*** – Ferries with nominal speed range of 22 to 27 knots; and

[3] Pax stands here for passengers. A discussion of foreign systems is included in the Phase III report.

- ***"Regular" Ferries*** -- Ferries with nominal speed of 21 knots or lower.

Most of the pure freight ferries in the world fall within the third category, especially those with a relatively small capacity such as that considered for the New York / Boston service. Regular-speed ferries are not included in this analysis, however. This is simply because due to their slow speed, regular ferries cannot not comply with a basic level-of-service requirement, namely, providing 2nd day delivery (see Section on Level of Service). Hence, the proceeding analysis only relates to the two first categories.

High Speed Ferries

High-speed ferries were the focus of the previous Phase III research, which included a review and comparison of several designs of these vessels.[4] The two main vessel systems considered in Phase III were the monohull for 100 trailers and the catamaran for 40 – 50 trailers. The analysis of market demand (see below) indicates that a reasonable marketing target, at least for the initial stage of operation, would be 100 – 120 trailers/day in each direction. A parallel analysis also indicates that the desirable level of service would be based on 2/day frequency. Accordingly, the required capacity of prospective vessels should be 50 – 60 trailers. The 100-trailer monohull design presented in Phase III is too large for this service. Also, the monohull design, based on a narrow and long cargo deck, is more difficult to handle at ports, resulting in longer port and transit times. The monohull requires a relatively deep channel and wide turning basin that may limit the port selection available. Hence, the monohull would not fit the New York / Boston service.

This leaves us with the two aluminum catamaran designs, one by Incat/Bollinger and the other by Austal, as the only viable high-speed designs presented in the previous report. The larger and the less expensive of the two, the Incat/Bollinger, was selected for further analysis. A second high-speed design, provided by Brekvik, Norway, which was not available at the time of the Phase III research, was also included in the analysis. The Brekvik design is based on a catamaran hull, but made of high-tensile steel instead of aluminum, resulting in a slower speed and a lower cost.

Figure 3 presents the main technical and cost characteristics of the high-speed ferries. As seen in this figure, the 2 selected designs have a relatively high capital cost of $1.4 and $1.0 million per trailer slot. The figure also includes 2 other cost indicators, $/dwt and $/trailer-NM. Both of these indicators are quite high in comparison with the fast ferries as discussed below. Likewise, both designs have a high ratio of engine power per slot of 1.0 mW per trailer slot, resulting in high fuel

[4] See, for example, Figure 31 of the Phase III report.

consumption. It should also be noted that the aluminum catamarans consume MDO, which costs almost double that of the steel catamaran's HFO.

Fast Ferries

There were no readily available fully suitable designs for fast ferries, although professional literature has numerous examples of similar designs. The specification of the 2 fast-ferry designs here is based on design of a similar ferry, prepared by Robert Allan Ltd (Allan), of Vancouver, BC, Canada. Allan specializes, among others, in designing workboats, which have a similar open-deck configuration as Ro/Ro vessels. Figure 4 presents the arrangement of Allan's design that was used as a basis to specification of the 2 fast ferries considered in this study, RR1 & 2. Appendix A includes a more elaborate description of Allan's designs.

Based on Allan's and other designs, the study team conducted a theoretical analysis of the desired fast ferry for the New York / Boston service. The analysis began with the definition of desired deck arrangement. Figures 5 & 6 present the arrangements of the 2 selected fast ferries, including the approximated calculation of respective hull dimensions. The deck arrangement for the first and smaller design, defined hereafter as RR1, is based on 5-wide, 6-long configuration. The second design, RR2, is based on 6-wide, 6-long configuration.[5] Both ferries have 2 decks, which is the most economical design for the small Ro/Ro, as can also be seen in Allan's double-deck design. Power requirements and cost estimates were developed based upon a review of the designs of similar vessels.

Figures 7 & 8 present both the technical and the cost characteristics of such relevant vessels. As seen in Figure 8, the cost of RR1 and RR2 is mainly based on Allan's design. However, the proposed ferry would be somewhat different than Allan's design since the latter was designed for short voyages (2 – 3 hours) and narrow waterways where maneuverability is critical. For this reason Allan's design is equipped with Z-Drives and has a rounded aft. The selected coastal design could be driven by conventional propulsion (propeller) and using HFO (instead of MDO). Likewise, the selected design has a narrower hull and no accommodation for driver and/or crew (see below). These modifications would result in a substantial reduction of construction and operating costs.

Altogether, 4 types of ferries are selected for further analysis, 2 high-speed and 2 fast ferries. Figure 9 presents a summary table of their main technical and cost characteristics. As seen in this figure, cost indicators vary widely, especially the slot cost, which varies from $1.4 million/trailer for Incat to $0.3 million/trailer for the RR2. The variations in slot cost also indicate wide differences in required freight rates for each vessel system.

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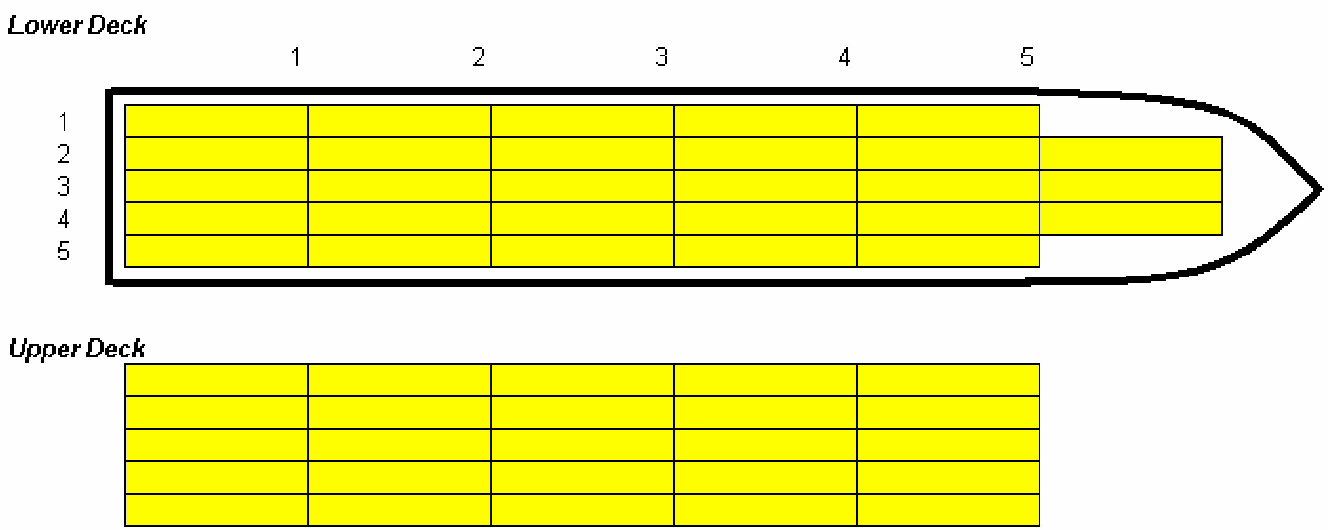
[5] Allan's design is based on 8 x 8 main deck configuration.

Figure 3. Technical and Cost Characteristics of High-Speed Ferries

	Country	High Speed					
	Shipyard	**Blohm & Voss**		**Kvarerner Masa marine**	**Incat / Bollinger**	**Austal USA**	**Brekvik, Norway**
	Model	**FM-147**	**BE SteelCar**	**SSCE**	**12F**	**TSV 101,10B**	
Hull Configuration		Monohull	Catamaran	Trimaran	Catamaran	Catamaran	Catamaran
Length Overall	meter	162	122	155	112	101	118
Beam	meter	26.4	22	32.2	30	27	22
Draft	meter	7	3.3	4.5	3.3	4.2	3.2
DWT	ton	4,000	1,200	1,500	1,024	750	1,400
Trailers	FEU	100	36	72	47	30	45
Total Power	MW	36.6		54	36	29	34
Type of Engines		Diesel	Gas Turbine	Gas Turbine / Diesel	Diesel	Diesel	Diesel
Number and Type of Engine		2 x 16,800 kW		2 x LM 2500 + 2 x MTU16V1163	4 x 9,000 kW, Ruston 20RK280	4 x 7,700 kW, Caterpillar 3618	2 x 17,000 kW
Type of Propulsor		Propellor	Waterjet	Waterjet	Waterjet	Waterjet	Waterjet
Maximum Speed	knots	28	36.5	42	40	40	35
Service Speed (90% MCR)	knots	25.5	32	38	36	36	
Fuel Consumption	tons/hour	6.2		11.44	5.9	5.3	
Construction Cost	$million	49		60	68	60	44.5
Hull Materials		Steel	Steel	Aluminum	Aluminum	Aluminum	Steel
Fuel Type		IFO	HFO	MDO	MDO	MDO	180 cst
Commetns		Double Deck	Single Deck	Single Deck	Single Deck	Single Deck	Single Deck
Unit Cost	**$/dwt**	**12,250**		**40,000**	**66,406**	**80,000**	**31,786**
"	**$/Trailer**	**490,000**		**833,333**	**1,446,809**	**2,000,000**	**988,889**
Unit Cost	**$/Trail-NM**	**17,500**		**19,841**	**36,170**	**50,000**	**28,254**

In case the number of trailers is not mentioned, it is calculated by dividng the lane-meter by 18.

Figure 4. RR1 Deck Arrangement and Dimensions



Arrangement

Lower Deck	28
Upper Deck	25
Total	**53**

Trailer Slot Dimentions

		m
Length	60 = 53 + 2 x 2.5	18.29
Width	10.5 = 8.5 + 2	3.20
Lane Length		969

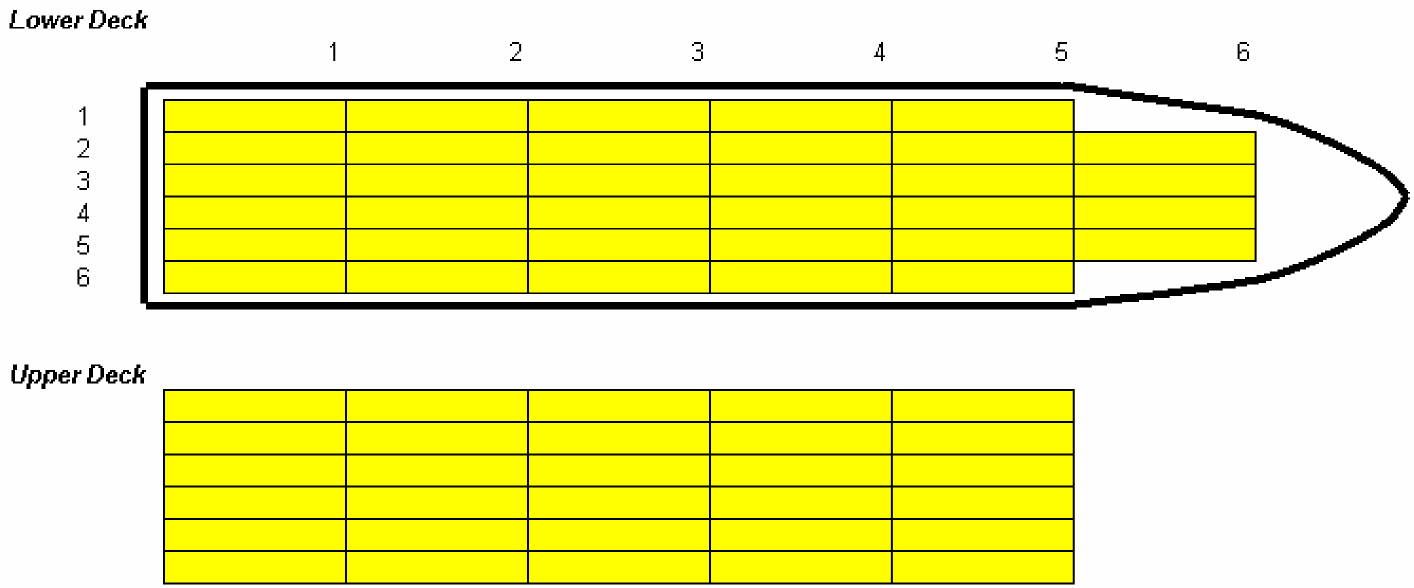
Vessel Characteristics

Tons/Trailer		35
DWT		1,855
Engine	kW	10,000
Fuel Consumption		1.6

Hull Dimensions

					Slacks	Total	Total
	Trailer Rows	ft	ft	m	m	m	ft
Deck Length -- Net	6	60.0	360.0	109.7	12.0	121.7	399.4
Deck Width -- Net	5	10.5	52.5	16.0	1.4	17.4	57.1
L/B							7.0

Figure 5. RR2 Deck Arrangement and Dimensions



Arrangement

Lower Deck	36
Upper Deck	30
Total	**66**

Vessel Characteristics

Tons/Trailer	35
DWT	2,310

Trailer Gross Dimentions

			m
Length	60	53 + 2 x 2.5	18.29
Width	10.5	8.5 + 2	3.20
Lane Length			1,207

Hull Dimensions

				Deck	Slacks	Total	Total
	Trailer Rows	ft	ft	m	m	m	ft
Length Deck	6	60.0	360.0	109.7	12.0	121.7	399.4
Length Width	6	10.5	63.0	19.2	1.4	20.6	67.6
L/B							5.9

Figure 6. Allan's Design Deck Arrangement and Main Characteristics

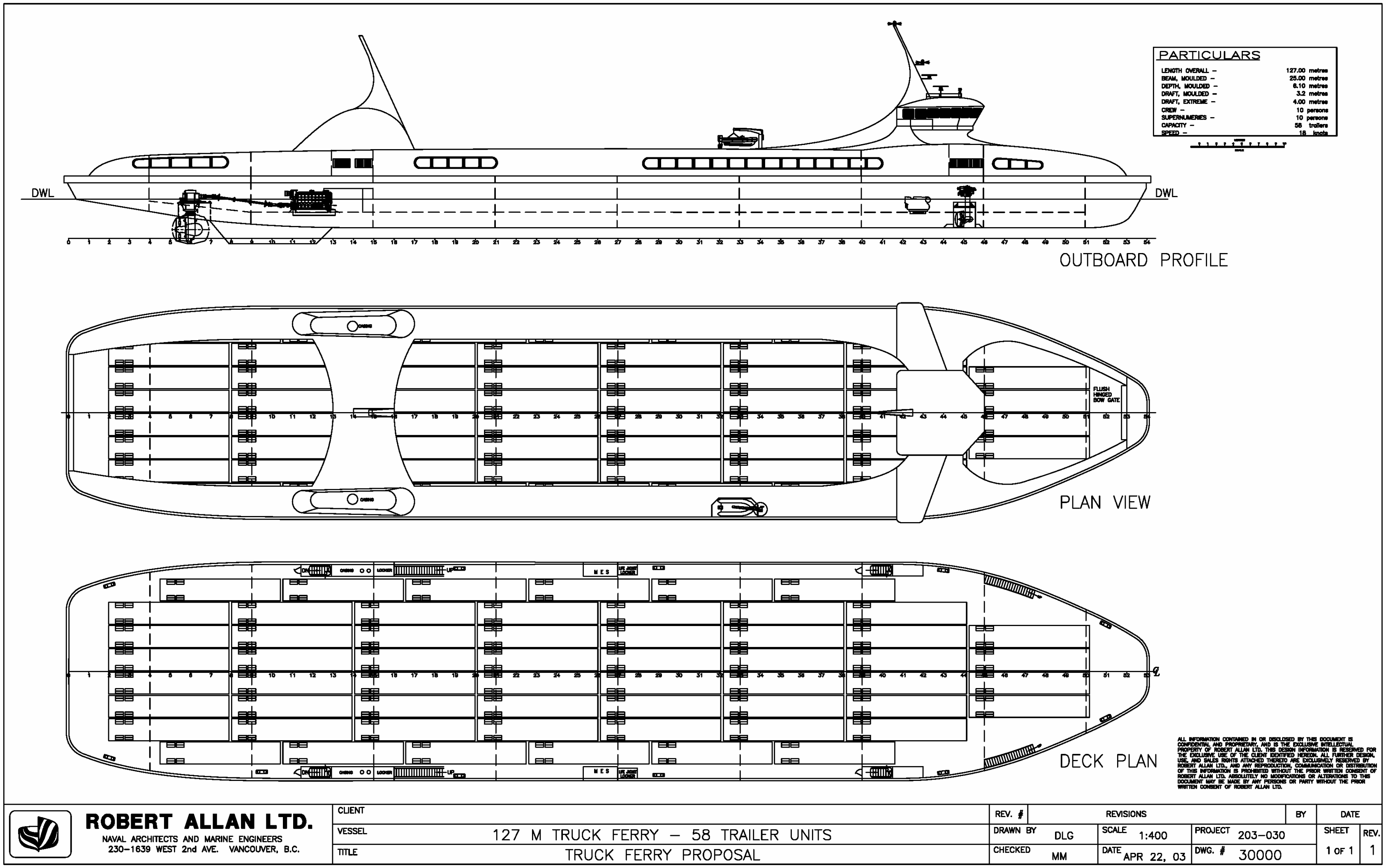


Figure 7. Characteristics of Small Ro/Ro Ships

Name	Unit	Esan	Sakura	Ferry Takachiho	Ferry Kirishima	Marine Road 2	Ferry Tkyo Maru	Druise Ferry Hiryu	Talbat	Celtic Star	Silver Queen	Hakata Maru
Type		Ro-Ro	Ro-Ro	Ro/Lo	Ro/Ro	PCC	Ro-Ro	Ro-Ro, Pas	Ro-Ro	Ro-Ro	Ro-Ro	Ro-Ro
Year		1988	1998	1990	1991	1993	1995	1995	1978	1991	1998	1997
LOA	meter	105	114	131	131	129	147	167	131	136	134	133
Beam	meter	16	16	20	20.2	20.4	23	22	18.5	20.5	21	21.4
Draught	meter	4.7	5.6	5.4	5.4	6.3	5.9	6	6.21	6.7	5.7	6.22
Deadweight	m ton	1,836	1,529	2,726	2,948	3,379	4,476	3,606	3,516	4,711	3,455	4,120
Speed	knot	17.5	20.2	19.9	19.9	22	23.5	25	21.8	20.8	21	21.5
Main Engine	kW	6,800	9,000	12,150	12,150	14,800	20,401	27,000	12,000	18,000	20,400	16,830
Fuel Consumption	ton/day		28.8				67				64	
TEU Capacity	TEU			68	78		150					300
Trailer Capacity	unit		35	29				145		86		20
Lane Length	meter	255		350	450		990		853			
Decks				2	2		2	1	2	2	2	
Passengers				12								
Cars						700	65	100	600			
											Double Screw	

Source: Clarkson

Figure 8. Technical and Cost Characteristics of Fast and Regular-Speed Ferries

	Country	Polish	Chinese	European Ro/Ro			USA				Prospective	Prospective
	Ship's Name	**Golfo Dei Coralli**	**Finnmill**	**Runner**	**RoRo 3200**	**RoRo 2700**	**APEX**	**Allan**		**Totem, Orca Class**	**RR1**	**RR2**
	Yard/Operator	**Szczecin**	**Jinling**	**Stena**	**Flensburger**	**Flensburger**						
Hull Configuration				Monohull	Monohull	Monohull	Monohull	Monohull	Monohull	Monohull	Monohull	Monohull
Length Overall	meter	197	185	183			131	127	127	255	122	122
Beam	meter	25	26.5	25.5			19.5	25.8	25.8	35	1.4	20
Draft	meter	6.1	6.8	6.6			5.2	3.2	3.2	9	4	4
DWT	ton	7,400	10,300	12,350			6,227				1,855	2,310
Trailers	FEU	140	211	185	180	145	219	58	88	648	53	66
Total Power	MW	19	18.9	23		19	10	6.6	6.6	50	10	11
Type of Engines		Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel / Electric	Diesel	Diesel
Number and Type of Engine		2 x 9,450 kW	2 x 9,900	4 x 5,760 kW			2 x 4,960 kW	2 x 3,300	3 x 3,300		10,000 kW	11,000 kW
Type of Propulsor		CT Propellor		Propellor			2 x VP prop	2 x Z-Drive	3 x Z-Drive	Propellor	VP Propellor	VP Propellor
Maximum Speed	knots	23	20	24	24	24	15	18	18	26	22	22
Service Speed (90% MCR)	knots			22	22	22	14			24	20	20
Fuel Consumption	tons/hour	3		4.60			0.83				1.6	1.7
Construction Cost	$million	35	25	35	34	27	29	22	25	150	20	22
Hull Materials		Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Fuel Type		HFO	HFO	HFO			MDO	MDO	MDO	HFO	HFO	HFO
Commetns		308 pas, 3-deck, reefer	12 drivers	12 pas, 3-deck, 2 x 1,000 kW bow thruster, flap rudder	3-deck	3-deck	2 cranes, open hatch	Driver Accommod.	Driver Accommod. Lifts to upper deck	5-deck, ice, reefer	Double Deck	Double Deck
Unit Cost	**$/dwt**	**4,730**	**2,427**	**2,834**			**4,657**				**10,782**	**9,524**
"	**$/Trailer**	**250,000**	**118,483**	**189,189**	**188,889**	**186,207**	**132,420**	**379,310**	**284,091**	**231,481**	**377,358**	**333,333**
Unit Cost	**$/Trail-NM**	**10,870**	**5,924**	**7,883**	**7,870**	**7,759**	**8,828**	**21,073**	**15,783**	**8,903**	**17,153**	**15,152**

In case the number of trailers not mentioned it is calculated by dividng the lane-meter by 18.

Figure 9. Technical and Cost Characteristics of Selected High Speed and Fast Ferries

		High Speed 1	High Speed 2	RR1	RR2
		Incat	**Brekvik**		
Hull Configuration		Catamaran	Catamaran	Monohull	Monohull
Length Overall	meter	112	118	112	112
Beam	meter	30	22	17.5	21
Draft	meter	3.3	3.2	4	4
DWT	ton	1,024	1,400	1,855	2,310
Trailers	FEU	47	45	53	66
Total Power	MW	36	34	10	11
Type of Engines		Diesel	Diesel	Diesel	Diesel
Number and Type of Engine		4 x 9,000 kW, Ruston 20RK280	2 x 17,000 kW	10,000 kW	11,000 kW
Type of Propulsor		Waterjet	Waterjet	VP Propellor	VP Propellor
Maximum Speed	knots	40	35	22	22
Service Speed (90% MCR)	knots	36		20	20
Fuel Consumption	tons/hour	5.9		1.6	1.7
Construction Cost	$million	68	44.5	20	22
Hull Materials		Aluminum	Steel	Steel	Steel
Fuel Type		MDO	180 cst	HFO	HFO
Commetns		Single Deck	Single Deck	Double Deck	Double Deck
Unit Cost	**$/dwt**	**66,406**	**31,786**	**10,782**	**9,524**
"	**$/Trailer**	**1,446,809**	**988,889**	**377,358**	**333,333**
Unit Cost	**$/Trail-NM**	**36,170**	**28,254**	**17,153**	**15,152**

In case the number of trailers not mentioned it is calculated by dividng the lane-meter by 18.

III Demand for Transportation Services in the New York – Boston Corridors

III.1 Level of Service

The trailer ferry service is intended to serve the freight currently handled by trucks. This freight, as already discussed in the previous chapter, consists of domestic trailers and domesticized containers (containers on chassis). In order to be competitive with current transportation services provided by trucks, the prospective coastal shipping service should provide a similar level of service at a similar, or, desirably, lower cost.

The two main characteristics that describe the level of service offered by existing truck services fare:

- ***Transit Time*** – Either same day or, mostly, 2nd day delivery; and
- ***Service Frequency*** – On demand.

The proposed coastal shipping service should desirably have the same characteristics. Providing same day service is technically impossible and should be left for trucks. In any event, as will be explained later on, it represents a very small fraction of the market, though it commands high rates.[6] Most of the traffic is characterized by 2nd day delivery, which should also be the aim of the coastal service and is also possible with both the high speed and fast ferries. Providing on-demand frequency is impossible for the planned scheduled service. Discussions with truck lines, the potential customers of the prospective service, indicated that if they are to retain the 2nd day delivery, a service frequency of 2/day would be acceptable. The main argument supporting the twice-daily frequency is that with a once-a-day frequency, if a truck misses the departure time, it has to wait an extra day.

III.2 Domestic Traffic between End and Intermediate Points

Despite intensive efforts by the study team, there still is not a reliable source of cargo flow data between New York and Boston. The team conducted an extensive analysis of the FHWA most recent "FHWA Eastern Seaboard Flows", a large database with 2 million records, provided by MarAd. The database included

[6] The high-speed may provide same day delivery only if the local pick-up is short and performed early in the morning and the delivery is performed late in the afternoon. But, this may result in considerable slack time for the ferry.

year 1998 flows as a base year, along with projection for years 2010 and 2020. To calculate the flow, the team defined the counties included in a range of about a 50-mile radius around the 2 selected terminals. Then the flow between these 2 regions, in tonnage and in truckloads, was calculated.

Figure 10 presents the results of the cargo flow analysis. These flows relate to 2003, which, in turn is based on linear interpolation between the actual data available for 1998 and the forecast prepared for 2010. The truckload data was derived from tonnage, hence it does not include empty trailers. As seen in this table the northbound flow between New York /New Jersey and Rhode Island /Massachusetts is 964 trailers/day and the southbound flow is 531 trailers/day. Presumably, the traffic has to be balanced in these two directions, hence the flow to consider should be 964 trailers/day. Altogether, the total traffic can be estimated at close to 1,000 trailers/day each way. Although unrelated to this study, it is interesting to note that most of the flows in Figure 8 are intra-state, the largest of which is within Massachusetts, at 15,379 truckloads/day. Appendix B describes the database and the analytical process of manipulating it.

Another source of traffic data is based on a Connecticut Department of Transportation study of March 2001 (see Appendix C). This study assumes that the I-95 corridor between New York and Boston is operating at level F, the highest level according to the FHWA, which relates to 7,200 vehicles/hour during the commuter travel time, of which 10% are tractor-trailers, or 720 trailers/hour. Assuming 12 hours of this rate and the other 12 hours at about 1/3 of it, the truck traffic would amount to about 11,500 trucks/day. This traffic includes all origin / destination points and there is no information on the percentage that could be assigned to the New York / Boston traffic. Using the previous estimate of about 1,000 trucks/day would indicate that this percentage is about 10%, which seems reasonable. A different, much higher, estimate was obtained from 2 operators in Connecticut, suggesting that information reviewed by them indicated about 15,000 vehicles/day on I-95, of which 15% are trucks, or 2,250 trucks/day.

Most of the truck lines operating along this corridor are relatively small (see below), with the largest hauling 20 – 30 trucks/day between New York and Boston. This is probably the reason why during interviews, these lines had difficulties estimating the entire market for trucking along this corridor.

Figure 10. Freight Flow in the New York / Boston Corridor

Highway Flows - trucks

DAILY

tons/truck	20
days/yr	312

1998	Destination				
Origin	MA	NJ	NY	RI	Total
MA	13,473	228	201	657	14,559
NJ	275	8,780	1,035	74	10,163
NY	396	1,454	7,409	53	9,312
RI	2	1	11	46	60
Total	14,146	10,464	8,656	829	34,094

2010	Destination				
Origin	MA	NJ	NY	RI	Total
MA	18,046	356	287	872	19,561
NJ	400	13,482	1,581	107	15,569
NY	610	2,227	11,223	81	14,141
RI	3	1	13	73	90
Total	19,060	16,066	13,104	1,132	49,362

2003	Destination				
Origin	MA	NJ	NY	RI	Total
MA	15,379	**282**	**237**	746	16,644
NJ	**327**	10,739	1,262	**87**	12,416
NY	**485**	1,776	8,998	**65**	11,324
RI	3	**1**	**12**	57	73
Total	16,193	12,798	10,509	955	40,456

NJ/NY to MA/RI ==>	**964**
MA/RI to NJ/NY ==>	**531**

Source: FHWA, manipulated by NPWI.

III.3 International Traffic between End and Intermediate Points

As already noted above, the Connecticut Department of Transportation conducted several studies looking at the possibilities of developing a coastal barge service between New York and the Connecticut port. The estimates in these studies were for a potential of about 60 - 90 containers/day (depending on source) for each of the Connecticut ports Bridgeport and New Haven, or a total of 120 - 180 containers/day for both. These estimates were also confirmed through interviews with truck lines already operating on these routes and shipping lines using them and the barge service (see below).

The New York / Boston corridor is much larger with, according to shipping or trucking lines 2 – 3 times the Connecticut flow, between 250 – 400 containers/day. The Columbia Coastal barge service between New York and Boston is carrying about 300 containers/week, or about 50/day.

III.4 Potential Traffic and Targeted Market Share

The prospective ferry service is intended to handle both domestic trailers and international, domesticized containers (containers on chassis). Hence, the total potential traffic for the ferry service is simply the summation of domestic and international, which based on the above discussion is:

Domestic Trailers	1,000 trailers/day
International Containers	500 containers/day

Total	1,500 trailers and containers/day

About 2/3's of the traffic above, or 1,000/day, is between New York and Boston and the remaining 500 are between New York and Connecticut points.

The above estimate is still rough and could well be somewhat conservative. The main reason is that the data related to the flow of domestic trailers, does not include to the so-called "through" traffic, in which the ferry can be used as in interim leg. For example, there is traffic between Florida and Boston that may be railed or trucked to New York and then take the ferry to avoid the congested segment of I-95 north in the New York area. Based on Phase II study, which was based on a database that allowed analysis of through traffic, it is estimated that it may amount to about 20% of the direct traffic.

Chapter V describes several alternative transportation schemes, each with a different service capacity. In general, the planned capacity for the start-up stage is about a 100 trailers/day, which is roughly about 7% of the entire potential market. This targeted market share may appear low, but it should be remembered that attracting this market may require structural changes by truck lines, converting their operating system from direct to “terminalized”, as described in the following chapter. If warranted by the success of the first stage, the service capacity could increase without much difficulty. One possible way is to increase the number of vessels and the respective service frequency say to 3 or even 4/day. This increase may require some increase in terminal parking. However, the ports identified for the service have large, underutilized facilities (see Chapter VI).

IV Transportation Services in the New York – Boston Corridors

IV.1 Truck Services

Trucks handle most of the traffic along the New York / Boston corridors. Present operators in the trucking of trailers and containers can be divided into two general groups:

- ***Large Truck Lines*** – Truck companies with over 50 tractors with at least some of them operated by company employees; and

- ***Small Independents*** – Truck companies or individual owners with several trucks.

The difference between these two is not only in size but also in their mode of operation. Large trucking companies are usually “terminalized”. Their mode of operation is built around regional truck terminals where they keep and maintain the equipment (tractors and trailers) and have their offices. For these companies, the transportation process usually involves 3 legs: local delivery on both ends and a linehaul. The local delivery relates to the short leg in which the trailer is transported between a regional terminal and the endpoint, usually a customer warehouse, factory, store, etc. The “breaking down” of the transportation process intends to achieve better productivity. Local delivery is done by local crews that are familiar with the local transportation system and customers. The local staff can call and coordinate with customers’ delivery and pick-up times, at their convenience, usually during the daytime. The local delivery also uses different types of tractors (smaller, without sleeping cabs, etc.) and the drivers spend their nights at home. In contrast, the long-haul leg may be undertaken late at night, when traffic is light and usually involves larger tractors, with sleeping arrangements. The long-haul drivers usually go for 3 – 4 days on assignments away from home. The “terminalized” system between New York and Boston results, in most cases, in a 2^{nd} day delivery.

The large truck lines are also involved in the intermodal movement, in which they substitute the long-haul leg with rail. Hence, for them, using the ferry, which is similar to the rail, is quite natural.

Small independents tend to “stay with the cargo”, which means that the same driver handles the entire door-to-door service. Typically, the driver begins early in the morning, taking the empty trailer to be stuffed at the origin point. The local leg may take 2 – 4 hours. Then, the same driver continues with the long haul, which, if it is between New York and Boston, may take 5 – 6 hours. Hence, by the time the driver arrives at Boston, the destination point, typically a warehouse, could already be closed or the driver running out of driving hours, which are limited to 10 hours per day. In any event, the trailer has to be de-stuffed at the destination point, which may also take 2 hours or so. Hence, in most cases, the delivery will take place the next day, and the resulting level of service 2nd day delivery. Also, there could be traffic or other problems resulting in delays.

There are no statistics relative to the market share of each type of the trucking company. Discussions with the industry indicate that at the present, the market is dominated by smaller independents. It may be demonstrated by the fact that the presence of the large, national truck lines (J.B. Hunt, Schneider National) in this market is limited. Rate data is kept confidentially. Nevertheless, discussions with several truck lines suggest that the all average for a Newark / Boston trip is $500/trailer one-way, with high of $600 and low of $450. There is an additional fuel surcharge of between 5 and 10%. Other than that, these rates appear to have been stable for several years. Interestingly, all truck lines interviewed indicated that as road congestion unavoidably increases, rates are also expected to rise.

The ferry service, as will be discussed in Chapter V, is intended to serve truck lines in a very similar way to the present service offered to them by intermodal railroads. Hence, the service is not planned to change market share or to favor in any way or fashion any market agent. However, it could well be that the availability of a frequent, reliable and cost effective ferry service may impact the trucking industry along the New York / Boston corridor, in favor of the larger truck lines. In this case, larger truck lines will use the ferry terminals as truck terminals, effectively substituting their current terminals. Furthermore, they will arrange local delivery services at both ends in a similar fashion to what they arrange for rail terminals.

IV.2 Barge Services

Columbia Coastal New York – Boston Service

Colombia Coastal Transport (CCT) maintains a weekly service between the marine terminals at the Newark / Elizabeth complex and Boston's Conley Terminal.[7] A second service by Hale was halted several years ago due to insufficient demand. CCT's present fleet includes 16 container barges, all U.S. flag, serving 11 East and Gulf Coast ports. CCT services are only provided to shipping lines and only for international containers. The typical CCT barge is 300 x 72 x 16 x 12 ft. (LOA x beam x depth x draft), with a nominal capacity of 540 TEU. The barge is pulled by a 5-6,000 HP ocean-going tug, operated by a 9-man crew. The crew is housed on the tug. CCT's total activity amounts to about 200,000 TEU/year.

[7] Another CCT service of interest is between New York and Norfolk, also 1/week.

The transit time for the 230 NM New York—Boston route is 28 – 32 hours, based on an average speed for the pull-barge system of 8.5 knots. However, flat-bottom barges, especially when being pulled, are sensitive to bad weather. Hence, the system suffers from delays during wintertime. Barge capacity is 250 – 300 boxes.

In New York, CCT usually calls at 2 terminals, Maher and APM, but may also call at a third one, PNCT. In Boston, the barge only calls at Conley. The port operation of the barge is quite cumbersome. For example, the barge may discharge inbound boxes first at Maher terminal, then move to APM and, occasionally even to PNCT. Once the discharge is finished, the barge may repeat this inter-terminal moves for loading. The inter-terminal moves require tying and untying of the barge and tug assist. In each terminal the barge requires a gantry crane and a gang, although barges usually enjoy a special arrangement for a "short", or reduced manning – only 9 persons. ILA gangs usually have a minimum of 4 hours and their working shifts only begin at certain hours.

Barges have lower priority relative to large ocean-going containerships. Hence, occasionally the barge has to wait for a crane and a gang to be available. Because of the interrupted port handling, the port time of CCT in New York is 2 – 3 days. However, since the service frequency is only 1/week, the rotation time has sufficient slack time to allow for such delays.

The average freight rate for barging is estimated, based on industry sources, at $500 - 600/box. The port cost is the main expense for CCT, estimated here at about $350 – 400 for the 2 lifts. Hence the portion that is left with CCT for the barge segment is about $150/box.

CCT's rate is similar to truck rate, but its level of service is much inferior, with only one departure a week and transit time of 3 days.[8] This raises the question of the overall viability of such a barge service. The viability of CCT is not the subject here, however, and only discussed here since the barge service has some resemblance to the prospective ferry service. One explanation provided by barge users is the reliability of the service and its large capacity. That is, shipping lines looking to move 50 boxes between New York and Boston would most probably have to use several truck lines, creating an administrative burden and problems with service reliability.

Another reason is that, presumably, for international containers, transit time is not of the essence since the local trip is viewed in the context of the entire trip time, which is 4 – 5 weeks. A related explanation is that, in any event, boxes stay in the terminal several days until being picked up by consignees, so the barge transport

[8] One way of incorporating the frequency and transit time is to add to the latter ½ of the inter-departure time, in this case 3.5 days, bringing the effective transit time to 6.5 days. In reality, the barge line would attempt to coordinate its departure time with its largest customers' ocean schedule and shorten the waiting interval.

takes place during this time. Yet another explanation is that using the barge service eliminates the need for chassis from the line, leaving this responsibility to shippers and their truck lines.

New York Barging Initiative

The Port of New York, in cooperation with several ports in Connecticut and Rhode Island, has been promoting a system of regional barge services. New York's initiative is mainly intended to ease the congestion in their marine terminals. The envisioned barge operation is based on handling containers directly to/from the dock, the same way it is being handled by the present CCT's Boston service except that they are shorter. The intended services would also be similar in terms of equipment and operation to the existing CCT service to Boston. Hence, like the present Boston service, barges will be shuttling between the different terminals in the New York area and the loading/unloading will be performed by ILA gangs and gantry cranes. A slight modification is envisioned in the case of the shorter distance to Bridgeport, whereby a Ro/Ro barge could be more advantageous.

New York support is understandable: barge services would eliminate the need for the barged containers to cross New York terminals' gates and may also shorten the containers dwell time at New York terminals, easing yard and, especially, gate congestion.[9] Appendix C provides a brief summary of 4 studies that discuss regional barging: (1) Southwest Corridor Commodity Flow Study, by the Connecticut Department of Transportation, May 2000; (2) Container Barge Feeder Service Study, Connecticut Department of Transportation, March 2001; (3) Mid Atlantic Rail Operations Project, by Cambridge Systematics, February 2001; and (4) Identification of Massachusetts Freight Issues and Priorities, by Massachusetts Highway Department and Louis Berger & Associates, 1998.

The first service, to Albany, was expected to begin on April 1, 2003, based on a 1/week frequency, later increasing to 2/week. The Albany service is supported by a large Federal grant, including $3.3 million for congestion mitigation and air quality improvement and $1 million earmarked by the Port Authority. From discussion with planners in Connecticut, it seems that a State grant will also be needed for the Connecticut's ports for this service.

The regional barge services, if ever implemented, will not present direct competition to the prospective ferry service. First, their level of service (transit time and frequency) would be much inferior; second, they are exclusively geared toward marine containers prior to their release.

[9] Media reports indicate that waiting lines in the Newark-Elizabeth complex may reach 4 or more hours. Recently, some terminals extended their gate hours to 6 am to midnight.

IV.3 Rail Service

There is no direct rail route between New York and Boston. The current service is provided by CSX and has a circuitous route, going first to Albany and then to Worcester. The service is geared toward containers. Its New York yard is in South Kearney, at the same complex whereby the intended ferry terminal may be located. The transit time is next day, with one daily departure. For example, cut-off time in South Kearney is presently at 4 pm and pick-up time in Worcester is 3 pm next day. The service is not geared to individual shippers but mainly to Intermodal Marketing Companies (IMC), which also contract for the drayage on the two ends. Rates quoted are somewhat lower than trucking with terminal to terminal at about $275/box.

The rail service's focus is on marine containers to/from the Worcester area, combining the New York flows with the largest flows from the Midwest and West Coast. The rail service is not geared to serve domestic trailers. Likewise, the service cannot serve the intermediate range, e.g., Long Island and Connecticut Rhode Island. Consequently, while the rail may pose some competition to the proposed ferry service, it would be limited.

V Operation System and Cost of the Prospective Coastal Service

V.1 Operational Schemes and Capacities

Figure 11 presents time and the cost calculations of the three operational schemes selected for further evaluation are presented in. There are 3 general operational schemes available for the ferry service on the 165 NM New York / Boston route, each corresponding to a different speed of the selected vessel:

- ***High Speed Ferry 1(HS1), 38 knots*** – Completing 2 roundtrips per day;
- ***High Speed Ferry 2(HS2), 29 knots*** – Completing 1.5 roundtrip per day, or 2 full roundtrips in 3 days (72 hours); and
- ***Fast Ferry (RR1 & RR2), 22 knots*** – Completing 1 roundtrip per day

The roundtrip includes 2 voyages (sailings) and 2 port handlings, along with some slack time.

Another operational assumption relates to the number of weekly roundtrips. In all schemes the number of voyages during weekend days is assumed at half of that of regular weekdays. Because of differences in vessel capacity and number of weekly voyages, the service capacity of the 4 types of vessels, as seen in the upper portion of Figure 10, is also different, ranging from 33,000 to 59,000 trailers/year (each way).

V.2 Ship Cost

The lower part of Figure 11 includes calculations of the ship cost for each of the 4 types of vessels under consideration. The costs are divided into fixed and variable. Fixed costs include construction (capital), crewing, maintenance and repair and insurance costs. Variable costs include fuel. As seen in the table, the construction cost is amortized over 20 years at 7%, which is the common commercial rate (no subsidy). The results of the calculation vary by type of vessel from $145/trailer-trip for the RR2 to $321/trailer-trip for HS1, a range of more than 2 : 1. It is interesting to note that the difference in fuel costs ranges from $29 to $127/trailer-trip between RR2 and HS1.

Figure 11. Service Capacity and Ship Cost

		High Speed1	High Speed2	RR1	RR2
Nominal Speed	Knots	**38**	**29**	**22**	**22**
Nominal Capacity	Trailers	**47**	**45**	**53**	**66**
One-Way Distance	NM	165	165	165	165
Average Speed	Knots	36	27	20	20
Onw-Way Trip Time	Hours	4.58	6.11	8.25	8.25
Two-Way Trip Time	"	9.17	12.22	16.50	16.50
Two-Way Port Time	"	2.00	3.00	4.00	5.00
Rotation Time Net	Hours	11.17	15.22	20.50	21.50
Roundtrips/Day - Possible	Days	2.15	1.58	1.17	1.12
Roundtrips/Day - Selected	Days	2.00	1.50	1.00	1.00
Roundtrips/Week	Trips	12	9	6	6
Trailers/ Roundtrip	Trailer-Trip	94	90	106	132
Trailer-Trips/Week, OW	Trailer-Trip	1,128	810	636	792
Trailer-Trip/Year, OW	Trailer-Trip	58,656	42,120	33,072	41,184
Fixed Costs					
Construction Cost	$	66,000,000	40,000,000	20,000,000	22,000,000
Capital Cost (7%, 20 yrs)	$/Year	6,229,933	3,775,717	1,887,859	2,076,644
Crew Cost	$/Year	1,755,000	1,755,000	1,755,000	1,755,000
Maintenance & Repair	$/Year	1,980,000	1,200,000	400,000	440,000
Insurance	$/Year	750,000	750,000	500,000	500,000
Total Annual Fixed Cost	$/Year	10,714,933	7,480,717	4,542,859	4,771,644
Total Daily Fixed Cost	$/Day	30,614	21,373	12,980	13,633
Annual Capacity	Trailer-Trip	58,656	42,120	33,072	41,184
Fixed Cost per Trip	$/Trailer-Trip	**183**	**178**	**137**	**116**
Fuel					
Fuel Consumption	Tons/Hour	5.9	3.3	1.6	1.7
Fuel Price	$/Ton	220	220	135	135
Fuel Hourly Cost	$/Hour	1,298	730	216	234
Sailing Hours per Roundtrip	Hours/Trip	9.17	12.22	16.50	16.50
Fuel Cost per Roundtrip	$/Trip	11,898	8,924	3,564	3,868
Capacity per Roundtrip	Trailers/Trip	94	90	106	132
Fuel Cost per Trip	$/Trailer-Trip	**127**	**99**	**34**	**29**
Total Cost per Trip	$/Trailer-Trip	**309**	**277**	**171**	**145**

Assumptions:

1. High Speed 1 is equivalent to Incat/Bollinger 12F; High Speed 2 to Brekvik.
2. Schedule assumes 50% of service capacity on weekends.
3. Fuel cost is based on Dec 2002 average for 380 CST in Houston, TX at $134/ton.

Crew cost is an important factor and one of the main obstacles for many coastal shipping systems. In order to achieve the relative low cost in the coastal systems included here, crew size was reduced based on two assumptions:

- ***Day Crews*** – Crews would be switched at end ports and will not have to be housed in the ferry; and

- ***Multi-Licensing*** – licensed personnel would have dual (deck & engine) licenses.

A crewing system based on switching crews at end ports is possible on the proposed ferry services since the voyage time, even in the case of the fast ferries, is only about 8 hours. Employing day crews saves on accommodations (no need for cabins) and most importantly, having replacement crews on-board. Requiring dual licensing from officers and requiring all officers to stand shifts reduces the number of licensed personnel. Altogether, the size of the on-board crew could be reduced to 5.[10] Another assumption is that all vessels are highly automated in terms of engine, navigation and mooring equipment. Other operational savings relates to the elimination of the need for pilot, since all personnel include US citizens and since the vessels sails between the same terminals; and tug, since vessels are equipped with bow thrusters. Figure 12 presents a calculation of crew cost, including underlying assumptions.

Figure 12. Crew Cost

Profession	Unit	Salary	Cost	Num of Persons	Total
Licensed	$/Year	90,000	135,000	3	405,000
Unlicensed	$/Year	60,000	90,000	2	180,000
Total Annual Cost	$/Year			**5**	**585,000**
Crews / Vessel					3.0
Total Annual Cost	$/Year				**1,755,000**
Working Days	day				350
Total Daily Cost	**$/Year**				**5,014**

Assumptions:

1. Crew size is based on "Day Crews", switching crews every end-port call. No accommodaion is provided on-board.
2. All licensed personnel is dual licensed (deck & engine).
3. Highly automated design (unmanned engine, constant tension pullies, etc.).
4. Numver of crews is based on working shifts of 12 hours, 4 on, 4 off.

[10] The minimum crew required according to Naval Architects is 4, 2 licensed (Captain/Chief Mate) and 2 deckhands. The lowest manning presently, 8, is on ocean-going tugs, but it includes on-board replacement.

V.3 Port Cost

The issue of coastal ports is probably the most critical for the economic implementation of coastal shipping. The issue was discussed in detail in the previous phases of research. Nevertheless, and for clarification, a brief review of the main factors and considerations, along with a generic cost calculation, is included here as well. The proposed coastal ferry system is based on dedicated domestic ports. These ports (or terminals, both terms are interchangeable here) are based on the Ro/Ro handling system, with all cargoes staged "on-wheels". That is, there is no lifting of boxes, chassis or pallets in the system's ports. In fact, the selection of a Ro/Ro vessel system for the coastal service was specifically intended to avoid lifting.

The prospective coastal ferry system, unlike the existing coastal barging system, is not based on existing container terminals. These terminals have high capital costs due to the fact that their facilities are designed to handle large, deep-sea containerships; they also suffer from operational inflexibility stemming from the stiff shift structure; and entering / exiting their gates is difficult since the entire terminal area is within a Customs zone.

A schematic layout of an envisioned, domestic terminal was already discussed and presented in the Phase III research. Briefly, the coastal terminal is simply a parking lot for trailers. The terminal yard includes 2 types of trailers: those who have been dropped there by truck lines to be loaded on-board the coming ferry and those discharged from the last ferry and waiting to be picked up by truck lines. The main facility at the terminal is a Ro/Ro ramp, with the ramp designed to suit the selected type of vessel. The ramp could be based on a "spacer" barge or any other arrangement (see Phase III report, Appendix D) and would have the same width of the vessel, allowing handling of all lanes simultaneously. The main terminal equipment is yard tractors to load and unload trailers to/from the ferry and move trailers in the yard. Port handing time for the ferries could varies according to the vessel system, but generally it should be only 1 – 2 hours.

<u>Figure 13</u> presents a calculation of port cost, including required terminal manning and equipment. The calculation is general in nature and does not relate to any specific site. The main assumption underlying this calculation is dedicated, permanent port labor, unlike the way CCT barges are presently handled using general gangs on the basis of availability. Using dedicated, permanent labor fits well with the coastal system based on 2 daily sailings. The suggested port work is based on 3 shifts, with the size of manning in each shift varies according to the expected activity in vessel and yard handling. The administration of the coastal system is expected to be quite simple, with booking and payment performed

directly via the Internet.[11] The fixed investment in yard, fence, lighting, ramp, office building and other facilities is estimated at $5 million per terminal, amortized over 20 years at 7%. Rental payment is estimated at $500,000/year and labor cost at $2.1 million/year. The total annual cost of the port is about $3.4 million. Assuming that the terminal handles about 60,000 vessel-handling moves ("lifts"), which is the case with RR1, the unit cost amounts to $50/trailer.

V.4 Total Service Cost and Comparison to Trucking Cost

Figure 14 provides a summary of the time and cost performance of the prospective coastal shipping service between New York and Boston. This figure summarizes previous information regarding ship and port cost, reviewed above. The terminal-to-terminal, "production cost", as seen in the figure, varies from $216/trailer-trip for RR2 to $359/trailer-trip for High-Speed 1. Assuming 85% average slot utilization, the total terminal-to-terminal costs range from $254/trailer-trip for RR2 to $422/trailer-trip for HS1. It should be emphasized that the above results assumes no public support and/or subsidy of any kind.

For comparison with existing trucking services, a drayage of $200/trip ($100 for each end) is added for the additional short legs between the ferry terminals and the final inland points (e.g., shipper / consignee warehouse). This cost figure is based on discussions with truck lines in which they indicate that drayage costs vary widely, depending on distance and traffic conditions. For example, drayage cost from Newark container terminals to the CSX yard ranges $65 - $125. Similar drayage costs are quoted for Jersey City, Bayonne, Secaucus, etc. Drayage costs to points further away are higher, ranging $150 – 250. However, the rates quoted by competing truck lines for further points are also higher.

Assuming that the proposed service concentrates on close-by cargoes where drayage charges are about $100, the total point-to-point cost of the coastal service, including drayage, ranges from $454/trailer-trip for RR2 to $622/trailer-trip for HS1. Trucking cost for the same route is presently about $500/trip. Hence, only RR2 and RR1 are competitive with trucking. It should be noted that RR1 & RR2 not only provide a cost competitive but also time competitive service, since the service's transit time is 2nd day, which is similar to trucking (see discussion in Section III.1). As for the HS1, while its travel time of 4.5 hours is about half that of the 8.25 hours for RRs, the impact of 4 hours difference is limited. This is because shippers usually only accept freight during the daytime, usually 8 am – 6 pm. As a

[11] For example, each participating truck line will have a credit arrangement. The line logs on to the ferry website to review space availability. Upon selecting the desired departure, the truck line is assigned a slot number on the ferry, which is also marked in the parking lot where the driver drops the trailer. Once the ferry leaves, the website is updated with all the trailers aboard along with projected arrival time. Another update is provided upon arrival including notification of the yard slot where the trailer is parked.

result, in most cases, the actual delivery would be the next day, similar to that of the RR2. Altogether, it seems that due to the short distance and working practices, the HS1 service would not be able to take advantage of its higher speed.

The conclusion of the cost vs. freight rate comparison above is that the prospective service, based on small fast ferries, either RR1 or RR2, is cost effective. Likewise, the market share that the service has to attract compared to the entire market potential appears reasonable. Hence, the overall conclusion is that the coastal service between River Terminal, NJ and Provport, RI, is feasible. That is, the prospective ferry-based system could provide the transport service in the New York / Boston corridor at a truck-like level of service and at truck rates or even slightly below it. The ferry-based service is most attractive to freight generated/terminated within a 5-10 mile radius of the terminal in New Jersey and a 20-30 mile radius in Providence. It is less attractive to areas outside these catchments radiuses.

A possible stop in Long Island was not discussed above due to lack of information on a potential site. Nevertheless, a short discussion is warranted. Truck lines serving Long Island indicated that it is very time consuming because it involves crossing congested bridges. Hence, there is always an additional charge ranging from $200 -- 800 /truck, depending on location in the Island. The ferry service could take advantage of this situation through higher charges. Moreover, in certain situations the ferry could even generate double revenues for the same slot, moving, first, a trailer from Newark to Long Island and then from Long Island to Providence.

The ferry service has another advantage related to often disregarded, level-of-service factor – reliability. An important advantage of the ferry service is that since its roadway is open, it is highly reliable. Likewise, the ferry has the capability to handle a larger number of trucks. Still, there could be weather problems. However, unlike the Boston barge, the ferry has high seaworthiness and the route is almost entirely protected.

Finally, before closing the assessment of the ferry system, it should be emphasized that for the coastal system to achieve the above-reviewed performance, it should be based on several novel principles, the most notable of which are the development of dedicated, domestic terminals and operating the ferries with reduced manning.

Figure 13. Port Cost of a Dedicated Ferry Terminal

Throughput

OW Trailer-Trips	33,072
Lifts/year per Port	66,144

Labor at Terminal

	Persons / Shift	Shifts / Day	Total	Salary / Person	Total Salareis	Total Salaries & Fringes	Cost Per Lift
General Manager	1	1	1	80,000	80,000	116,000	
Shift Manager	1	2	2	70,000	140,000	203,000	
Secretary	1	1	1	40,000	40,000	58,000	
Operators	6	2	12	60,000	720,000	1,044,000	
Mechanic	1	1	1	70,000	70,000	101,500	
Gate Keeper	1	3	3	35,000	105,000	152,250	
Total Cost	11		20		1,155,000	1,674,750	**25.32**

Equipment

			Number of Units	Cost / Unit		Total Cost	
Terminal Tractors			6	60,000		360,000	
Amrtization (7 years ,7%)						66,799	
Maintenance (10%)						36,000	
Fuel						20,000	
Total Cost						122,799	**1.86**

Facilities

Investment						5,000,000	
Amortization (20 years, 7%)						471,965	7.14
Maintenance (3%)						150,000	2.27
Rent						500,000	7.56
Total Cost						1,121,965	**16.96**

Management & Administration (entire system)

General Manager	1	1	1	90,000	90,000	130,500	
Administrative	3	1	3	50,000	150,000	217,500	
Total Cost						348,000	**2.63**

Total Port

Labor						1,674,750	25.32
Equipment						122,799	1.86
Facilities						1,121,965	16.96
Mngt & Adm						348,000	2.63
Total						**2,919,514**	**44.14**

Figure 14. Ro/Ro Service between New York and Boston -- Cost and Time Summary

			High Speed1	High Speed2	RR1	RR2
	Nominal Speed	Knots	38	29	22	22
	Nominal Capacity	Trailers	45	45	53	66
Average Speed		Knots	36.00	28.00	20.00	20.00
OW Tranist Time		Hours	4.58	6.11	8.25	8.25
Ship Cost	Fixed	$/Trailer-Trip	183	178	137	116
	Fuel	"	127	99	34	29
	Subtotal Ship	$/Trailer-Trip	**309**	**277**	**171**	**145**
Port Cost	Labor	"	25	25	25	25
	Equipment	"	2	2	2	2
	Facilities	"	17	17	17	17
	G & A	"	3	3	3	3
	Subtotal Port	$/Trailer-Trip	**25**	**35**	**44**	**35**
Total OW Trip Cost		$/Trailer-Trip	**359**	**346**	**259**	**216**
Utilization			0.85	0.85	0.85	0.85
Adjusted Total OW Trip Cost		$/Trailer-Trip	**422**	**407**	**305**	**254**
Local Drayage, both ends		"	200	200	200	200
Total OW Point-to-Point		$/Trailer-Trip	**622**	**607**	**505**	**454**

Assumptions:

1. Rotation: Newark, NJ -- Providence, RI, 165 NM one-way, with possible stops in Long Island and Bridgeport / New Haven, CT.
2. Service capacity about 100/day each way; frequency 2/day.
3. End point drayage is assumed at $100 per port (about 2 hour roundtrip).

V.5 Possible Response of Truck Lines

While, overall, the coastal system appears to be cost effective, its implementation might be difficult. As noted at the beginning of this report, the prospective ferry service is NOT geared to compete with truck lines but to serve them. Put differently, the ferry service's main customers are expected to be truck lines, the present providers of most of the transportation services in the New York / Boston corridor. Most of these truck lines are small and work on a direct point-to-point basis. These truck lines will have to change their mode of operation to terminal-based in order to use the ferry system. For some smaller truck lines, the savings involved in this change may not justify the related investment (e.g., developing terminals). Other may elect to merge or form alliances.

The availability of such a ferry service may also induce the entry of large truck lines to the New York / Boston market. These lines already operate a "terminalized" system that fits well with the ferry system; they also use intermodal rail services. Large truck lines tend to contract with large shippers offering them nationwide contracts. Currently, large truck lines avoid the New York /Boston corridor since they cannot compete with their terminalized system with smaller, truckers offering direct services. The ferry system will allow large truck lines to enter this market, increasing competition to the benefit of consumers.

V.6 The Impact of the Coastal System

Future Service Expansion

The focus of this phase of research was on a specific application of the coastal system, a service between New York and Boston. This service, as indicated above, appears to be economically viable, although its implementation is conditioned on changes in labor practices in port and ship operations. The capacity of the initial stage of the service is 82,000 trailer-trips/year. This is based on employing RR2 with a nominal capacity of 66 trailers and 2/day frequency. This capacity is equivalent to roughly 7% of the entire potential market. If, following the initial implementation, this service is proven to be a commercial success, there is plenty of room for the service to grow. A reasonable expansion plan would include deploying additional vessels of the same capacity, increasing the frequency to 4/day, handling 164,000 trailer-trips/year and capturing 15% of the market. The increased service frequency will reduce cost, since a large portion of the expenses are fixed.[12] A higher frequency service will also be more competitive with trucks. Another reason for the future growth of the coastal service is the increasing road congestion on I-95 and the resultant increase in trucking cost and degradation of trucking level-of-service.

---

[12] The 4/day service will use the same berthage and only require a small increase in yard area. Likewise, there will only be a slight increase in administrative costs. Savings can also be incurred due to a reduction in ship construction costs (learning curve).

Eliminating over 150,000 truck-trips/year due to the coastal service may result in important environmental benefits in terms of road congestion, fuel conservation, reduction in gas emission and noise.

Additional Regional Coastal Services

Moreover, once the New York / Boston service is commercially successful, related coastal services could be developed, taking advantage of the experience gained in the first service. For example, a complementary service could be initiated between New York / Philadelphia / Baltimore / Norfolk. A further extension may reach Wilmington, NC, Charleston, Savannah, Jacksonville, Miami, etc. The network of inter-connected regional services will provide for longer trips, such as that between New York and Miami. Finally, as indicated in Phase II study, coastal services could be developed in the Pacific Coast and, eventually encompass the entire 3-nation NAFTA region.

V.7 Military Use of the Prospective Coastal System

The selected type of vessels, defined before as fast ferries, have speed ranges well below that required by the military. However, the high-speed ferries, advocated in the previous phases of study, have much higher costs of construction and operation (fuel). Moreover, as demonstrated in this study, the commercial use for shorter routes, which constitutes most of the traffic, is limited. The high-speed vessels are simply not cost competitive with trucks.

While the selected fast ferries could not reach the speed range of the high-speed ferries, they should still be considered as militarily useful. The existing Ro/Ro fleet in the United States consists mostly of larger, deep-draft vessels. The Ro/Ro selected in this study have smaller dimensions and shallow draft, which provide a very desirable addition to the current commercial and military US-flag fleet. In time of emergency, the coastal ferry system can carry rolling military equipment or, if required, containers between the many ferry ports and assist in the mobilization effort. Moreover, since handling ferries does not require large investments in port facilities and equipment, the ferries could use any port, including secondary ports located nearby military bases. Finally, if required, the ferries could be used in foreign ports, especially those who do not have the installation to handle large vessels.

Another advantage of the coastal system is training and maintaining US seafarer personnel.

VI Proposed Institutional Setting of the Ferry System

Defining the institutional setting of the prospective service is the subject of the next phase of implementation. Still, a brief discussion of this issue is warranted at this phase. The envisioned service is geared toward truck lines and, hence, should not compete with truck lines by providing alternative, competing services. The coastal service operator should be a “neutral” party, who will only be involved in the operational aspects of vessels and terminals. That is, the operator will not in any way be involved with freight and specifically, will be not attempt to provide point-to-point or related transport services. The separation between the operating entity and users is also required since the ferry service might have a monopolistic position in terms of competing (parallel) coastal service.[13] Another possibility is that the service will be operated by a regional public agency, similar to other ferry systems in the United States. There could be also different mixtures of public/private systems, in which the public agency is acting as a landlord, bidding out the various segments to private operators, similar to the common model for many US port authorities.

[13] This could either be due to scale economies or, more probably, because of the shortage of suitable terminals.

VII Workshop on Study Findings

VII.1 Organization

The workshop to discuss this study's findings was held on May 29, 2003. The workshop was organized jointly with the U.S. Maritime Administration and took place in the U.S. Department of Transportation; see attached invitation and agenda for the workshop.

The objectives of the workshop were:

- Verify the study methodology, data, assumptions and conclusions.
- Define the next steps in development of the proposed service with focus on implementation.

Throughout the conduct of all phases of this study the Institute has closely collaborated with the Study Industry Advisory Council and with Coastal Shipping Coalition. Participants of the workshop were comprised by members of these groups, representatives of MARAD and other individuals with a direct interest in Short Sea/Coastal Shipping. A list of participants is attached.

The overall conclusion of the workshop was that this study presented a well-substantiated case for establishing a coastal shipping service between New York/New Jersey and Massachusetts. The study presented the major parameters of the proposed service: vessel type, specific ports, traffic volume, investments, cost of operation, competitive comparison with trucking costs and logistics, frequency of services, etc. All these parameters indicate that proposed service is viable and analyzed in sufficient detail to proceed with the actual implementation.

In general, in addition to some transportation cost savings the proposed service also:

- Provides a new maritime based intermodal system;
- Opens opportunities in development of waterfront marine infrastructure, Shipbuilding and cadres of U.S. Seafarers;
- Decreases the density of heavy trucks on most congested segments of highway network;
- Reduces the environmental impact of transportation;
- Creates additional U.S. Flag fleet reserve in case of emergencies.

Despite these advantages implementation of the proposed services is not an easy task.

- Direct savings in transportation rates might not be sufficient for a private operator to accept a risk associated with initiation of a new and untested service, up front investments, marketing and so forth;
- Significant benefits are external, generated in other socio-economic areas (congestion, environment, military) and there is no mechanism to credit a potential operator with these external benefits;

- There are multiple stakeholders involved who need to be organized and contribute to support initiation of the proposed service.

Accordingly, it is clear that Private/Public partnership must be prerequisite to successful implementation of the proposed service.

VII.2 Conclusions and Recommendations

To address the framework of this partnership and overall framework of implementation process the participants of the workshop were organized in several breakout sessions. In the end, recommendations developed by this group were reported and consolidated.

The participants defined stakeholders as follows: U.S. DOT and specifically MARAD and FHWA; State DOTs responsible for highway planning in the affected coastal corridors; Labor; U.S. Shipbuilding companies; Vessel operators; Port operators; Truck line operators; Shippers; DOD.

It was concluded that MARAD should take a role of organizing and coordinating these stakeholders. To initiate implementation of the service it is important to identify the major player(s). This can be a vessel operator with experience in coastal shipping or a large trucking company or a large shipper, operating its own fleet of trucks or a combination of these and possibly other stakeholders.

Due to the innovative nature of the proposed service and its significant socio-economic impact it was suggested that it might be started as a “Demonstration Project”.

As a next immediate step it was recommended that the Maritime Administrator and other U.S. DOT executives should be informed of the workshop recommendation to initiate implementation of the proposed service and necessity to define means to support such implementation. In parallel, it was also recommended to initiate a search for private entrepreneurs who would be interested in participating in organizing the service. One way to achieve such participation would be a briefing to high-level executives who may benefit from the service, that is large shippers and truck lines. It would be most effective if such a briefing would be organized at U.S.DOT with the participation of top executives(s) and Maritime Administrator.

ATTACHMENT

SHORT SEA SHIPPING WORKSHOP

The U. S. Maritime Administration and the University of New Orleans' National Ports and Waterways Institute (NPWI) are sponsoring a workshop on U.S. Short Sea Shipping. The workshop will review NPWI's work on the feasibility of a regularly scheduled U.S. freight ferry service along the North Atlantic Coast and explore the future of short sea shipping in the U.S.

WHEN: **May 29, 2003**
9:30 A.M. – 12:00 P.M.

WHERE: **U.S. DEPARTMENT OF TRANSPORTATION**
400 SEVENTH ST., SW
WASHINGTON, D.C. 20590
ROOM 6244-48

For more information and to register for the workshop, please contact Michael Gordon, (202) 366-5468, e-mail: Michael.Gordon@marad.dot.gov.

SHORT SEA SHIPPING WORKSHOP
MAY 29.2003
9:30 A.M. – 12:00 P.M.
ROOM 6244-48
DEPT OF TRANSPORTATION HEADQUARTERS

AGENDA

9:30 – 9:45	Introduction – ***Michael Gordon – Office of Ports and Domestic Shipping***
9:45 –9:55	Introduction of phased research program conducted by the National Ports and Waterways Institute, UNO. ***Dr. Anatoly Hochstein – NPWI***
9:55 – 10:30	Case Study Feasibility of NY/NJ – Boston freight ferry service. ***Asaf Ashar – NPWI***
10:30 – 10:50	Question and Answer Session
10:50 – 11:35	Breakout Session
11:35 – 12:00	Conclusions and recommendations

WORKSHOP PARTICIPANTS

Name	**Organization**
Carl Sabremisana	MARAD
Mario Lolic	Euro Shipmanagement Inc.
Igor Mizine	SAIC
Rick Thorpe	Herbert Engineering Corp.
L. Cor. Marshall Parsons	USNR/MARAD
William Hogg	Alba Marine Consulting
Delores Greenwich	Steinberg & Assoc.
Ed Fitzgerald	MARAD
Capt. F.B. Wellock	Massport
Ingo Esders	ILA
David Tubman	MEBA
John Bowers, Jr.	ILA
Sandra K. Jellberg	MIRIAD
Holly Pollinger	Modi Hull
Carl J. Seiberlich	Transystems Corp.
Gerardo Ayzanoa	NPWI
A. Ashar	NPWI
D. Tipton	Wallenius Lines
Donovan Murray	Columbia Coastal
Peter J. Finnerty	American Ocean Enterprises, Inc.
A. Hochstein	NPWI
Roberta Weisbrod	Partnership for Sustainable Ports
Paul Pollinger	Modi Hull
Richard Lolich	MARAD
Megan Tucker	AWO
Michael Gordon	MARAD
Sharon Cassidy	MARAD

APPENDIX A:

Trailer Ferry Designs

R O B E R T   A L L A N   L T D .
NAVAL ARCHITECTS AND MARINE ENGINEERS
230 - 1639 West 2nd Avenue
Vancouver, BC V6J 1H3 Canada

April 22, 2003
Ref. 203-030

BY EMAIL/FAX

Mr. Asaf Ashar
National Ports and Waterways Institute

RE: TRUCK AND TRAILER FERRY DESIGNS

Dear Sir:

Please find attached drawings and specifications for our truck and trailer ferry designs. The first of this series is in the planning stages for service in the Pacific Northwest. Both the single and doubled decked trailer ferries illustrated are designed utilizing the same hull and machinery package. Their simple design and minimal outfit are intended to provide ferry fleets with vessels that are affordable, easily built, and economical to operate.

The ferries illustrated are intended for protected water operations only, with loading over both bow or stern to suit the intended service. For your intended operation from New York to Boston, the main deck would be reconfigured to provide open water capabilities. A full bow would be incorporated which would require stern leading to both main and upper decks. The main deck would be made water tight with the installation of a stern door.

A budget–only cost to build this vessel in a US shipyard would be between 22 to 25 million dollars US.

Yours truly,
ROBERT ALLAN LTD.

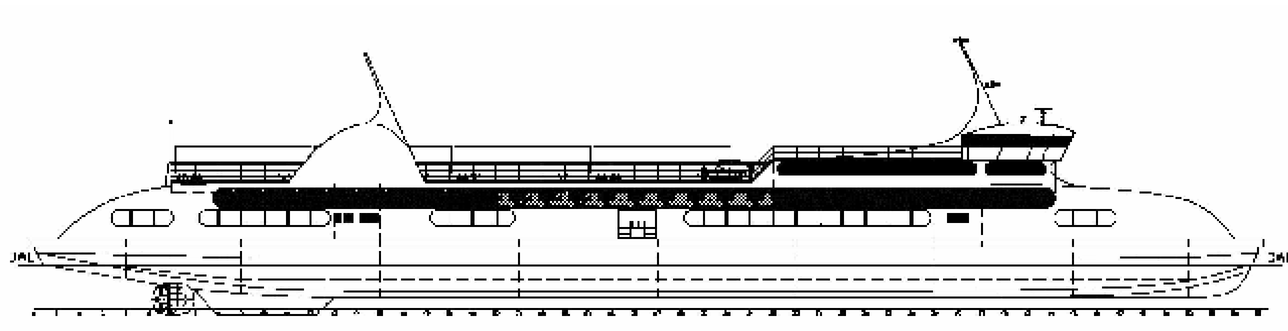
Mark Mulligan, P. Eng.
Senior Naval Architect

MM/cpb
Attachments

Telephone (604) 736-9466
ral@ral.bc.ca
www.ral.bc.ca
Facsimile (604) 736-9483

R O B E R T   A L L A N   L T D.

NAVAL ARCHITECTS AND MARINE ENGINEERS
230 - 1639 West 2nd Avenue
Vancouver, BC V6J 1H3 Canada



Vessel	- **Double Decked Trailer Ferry**
Length overall	- 417' (127 metres)
Beam over guards	- 85' (25.8 metres)
Depth, moulded	- 20' (6.1 metres)
Draft	- 10.5' (3.2 metres)
Propulsion	- two marine diesels (i.e. CAT 3608) - total horsepower: 6,600 bhp - two azimuthing Z-drives (i.e. Rolls-Royce US305) fitted with Nautican high-speed nozzles
Bow Thruster	- retractable 1,600 bhp Z-drive or 1,600 bhp tunnel thruster, depending on required manoeuverability
Capacity	- 58 unaccompanied trailers (50' average) stowed on the main deck - 30 trailers stowed on the upper deck - upper deck is reached via two MacGregor rigger lifts installed within the main deck
Speed	- 18 knots
Crew	- 10
Supernumeries	- 10

* * *

Telephone (604) 736-9466 | ral@ral.bc.ca | www.ral.bc.ca | Facsimile (604) 736-9483

R O B E R T   A L L A N   L T D.

NAVAL ARCHITECTS AND MARINE ENGINEERS
230 - 1639 West 2nd Avenue
Vancouver, BC V6J 1H3 Canada

Vessel	**- Single Decked Trailer Ferry**
Length overall	- 417' (127 metres)
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Bow Thruster	- retractable 1,600 bhp Z-drive or 1,600 bhp tunnel thruster, depending on required manoeuverability
Capacity	- 58 unaccompanied trailers (50' average) stowed on the main deck
Speed	- 18 knots
Crew	- 10
Supernumeries	- 10

* * *

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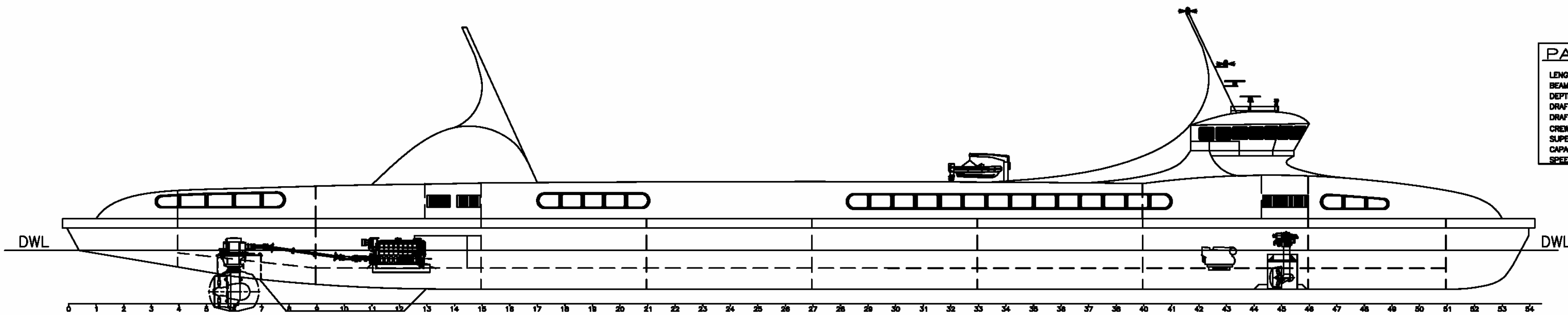
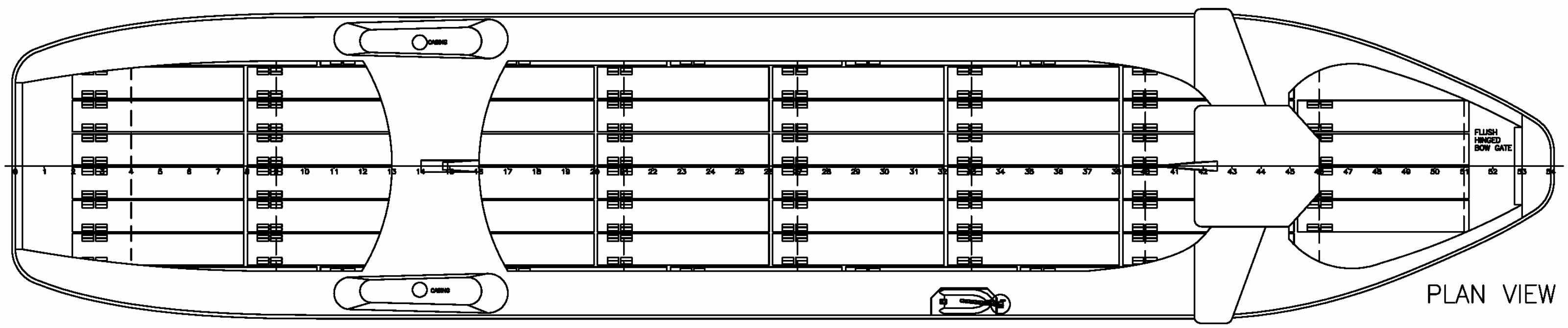
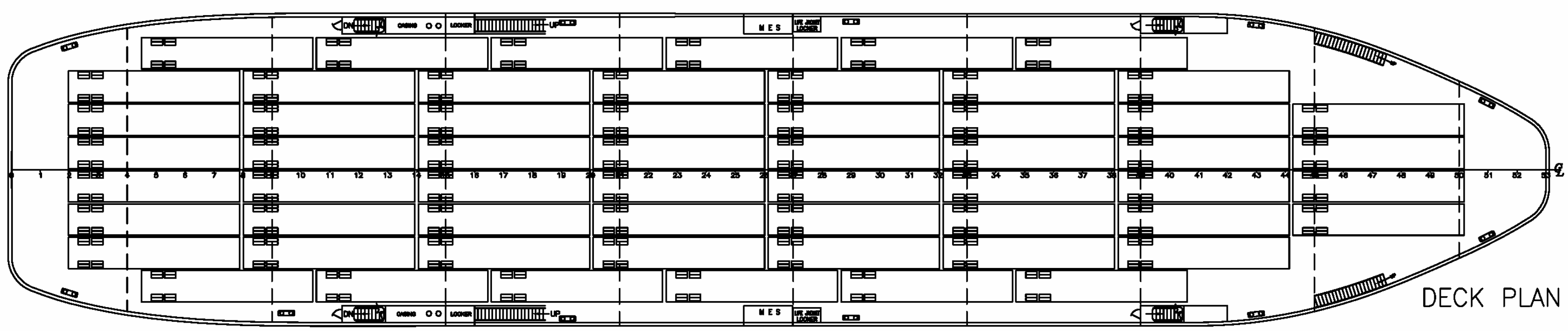


OUTBOARD PROFILE



PLAN VIEW



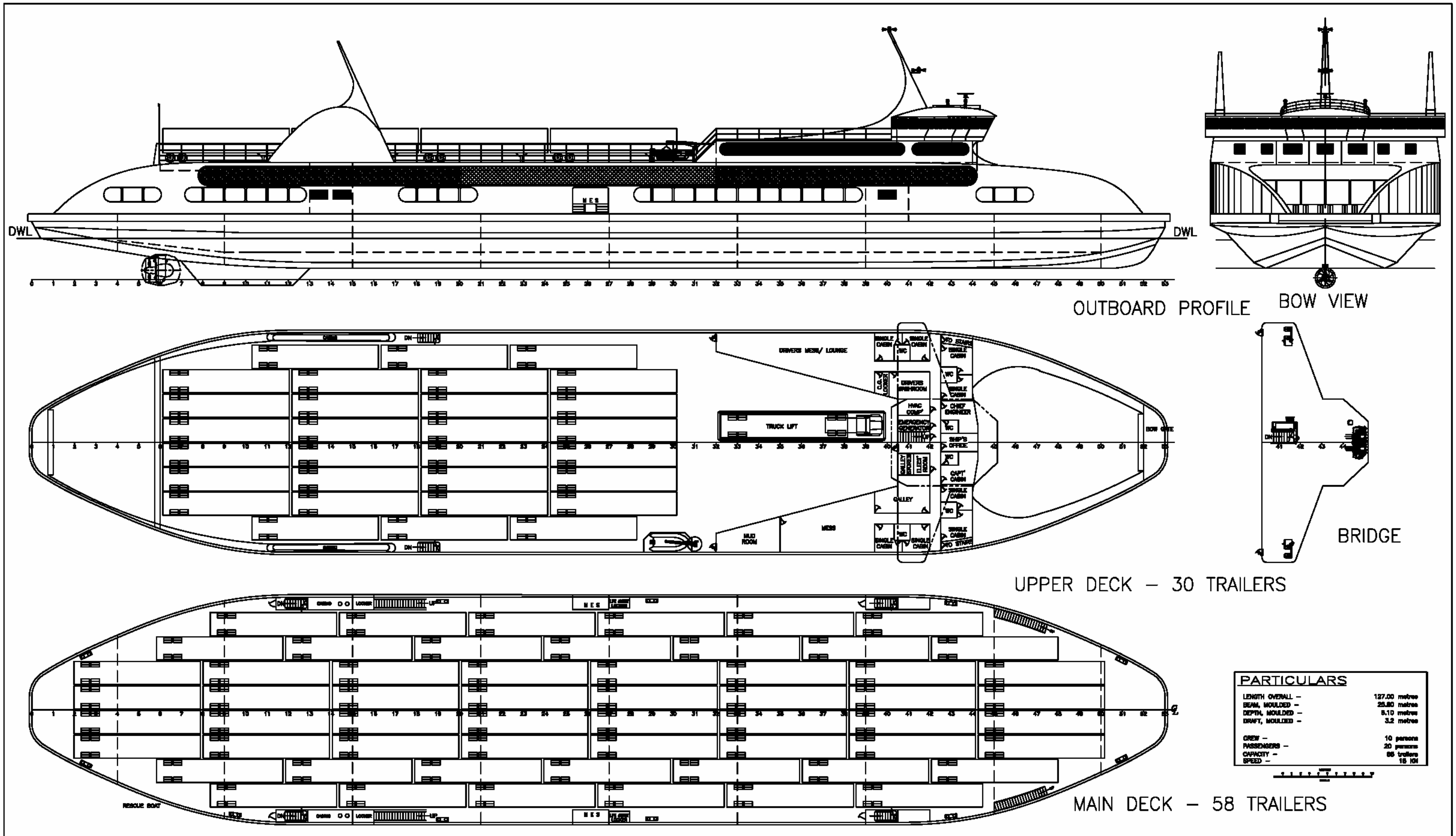
DECK PLAN

PARTICULARS

LENGTH OVERALL –	127.00 metres
BEAM, MOULDED –	25.00 metres
DEPTH, MOULDED –	6.10 metres
DRAFT, MOULDED –	3.2 metres
DRAFT, EXTREME –	4.00 metres
CREW –	10 persons
SUPERNUMERIES –	10 persons
CAPACITY –	58 trailers
SPEED –	18 knots

ROBERT ALLAN LTD.
NAVAL ARCHITECTS AND MARINE ENGINEERS
230–1639 WEST 2nd AVE. VANCOUVER, B.C.

CLIENT		REV. #	REVISIONS			BY	DATE
VESSEL	127 M TRUCK FERRY – 58 TRAILER UNITS	DRAWN BY DLG	SCALE 1:400	PROJECT 203–030		SHEET	REV.
TITLE	TRUCK FERRY PROPOSAL	CHECKED MM	DATE APR 22, 03	DWG. # 30000		1 OF 1	1



ROBERT ALLAN LTD. NAVAL ARCHITECTS AND MARINE ENGINEERS 230–1639 WEST 2nd AVE. VANCOUVER, B.C.	CLIENT		REV. #	REVISIONS			BY	DATE
	VESSEL	SELF-PROPELLED TRAILER FERRY – 88 TRAILERS	DRAWN BY DLG	SCALE 1:200	PROJECT 203-030		SHEET 1 OF 1	REV. 1
	TITLE	TRAILER FERRY PROPOSAL	CHECKED MM	DATE 22 APR 03	DWG. # 30000			

APPENDIX B:

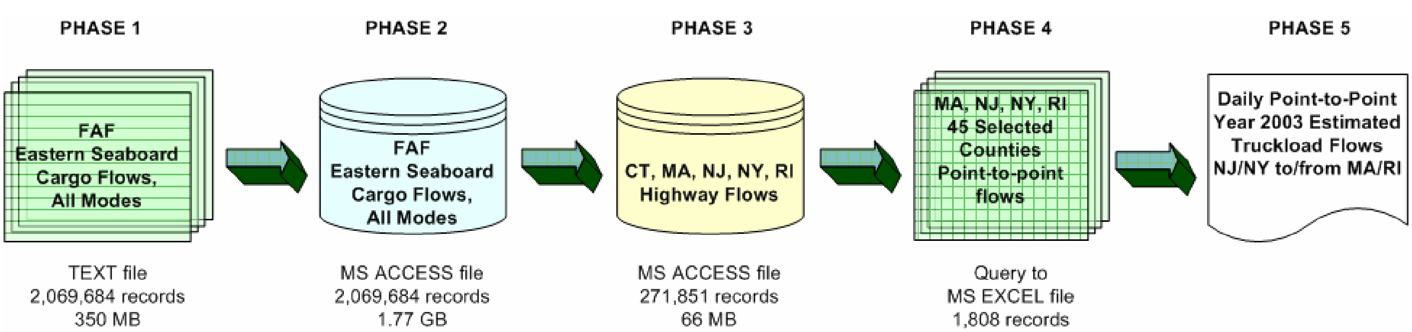
Truck Traffic Analysis

Appendix B: Truck Traffic Analysis

Source of Information and Data Manipulation

MARAD provided the "FAF Eastern Seaboard Flows" database for analysis of localized, point-to-point flows. This database contains cargo flows between eastern seaboard points for all transportation modes for the year 1998 and base, high and low projections for the years 2010 and 2020. Due to the massive amount of data, successive manipulations were needed to compile information relevant to our analysis (see figure below).

After the conversion of original data (Phase 1) to a relational database in MS Access format (Phase 2), a subset of all the records were filtered out for easier manipulation (Phase 3). This subset contains highway flows for five northeastern states: Connecticut, Massachusetts, New Jersey, New York and Rhode Island, on a county-to-county basis (Appendix A presents the list of these states' counties). Based on the requirements of our analysis, where two terminal sites (Newark, NY, and Providence, RI) have been selected to illustrate the technical characteristics of a coastal shipping service, a subsequent query was performed to obtain point-to-point highway flows between selected counties in four states: Massachusetts, New Jersey and New York and Rhode Island (Phase 4). Therefore, final flow calculation does not represent state-to-state figures but county-to-county. The selected counties, located approximately in a 50-mile radius of these two terminals, are listed in the table below.



Selected Counties for Point-to-point Flow Calculation

State	County
Massachusetts (10 counties)	Barnstable
	Norfolk
	Plymouth
	Bristol
	Suffolk
	Dukes
	Middlesex
	Worcester
	Essex
	Nantucket
New Jersey (13 counties)	Hudson
	Bergen
	Hunterdon
	Somerset
	Mercer
	Sussex
	Middlesex
	Union
	Monmouth
	Warren
	Morris
	Essex
	Passaic
New York (17 counties)	Suffolk
	Bronx
	Sullivan
	Nassau
	New York
	Ulster
	Westchester
	Columbia
	Orange
	Delaware
	Dutchess
	Putnam
	Queens
	Richmond
	Rockland
	Greene
	Kings
Rhode Island (5 counties)	Bristol
	Kent
	Newport
	Providence
	Washington

Final Data Aggregation and Results

Summary of yearly flows in short tons were converted into daily truckload flows by assuming a truckload of 20 tons and 6-day weeks. Current (year 2003) daily flows can be estimated by interpolation of 1998 and 2010 results (Phase 5).

The following tables present state-to-state flows for the selected counties. These detailed summaries are for northbound flows (NJ/NY to MA/RI), the dominant one. The last table shows expected daily trucks between NY/NJ and RI/MA, both north and southbound. Figures add up to 964 trucks per day northbound and 531 truck per day southbound.

From NJ to MA, selected counties

YERALY SHORT TONS

		MA - Selected Counties										
		25001	25005	25007	25009	25017	25019	25021	25023	25025	25027	Grand Tota
NJ - Selected Counties	34003	1,107	15,590	0	17,107	154,855	0	13,409	6,245	11,420	78,465	298,197
	34013	1,344	8,487	3	9,927	49,598	0	7,726	3,175	8,324	24,253	112,838
	34017	1,222	20,148	0	24,278	67,334	0	15,732	8,665	13,501	444,302	595,182
	34019	19	507	0	390	5,857	0	921	349	454	387	8,884
	34021	216	5,046	4	5,763	23,924	6	3,717	2,000	3,528	8,036	52,239
	34023	1,910	27,634	3	33,756	102,514	1	25,004	11,690	19,288	39,430	261,230
	34025	106	3,445	0	3,307	15,010	0	2,758	1,035	1,936	4,137	31,734
	34027	494	10,989	1	16,088	56,579	0	8,959	3,866	6,432	14,600	118,008
	34031	716	11,654	0	12,598	50,382	0	10,816	3,567	10,051	25,516	125,300
	34035	492	7,270	1	7,800	29,997	2	5,519	2,445	4,176	10,285	67,988
	34037	97	563	0	414	945	0	367	423	545	596	3,949
	34039	5,826	36,368	8	48,448	119,463	2	42,645	17,146	28,458	51,643	350,007
	34041	40	1,098	0	715	9,684	0	505	227	438	1,200	13,905
	Grand Total	13,588	148,799	20	180,592	686,140	10	138,077	60,833	108,552	702,849	2,039,460

DAILY TRUCKLOADS

		MA - Selected Counties										
	NY	25001	25005	25007	25009	25017	25019	25021	25023	25025	25027	Grand Tota
NJ - Selected Counties	34003	0	2	0	3	25	0	2	1	2	13	48
	34013	0	1	0	2	8	0	1	1	1	4	18
	34017	0	3	0	4	11	0	3	1	2	71	95
	34019	0	0	0	0	1	0	0	0	0	0	1
	34021	0	1	0	1	4	0	1	0	1	1	8
	34023	0	4	0	5	16	0	4	2	3	6	42
	34025	0	1	0	1	2	0	0	0	0	1	5
	34027	0	2	0	3	9	0	1	1	1	2	19
	34031	0	2	0	2	8	0	2	1	2	4	20
	34035	0	1	0	1	5	0	1	0	1	2	11
	34037	0	0	0	0	0	0	0	0	0	0	1
	34039	1	6	0	8	19	0	7	3	5	8	56
	34041	0	0	0	0	2	0	0	0	0	0	2
	Grand Total	2	24	0	29	110	0	22	10	17	113	327

From NJ to MA, selected counties

YERALY SHORT TONS

		MA - Selected Counties										
		25001	25005	25007	25009	25017	25019	25021	25023	25025	25027	Grand Total
NY -	36005	276	3,154	2	3,726	24,112	0	3,958	1,732	2,632	9,451	49,044
Selected	36021	21	3,149	1	2,310	6,206	1	4,996	1,496	1,626	9,023	28,830
Counties	36025	541	150	1	1,661	5,984	2	262	111	65	513	9,290
	36027	54	1,494	0	1,509	6,667	0	1,505	624	5,610	5,221	22,686
	36039	34	1,154	0	1,129	12,026	0	1,358	725	1,379	3,006	20,813
	36047	10,212	64,711	64	78,829	1,161,719	21	53,963	55,790	111,329	96,760	1,633,398
	36059	544	5,272	0	4,114	42,808	0	3,855	1,900	3,300	25,326	87,117
	36061	1,060	11,111	1	11,479	37,376	0	7,330	3,984	8,293	70,444	151,077
	36071	108	1,943	3	550	11,012	5	986	900	794	7,984	24,286
	36079	97	474	0	482	1,561	0	298	153	1,106	1,063	5,234
	36081	703	7,461	1	6,688	49,668	1	6,037	3,146	4,985	26,466	105,156
	36085	5	162	0	10	2,367	0	4	210	226	1,592	4,576
	36087	131	2,146	2	1,277	16,325	1	1,087	302	1,145	6,896	29,312
	36103	601	7,835	0	7,529	65,212	0	5,762	3,392	6,256	11,103	107,689
	36105	18	277	0	331	1,565	0	216	112	182	573	3,274
	36111	28	989	0	491	8,048	0	350	276	636	3,179	13,998
	36119	546	6,075	3	6,485	661,820	5	5,256	2,854	27,633	20,421	731,099
	Grand Tota	14,981	117,557	79	128,601	2,114,476	36	97,223	77,708	177,198	299,019	3,026,879

DAILY TRUCKLOADS

		MA - Selected Counties										
	NY	25001	25005	25007	25009	25017	25019	25021	25023	25025	25027	Grand Total
NY -	36005	0	1	0	1	4	0	1	0	0	2	8
Selected	36021	0	1	0	0	1	0	1	0	0	1	5
Counties	36025	0	0	0	0	1	0	0	0	0	0	1
	36027	0	0	0	0	1	0	0	0	1	1	4
	36039	0	0	0	0	2	0	0	0	0	0	3
	36047	2	10	0	13	186	0	9	9	18	16	262
	36059	0	1	0	1	7	0	1	0	1	4	14
	36061	0	2	0	2	6	0	1	1	1	11	24
	36071	0	0	0	0	2	0	0	0	0	1	4
	36079	0	0	0	0	0	0	0	0	0	0	1
	36081	0	1	0	1	8	0	1	1	1	4	17
	36085	0	0	0	0	0	0	0	0	0	0	1
	36087	0	0	0	0	3	0	0	0	0	1	5
	36103	0	1	0	1	10	0	1	1	1	2	17
	36105	0	0	0	0	0	0	0	0	0	0	1
	36111	0	0	0	0	1	0	0	0	0	1	2
	36119	0	1	0	1	106	0	1	0	4	3	117
	Grand Tota	2	19	0	21	339	0	16	12	28	48	485

From NY to RI, selected counties

YERALY SHORT TONS

		RI - Selected Counties					
		44001	44003	44005	44007	44009	Grand Tota
NJ - Selected Counties	34003	1,573	12,385	5,464	57,079	4,973	81,475
	34013	116	5,805	1,759	22,283	8,072	38,036
	34017	1,620	12,709	8,477	49,741	4,538	77,085
	34019	78	90	0	1,540	17	1,725
	34021	117	3,494	2,183	15,964	1,365	23,123
	34023	2,408	18,325	8,331	70,116	7,114	106,294
	34025	41	1,642	684	8,909	735	12,011
	34027	1,034	10,068	2,414	35,473	3,694	52,683
	34031	397	7,117	2,830	28,086	2,969	41,399
	34035	610	5,040	2,332	19,508	1,909	29,398
	34037	1	368	88	1,215	252	1,924
	34039	1,592	13,741	4,898	45,856	5,115	71,202
	34041	73	1,275	70	6,799	536	8,753
	Grand Tota	9,659	92,059	39,531	362,568	41,291	545,108

		MA - Selected Counties					
		25001	25005	25007	25009	25017	Grand Tota
NJ - Selected Counties	34003	0	2	1	9	1	13
	34013	0	1	0	4	1	6
	34017	0	2	1	8	1	12
	34019	0	0	0	0	0	0
	34021	0	1	0	3	0	4
	34023	0	3	1	11	1	17
	34025	0	0	0	1	0	2
	34027	0	2	0	6	1	8
	34031	0	1	0	5	0	7
	34035	0	1	0	3	0	5
	34037	0	0	0	0	0	0
	34039	0	2	1	7	1	11
	34041	0	0	0	1	0	1
	Grand Tota	2	15	6	58	7	87

From NY to RI, selected counties

YERALY SHORT TONS

		RI - Selected Counties					
		44001	44003	44005	44007	44009	Grand Tota
NY - Selected Counties	36005	31	402	107	5,963	170	6,672
	36021	237	620	183	5,209	920	7,169
	36025	7	43	7	1,165	41	1,263
	36027	124	1,714	90	5,519	325	7,772
	36039	18	122	0	2,538	119	2,797
	36047	1,159	21,645	2,694	160,531	6,799	192,828
	36059	195	5,513	161	21,312	1,393	28,574
	36061	229	5,579	627	24,042	1,243	31,719
	36071	124	476	50	3,426	270	4,346
	36079	0	24	20	944	10	999
	36081	95	2,238	486	18,058	987	21,863
	36085	0	46	0	582	3	631
	36087	76	2,756	46	10,517	549	13,945
	36103	106	3,347	519	20,659	1,046	25,677
	36105	13	237	24	1,450	194	1,918
	36111	26	738	44	2,981	127	3,916
	36119	704	13,451	357	33,842	2,313	50,666
	Grand Tota	3,143	58,952	5,414	318,738	16,509	402,755

DAILY TRUCKLOADS

		RI - Selected Counties					
		25001	25005	25007	25009	25017	Grand Tota
NY - Selected Counties	36005	0	0	0	1	0	1
	36021	0	0	0	1	0	1
	36025	0	0	0	0	0	0
	36027	0	0	0	1	0	1
	36039	0	0	0	0	0	0
	36047	0	3	0	26	1	31
	36059	0	1	0	3	0	5
	36061	0	1	0	4	0	5
	36071	0	0	0	1	0	1
	36079	0	0	0	0	0	0
	36081	0	0	0	3	0	4
	36085	0	0	0	0	0	0
	36087	0	0	0	2	0	2
	36103	0	1	0	3	0	4
	36105	0	0	0	0	0	0
	36111	0	0	0	0	0	1
	36119	0	2	0	5	0	8
	Grand Tota	1	9	1	51	3	65

Final Summary

Highway Flows - trucks

DAILY

tons/truck	20
days/yr	312

1998	Destination				
Origin	MA	NJ	NY	RI	Total
MA	13,473	228	201	657	14,559
NJ	275	8,780	1,035	74	10,163
NY	396	1,454	7,409	53	9,312
RI	2	1	11	46	60
Total	14,146	10,464	8,656	829	34,094

2010	Destination				
Origin	MA	NJ	NY	RI	Total
MA	18,046	356	287	872	19,561
NJ	400	13,482	1,581	107	15,569
NY	610	2,227	11,223	81	14,141
RI	3	1	13	73	90
Total	19,060	16,066	13,104	1,132	49,362

2003	Destination				
Origin	MA	NJ	NY	RI	Total
MA	15,379	**282**	**237**	746	16,644
NJ	**327**	10,739	1,262	**87**	12,416
NY	**485**	1,776	8,998	**65**	11,324
RI	3	**1**	**12**	57	73
Total	16,193	12,798	10,509	955	40,456

NJ/NY to MA/RI ==>	**964**
MA/RI to NJ/NY ==>	**531**

Source: FHWA, manipulated by NPWI.

APPENDIX C:

Summary of other Relevant Studies

Appendix C: Summary of other Relevant Studies

Southwest Corridor Commodity Flow Study

This study was conducted by the Connecticut Department of Transportation, Office of Intermodal Project Planning, and was released in May of 2000. The study assesses the transportation issues regarding the movement of goods via truck in the southwest corridor of the State of Connecticut (CT) and the alternative modes of transportation.

While the study does not provide the detailed type of origin/destination data that is needed for this phase of the Coastal Shipping Study, it does provide some examples of coastal cargo flow data. For instance, the study shows that, on an annual basis, just under 1.6 million trucks move north through Connecticut on highway I-95 and just under 1.3 million trucks move south through Connecticut on highway I-95. Unfortunately, the origin/destination points for these trucks are, for the most part, aggregated by state.

The influence of factors such as distance, commodity, and geographic trading partners on cargo diversion is briefly outlined. For example, the study points out that high value commodities are less likely to travel by modes other than truck, and that shipments traveling less than 500 miles are less likely to be diverted from trucks due to their higher efficiency. The study also claims that short line rail carriers are more aggressively pursuing commodities that are shipped in corridors of less than 300 miles.

The study uses models developed by Reebie Associates to analyze both trucking and intermodal (truck/rail) costs over several routes. In nearly all of the shorter routes examined (less than 1,000 miles), the intermodal cost estimates were higher than the trucking cost estimates, and on those of longer routes (over 1,000 miles), intermodal costs were lower than trucking costs. However, these cost estimates were developed at least three years ago and they cannot be relied upon for precise analysis. For comparison, a route from Boston to Newark, with an empty return, the estimated cost per trailer via truck is $438.55 ($1.75 per mile). The intermodal cost is estimated to be $780 per trailer ($3.12 per mile). In summary this study provided:

- Examples of traffic density in the Northeast highway corridor.
- Definition of comparative areas of trucking and intermodal (truck/rail) options as a function of distance.
- Examples of trucking rates.

This study represents an attempt to introduce rail intermodal operation, which has been successful in cross-country movements, to coastal areas. The study material can be used for comparison of intermodal rail and intermodal maritime options as well as a comparison with data generated in this study.

Container Barge Feeder Service Study

This study was conducted by the Connecticut Department of Transportation, Office of Intermodal Planning, and was released in March of 2001. The study examines the service parameters of both a Ro/Ro service from Bridgeport to New York/New Jersey and a Lo-Lo service from New Haven to New York/New Jersey. While the major conclusions of this study are not *directly* applicable to a coastal shipping in High Speed Ferries, the report does provide some information, which is illustrative.

The major incompatibility of the system in this study with the proposed coastal shipping system is that the container feeder service ships *international* containers. The ILA fees for moving containers in the feeder service are listed as approximately $500 (for all moves). A coastal shipping system would not be cost effective using the lift on/lift off charges associated with international containers. Furthermore, the study indicates that most domestic cargo is more time sensitive than international containers, a fact that bolsters the need for a high-speed vessel in a coastal shipping system.

The study does provide cargo estimates for the container feeder services. It is estimated that, at 80% efficiency, the container service from Bridgeport to New York/New Jersey would move 90 trucks per day, and the Lo-Lo service would move from 300 to 400 containers per week. However, these volumes consist entirely of international containers and may not be particularly useful for planning a coastal shipping system. The study estimates that the truck costs from the port of New York/New Jersey to Hartford are $935 per container. Comparatively, the Ro/Ro service at Bridgeport, with final delivery via truck, is estimated to cost $873 per container. Alternatively, the Lo-Lo service at New Haven is estimated to cost $1,370. In summary this study provided:

- Feasibility of distribution of international containers by barges between several points connecting Connecticut and New York/New Jersey.
- Examples of trucking rates and potential volume of trucks for barge services.

This study addressed one more intermodal option, which may compete or complement the introduction of high speed freight ferry services. The study material can be used for a comparison of market share between different options of coastal shipping.

Mid Atlantic Rail Operations Project

This study was produced by Cambridge Systematics for the I-95 Corridor Coalition and was released in February of 2001. The main objective of this study was to analyze the investment needed to eliminate rail bottlenecks throughout the Mid-Atlantic Corridor. Since the study is geared towards relieving congested highways by diverting more truck traffic to rail, the study is similar to those analyzing freight diversions for a coastal shipping system. For example, the rail study points out that Mid-Atlantic States are more dependent on long-haul trucking than the nation as a whole (16% nationally versus 18% for the Mid-Atlantic region). The study claims that the elimination of rail bottlenecks would allow the Mid-Atlantic region to lower its reliance on longhaul trucking (by as much as 25%). While overall tonnages are supplied (e.g., 11,000 trucks/day from Washington to Baltimore), the study does not include any specific origin/destination information. In summary this study:

- Addresses similar concepts of intermodal services in coastal areas, but for rail option.
- Provides examples of trade traffic density.

The focus of this study is on investment needs for rail to divert trucks from roads in the Mid-Atlantic area; estimates of traffic density is however at the very preliminary level. The study material can be used for comparison of investments needed for rail and water offering similar intermodal options.

Identification of Massachusetts Freight Issues and Priorities

This study was produced by the Massachusetts Highway Department and Louis Berger & Associates, and was released in 1998. This study summarizes the primary modes of freight transportation in Massachusetts and discusses many planning issues, which affect the State. While this study does not provide the specific origin/destination data needed for the Coastal Shipping study, it does provide some freight flow data for Massachusetts and other regions throughout the United States.

There are ten rail freight carriers, which operate more than 1000 route miles throughout Massachusetts, with five operating intrastate lines. CSX operates a Boston/Albany line, which connects to the CSX rail network at Selkirk, NY with intermodal terminals in Springfield, Palmer, Worcester, and Boston. Another major connection point is in Worcester, where Rhode Island and Connecticut are linked to the CSX system.

The study also discusses freight transportation at various seaports throughout Massachusetts. While Boston is the major seaport in the State, two smaller ports, Fall River and Salem, also rank among the top 150 U.S. ports in terms of total tonnage. A main competing port for Massachusetts' ports is the port of New York/New Jersey. The study points out that CSX offers a "short" double stack service from the dock at New York/New Jersey to Worcester. Additionally, there has been a significant backhaul via truck from the port of New York/New Jersey to Boston.

The flow data included in this study use models developed by Reebie and Associates using 1995 statistics. The data show that just under 10 million trucks (TL) traveled into Boston in 1995, with most of the traffic coming from the Mid-Atlantic and Midwest regions. The data also show the disparity in directional flows, with only about 4 million trucks (TL) leaving Boston in 1995, the largest portion destined for the New England area. In summary this study provided:

- An overall description of the transportation network serving the state of Massachusetts.

Its application to our objectives is limited to the general understanding of transportation issues in that part of the Northeastern corridor.