Analysis of Drummond Island Ferry System

Final Report
August 22, 1986

by
John G. Jessup
Howard M. Bunch

UMTRI The University of Michigan
Transportation Research Institute

Analysis of Drummond Island Ferry System

Final Report
August 22, 1986

by
John G. Jessup
Howard M. Bunch

The University of Michigan
Transportation Research Institute
Marine Systems Division
Ann Arbor, Michigan 48109

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTRI-86-42		

4. Title and Subtitle	5. Report Date
Analysis of Drummond Island Ferry System	August 1986
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
John G. Jessup, Howard M. Bunch	UMTRI-86-42

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Marine Systems Division Transportation Research Institute The University of Michigan Ann Arbor, Michigan 48109	11. Contract or Grant No. N-2 Contract
	13. Type of Report and Period Covered Final 6/1/86 - 8/31/86
12. Sponsoring Agency Name and Address Michigan Department of Transportation Lansing, Michigan	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This analysis of the Drummond Island Ferry System was undertaken to determine the vessel configuration that will satisfy the passenger/auto demand for ferry service between Detour Village and Drummond Island, MI. The report provides an overview of the present ferry system and three alternatives for enhancing the operation.

17. Key Words	18. Distribution Statement
Cost/Benefit Analysis, Ferry	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	68	

EXECUTIVE SUMMARY

This analysis of the Drummond Island Ferry system was undertaken by the Marine Systems Division, University of Michigan Transportation Research Institute, for the Michigan Department of Transportation, to determine the vessel configuration that will satisfy the passenger/auto demand for ferry service between Detour Village and Drummond Island, Michigan. The report provides a snapshot of the present ferry system and three alternatives for enhancing that operation.

The two vessels that provide the present Drummond Island Ferry Service are the "Drummond Islander I" and "Drummond Islander II." Both ferries have a capacity of twelve vehicles each. The two major deficiencies of the present service are that: (1) the peak summer traffic is not adequately handled and (2) during the winter only one vessel, the "Drummond Islander I", is capable of ice navigation.

Three alternative operating scenarios are presented in this report and compared with the present ferry service both in operating cost and relative merit of service. The present system operating costs are estimated to be $430,000 per year. The three alternatives--referred to as Alternative A, B, and C--are summarized below.

Alternative A envisions selling the "Drummond Islander II" and purchasing a 1.5 million dollar double-ended ice class ferry capable of carrying 20-25 automobiles at 12 mph. The "Drummond Islander I" will be retained to provide relief during the peak summer season. The increase in yearly operating costs for this alternative was estimated to be $172,000 per year (purchase price and sale of "Drummond Islander II" included). This alternative would be the best long-term solution for improving the ferry operation in both winter and summer.

Alternative B envisions the lengthening of the "Drummond Islander II" by 32 feet. The "Drummond Islander I" would continue to be the vessel used for ice operations, and both ferries would operate during the peak summer hours. The increase in yearly operating costs for this alternative was estimated to be $32,000 per year (vessel modification costs included). This alternative would adequately solve the ferry system capacity deficiency but would not enhance winter service.

Alternative C envisions selling the "Drummond Islander II" and purchasing a 3.5 million dollar double-ended ice class ferry capable of carrying 30-40 vehicles at 12 mph. The "Drummond Islander I" would be retained only as a backup vessel in case of a breakdown. The increase in yearly operating costs for this alternative was estimated to be $538,000 per year (purchase price and sale of "Drummond Islander II" included). This alternative would more than double the present operating costs and therefore is not considered to be a viable alternative.

ACKNOWLEDGEMENTS

Appreciation is expressed to the following individuals who helped to provide advice and direction for this report:

Professor Harry Benford of University of Michigan
Mr. John Duclos of Gladding & Hearn, The Duclos Corp.
Mr. John Gilbert of John W. Gilbert Associates, Inc.
Mr. Tim Graul of Graul Marine Design
Mr. Keith Harris of Eastern U.P. Trans. Authority
Mr. John Kiser of Michigan Department of Transportation
Mr. Roger Kline of R.A. Stearn Inc.
Mr. Dennis Laney of Merce Industries
Mr. John Neuman of Neuman Boat Lines
Mr. Norris Poirier of Twin City Drydock & Marine Inc.
Mr. Arni Richter of Washington Island Ferry Line
Mr. Phillip Spaulding of Nickum & Spaulding Associates, Inc.

The editor of this report is Ms. Wendy Barhydt, Research Associate, UMTRI. Many thanks to her and to Lee Ferris for their efforts in preparing this manuscript.

TABLE OF CONTENTS

ANALYSIS OF DRUMMOND ISLAND FERRY SYSTEM
FINAL REPORT - AUGUST 22, 1986
UNIVERSITY OF MICHIGAN
TRANSPORTATION RESEARCH INSTITUTE

1.0 INTRODUCTION

1.1 Objectives

The primary objective of this study is to determine the vessel configuration that will satisfy the passenger/auto demand for ferry service between Detour Village and Drummond Island, Michigan. The results of the analysis are intended to provide a basis for decisions concerning the future role of the "Drummond Islander II." To meet this objective the following factors were considered:

1. feasibility and cost analysis to modify the "Drummond Islander II";
2. availability and purchase price of an existing design/vessel;
3. cost to construct a new vessel; and
4. benefit/cost analysis and comparison of alternatives.

1.2 The Final Report

This final report provides alternatives for improving the ferry service of the Drummond Island Ferry System. In particular, the data on which to base decisions concerning the fate of the "Drummond Islander II" are detailed. In section 2.0 an overview of the present ferry operation at Drummond Island is covered. Section 3.0 and 4.0 provide the possible alternatives for modifying the "Drummond Islander II" and the possible replacement ferries respectively. Finally, in section 5.0,

a comparison of the alternatives is made. Due to a number of factors that are not quantifiable in terms of dollars and cents, a single recommendation for improving the system can not be made in those terms. Rather, this report is intended to provide the Michigan Department of Transportation with a menu of choices for decision-making in light of the quality of ferry service that might be provided by each alternative.

2.0 Ferry System Overview

2.1 Background

The two vessels that provide the Drummond Island Ferry Service--the "Drummond Islander I" and "Drummond Islander II"--are owned and operated by the Eastern Upper Peninsula Transportation Authority (EUPTA). Both ferries have a capacity of twelve vehicles each and are capable of roll on / roll off by the ramps at both bow and stern. This however, is the extent of their similarities. (Appendix A gives the particular characteristics of each vessel.)

The service provided by these two ferries (as pointed out in a 1984 study of the St. Marys River Ferry System [1]) has fallen short of the demands required to support resident and recreation traffic between Detour and Drummond Island. The major problem as identified in the report (and as verified in recent discussions with EUPTA personnel) is the inability of the present system to handle the increase in traffic during the peak tourist season.

The M/V "Drummond Islander II" was identified as the ferry that is the most inefficient. Among the deficiencies identified in the report [1] are: the vessel's poor performance in ice, inadequate vehicle

capacity, and an inability to efficiently load all types of vehicles. This analysis of the Drummond Island Ferry System is therefore directed primarily at the role of the "Drummond Islander II."

2.2 The Service

The Drummond Island Ferry Service is operated throughout the year between Detour Village and Drummond Island (See Figure 1.0)--a distance of approximately 0.9 miles across the St. Marys River in the Upper Peninsula of Michigan. The number of scheduled trips varies from twenty two trips per day between April 1 - January 1 to thirteen trips per day between January 2 and March 31st. (Figure 2.0 shows both the summer and winter schedule.)

In addition to the scheduled runs, the ferries make unscheduled crossings to pick up overflow traffic in peak periods. This is standard operating procedure during the months of June, July, and August when weekend traffic is 3-4 times that of the basic ridership. It is during these peak months between the hours of 10:00 am and 6:00 pm that two ferries are required to be in operation to keep up with traffic.

2.3 Operating Profile

The Bureau of Transportation Planning provided an updated operating profile for the Drummond Island Ferry Service to supplement the 1984 St. Mary's River Ferry Study. This updated profile is included

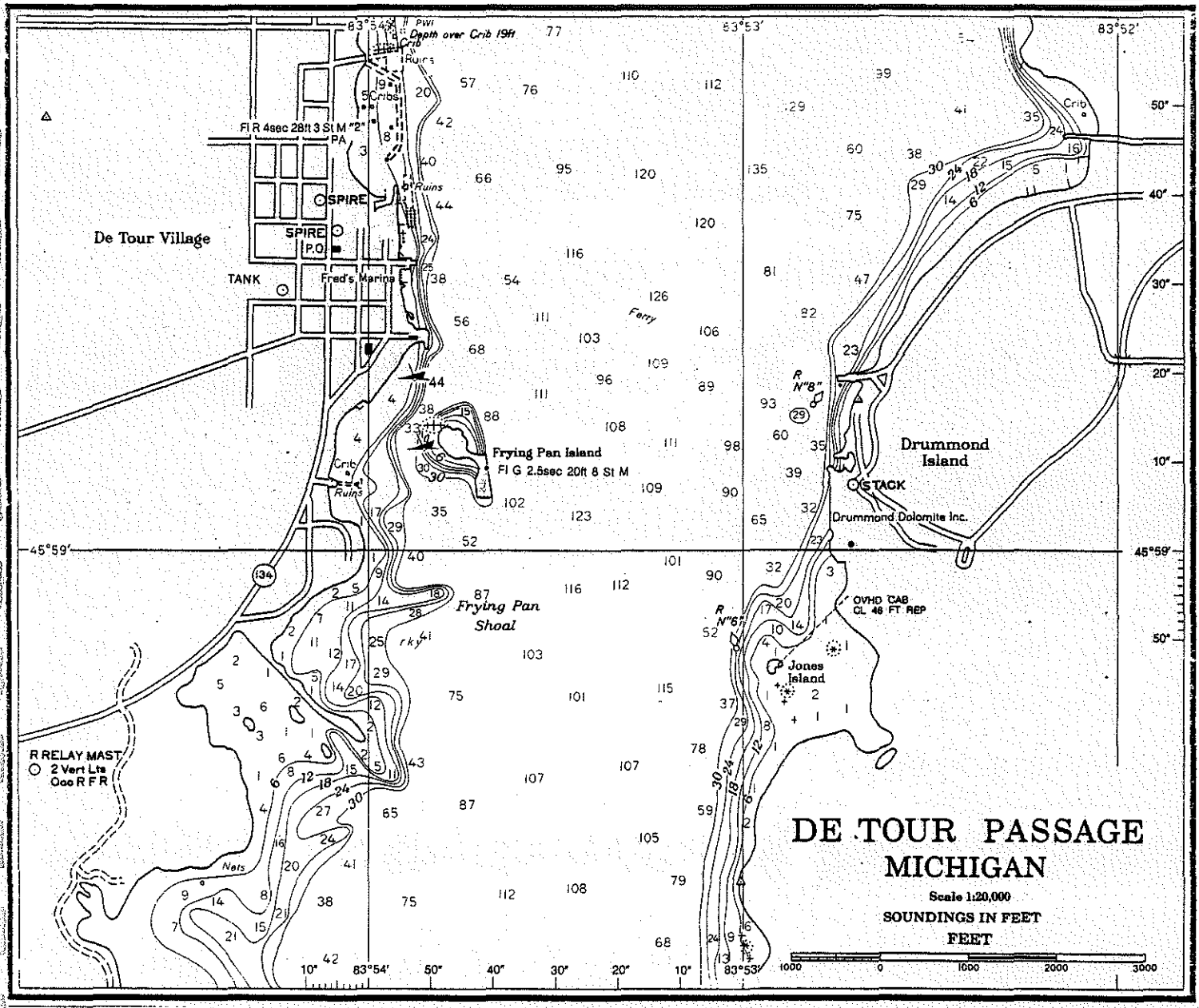


Figure 1.0 - Drummond Island Ferry Route
(Ref. NOAA Chart #14882, 1982)

DRUMMOND ISLAND

FERRY SCHEDULE

WINTER SCHEDULE

January 2nd through March 31st

Leave Island	Leave Mainland
6:10 AM	6:40 AM
7:30 AM	7:45 AM
8:30 AM	9:00 AM
10:00 AM	10:30 AM
12:00 NOON	12:30 PM
2:00 PM	2:30 PM
3:10 PM	3:45 PM
4:10 PM	4:30 PM
5:00 PM	5:30 PM
6:00 PM	6:30 PM
7:10 PM	7:30 PM
9:10 PM	9:40 PM
11:10 PM	11:30 PM

Summer Schedule

April 1st through January 1st

Leave Island	Leave Mainland
6:10 AM	6:40 AM
7:10 AM	7:20 AM
7:30 AM	7:45 AM
8:30 AM	9:00 AM
10:00 AM	10:30 AM
11:00 AM	11:30 AM
12:00 NOON	12:30 PM
1:10 PM	1:40 PM
2:10 PM	2:40 PM
3:10 PM	3:45 PM
4:10 PM	4:30 PM
5:00 PM	5:30 PM
6:00 PM	6:30 PM
7:10 PM	7:30 PM
8:00 PM	8:30 PM
9:10 PM	9:40 PM
10:10 PM	10:40 PM
11:10 PM	11:30 PM
12:00 MIDNIGHT	12:30 AM
1:00 AM	1:30 AM
3:10 AM	3:30 AM
5:00 AM	5:40 AM

FIGURE 2.0 FERRY SCHEDULE

as Appendix B of this report. The following are highlights from Appendix B and the 1984 study:

*Ridership levels for the St. Marys Ferry system as a whole (Neebish, Sugar and Drummond Island) can be expected to remain relatively constant, recognizing that modest increases may occur. Any such increases however, will not be sufficient to warrant changes in service level.

*Projections made for the Drummond Island Ferry System for the year 2000 are that the design hour high-direction-vehicle-volume will be between 44 and 60 units, an increase of 60% over the 1985 volume.

*The ferry serves a community of 750-1000 island residents. Summer tourist volumes are approximately 4 times the winter base volume.

*A summer survey taken in July, 1983 showed that one third of the ferry users planned to stay one day or less.

*The basic ridership (permanent island residents, non-island residents working on the island, and those performing services on the island) make up approximately 1/3 of the volume. The other 2/3 of the traffic is riders making vacation and social recreation trips.

*The FY 84-85 ridership consisted of 220,705 passengers and 93,182 vehicles taken across in 20,196 trips. This averages out to 4.6 vehicles per trip and makes the Drummond Island Ferry service the most productive of the three services operated on the St. Marys.

*The design day is the average Friday in July and August. The design period is 2:00 pm to 5:00 pm during which time 25% of the design day total of 450 vehicles occurs. Queue lines of up to three hours are experienced during this time period.

*July and August comprise 30 percent of the annual use.

*The design hour high direction vehicle volume for 1985 was estimated to be 28.

The above operational profile information was supplemented with some vessel requirements identified by EUPTA. These requirements are as follows:

1. Propellers at bow and stern. This eliminates the need for the two vessel turnabouts now required. The rudder should be self centering and have ice protection.

2. Special hull design with a draft of at least 10 feet. This would keep the propellers below the ice. Good ice breaking design is imperative. A deeper hull would also be more stable in bad weather.

3. Ice breaking capability. This requires the ability to break up solid ice 18 inches thick and brash ice two to three feet thick.

4. Load/unload at bow and stern. Present vessels have this feature, necessary for efficient vessel use.

5. Gross tonnage less than 100 tons. This avoids the need to add an additional crew member which would be required on a larger vessel to conform with Coast Guard regulations.

6. Faster than present vessels. The present vessels have a maximum speed of 12 mph and average about 8 mph in making the crossing; a 16 mph average would significantly reduce travel time.

2.4 Need for Increased Capacity

Figure 3.0 is an updated queue simulation from Appendix B. This operational profile data for the design day indicates that: with an average carrying capacity of 11 vehicles each (assuming one trailer per trip), 2 vessels should be able to handle the 1985-86 traffic volume. During that time period in July and August, however, the Detour side typically reported vehicles waiting from 30 minutes to 3 hours. The discrepancy between the actual and the simulated queue of the ferry is

Drummond Island Ferry Service Analysis

DESIGN DAY QUEUE SIMULATION: 1984-85

Hour Ending	1984 - 1985 Drummond De Tour	Drummond Island	Total	One Vessel Fleet 2/ Accommodates 1/	Queue (Minutes) 30	70	110	Two Vessel Fleet 2/ 3/ Accommodates 1/	Queue (Minutes) 30	70	110
1	3	1	4	11	0	0	0	11	0	0	0
2	2	1	3	11	0	0	0	11	0	0	0
3	1	1	2	11	0	0	0	11	0	0	0
4	1	1	2	11	0	0	0	11	0	0	0
5	1	1	2	11	0	0	0	11	0	0	0
6	1	1	2	11	0	0	0	11	0	0	0
7	20	10	30	22	0	0	0	22	0	0	0
8	15	7	22	11	4	0	0	11	0	0	0
9	15	7	22	22	0	0	0	22	0	0	0
10	15	7	22	11	4	0	0	11	4	0	0
11	20	10	30	22	2	0	0	33	0	0	0
12	20	10	30	11	11	0	0	33	0	0	0
13	17	8	25	22	6	0	0	33	0	0	0
14	17	8	25	11	11	1	0	33	0	0	0
15	28	7	35	22	11	7	0	33	0	0	0
16	28	7	35	11	11	11	13	33	0	0	0
17	28	7	35	22	11	11	19	33	0	0	0
18	16	4	20	11	11	11	24	33	0	0	0
19	16	4	20	22	11	11	18	22	0	0	0
20	16	4	20	11	11	11	23	11	5	0	0
21	15	3	18	22	11	11	16	22	0	0	0
22	15	3	18	11	11	11	20	11	4	0	0
23	15	3	18	22	11	11	13	22	0	0	0
24	8	2	10	11	11	11	10	11	0	0	0
Total	333	117	450								

Notes: 1/ Each of the vessels is capable of carrying 12 vehicles or units. Based on figures provided by EUPTA for vehicles carried by type, approximately one vehicle per crossing is larger than a single vehicle or is hauling a trailer. This results in only 11 actual vehicles being carried, even though all 12 available unit spaces are being utilized. Therefore, a capacity of 11 vehicles per vessel has been used for this analysis.

2/ It is assumed that one round trip takes 40 minutes.

3/ The two vessel fleet consists of one vessel operating 24 hours daily and the second operating from 10:00 a.m. to 6:00 p.m.

Source: MDOT, Bureau of Transportation Planning, Passenger Transportation Planning Section, Surface Systems Unit.

Figure 3.0 - Simulated Queue Analysis

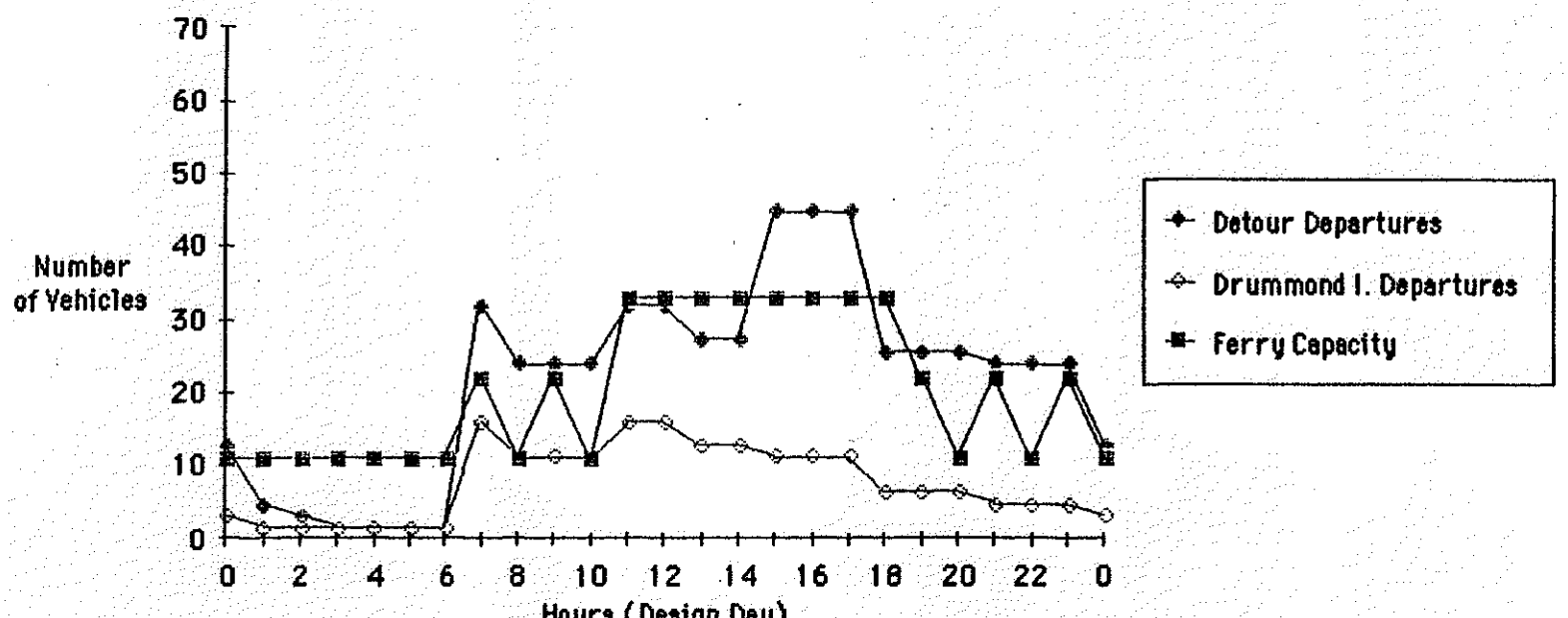
believed to be due to the unpredictable concentration and mix of vehicles during the peak season.

An additional variable is that the actual time it takes for the "Drummond Islander I" to make a trip differs from that of the "Drummond Islander II." The "Drummond Islander I" usually takes less time for loading and unloading. The simulated queue analysis deals with an average time of 20 minutes/trip for each ferry. The true operating scenario, in fact, is that often during these peak periods one ferry has been overtaken, necessitating one vessel to wait for the other to load/unload. With these variables in mind, it is not surprising that the queue simulation does not reflect the worst case.

The need for increased capacity is further supported by the future growth in ridership that is predicted by the year 2000 (see Appendix B). Figure 4.0 depicts the design day queue simulation with a 60% increase in ridership.

The amount of delay now experienced during the months of June, July, and August (with the operation of two ferries during peak hours) and the projection that an increase in ferry traffic can be expected in the next fifteen years, demonstrate the need to increase the carrying capacity of the overall system. With this need established, criteria for (1) the modification of the "Drummond Islander II" and (2) the purchase of a new/existing vessel were developed.

Figure 4.0 - Present Ferry Capacity, Ridership
60% increase for the year 2000.



3.0 Alternatives: "Drummond Islander II"

3.1 Modification Criteria

As a result of a review of the operating profile and interviews with EUPTA personnel discussing the shortcomings of the "Drummond Islander II", the following criteria for modification are offered:

Modify the "Drummond Islander II" to:

1.) allow for better ice operations, and

2.) increase the overall carrying capacity of the ferry system to meet the present needs of the route.

3.2 Modifications to Improve Ice Operations

A study of the vessel showed that no economical modifications could be made to the "Drummond Islander II" that would greatly improve its ice operations. The "Drummond Islander II" does not lend itself to ice operations due to its barge-like shape which tends to build up ice in front and under the vessel. In addition to its inability to move through the ice, the crews report that the amount of stress taken by the propellers in ice is excessive due to the relatively shallow draft, flat bottom, and the outboard location of the twin screws. One comment summed it up: "she is shaped like a pumpkin seed and everything comes up into the propellers."

Operators of the ferry, EUPTA personnel, naval architects, and the shipyards interviewed agreed that for vessels of this size (under 100 gross tons), a single screw vessel or a double-ender (propeller at bow & stern) is the best choice for ice operations. A vee-shaped hull that

spreads the ice, the center line location of the propeller with increased immersion, and the increased thrust available from a larger single screw add up to the best choice for ice operations. The performance of the "Drummond Islander I," a single screw vessel, attests to this fact.

3.2.1 General Recommendations - Ice Operation

Both vessels can be better protected from rudder damage in ice. An ice chock could be installed to protect the rudder when backing down. This small appendage would cause little drag and can be economically designed and installed. (Figure 5.0 illustrates the type of ice chock that could be fitted.)

An additional protection that might be considered to alleviate bow damage in ice is ferrous cement reinforcement. Determination of the effective use of cement is dependent on past experience of the vessels and the amount of damage that is encountered in the bow area due to running in ice.

Finally, investigation should be made into the use of a bubbler system at each of the ferry slips. It was reported that most of the hull, rudder, and propeller damage in ice is a result of jamming the ferry into an ice-packed slip. Although a bubbler system would not address every ice condition (i.e., large shifting ice flows) it would seem that it could help to reduce ice build-up in the ferry slips. A decision on this recommendation would require more indepth study of the local ice conditions and is beyond the scope of this project.

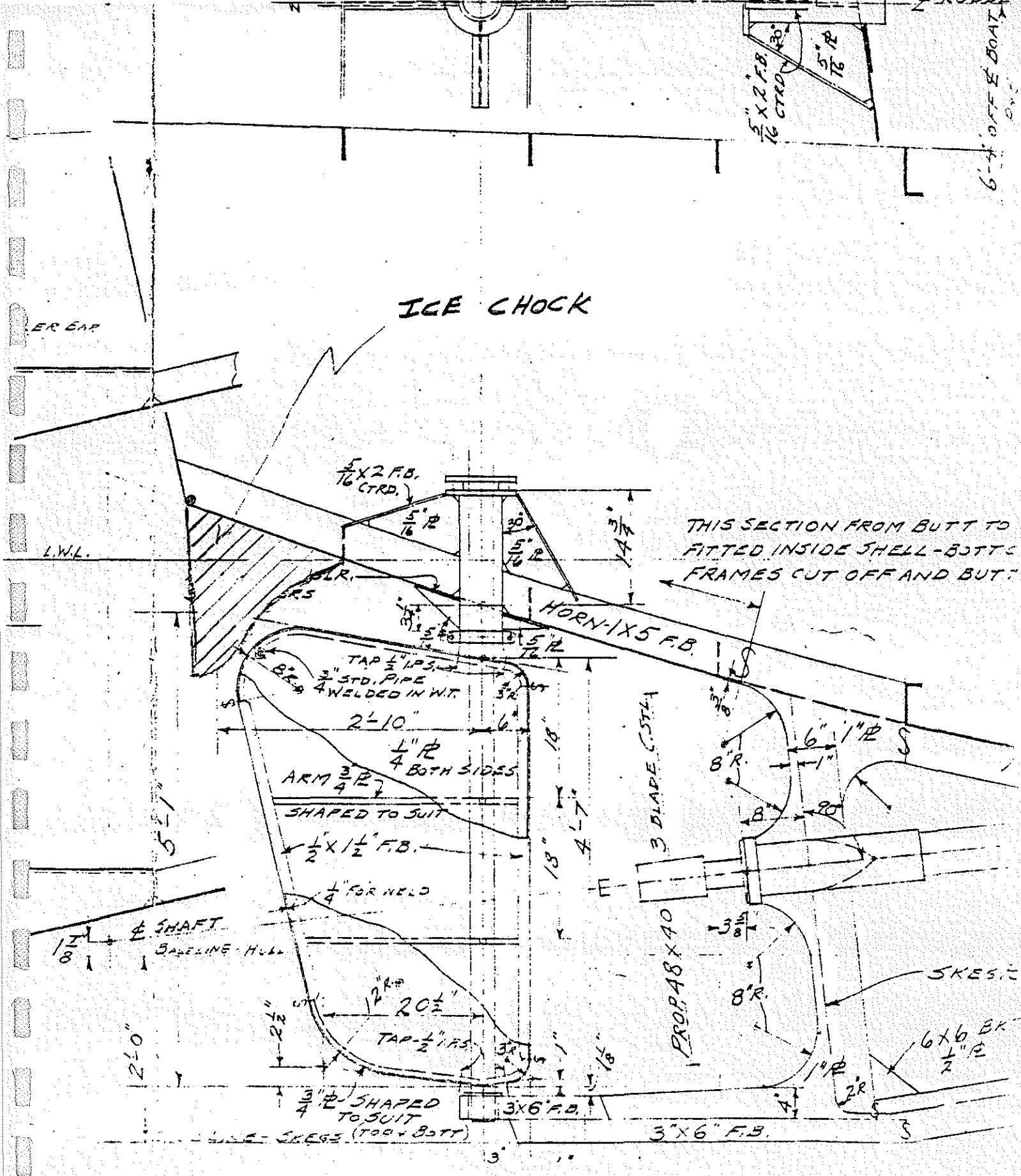


Figure 5.0 - Ice Chock for Rudder Protection

3.2.2 Conclusions - Ice Operation

The volume of vehicle traffic is low enough during the ice season that operating only one ferry is justified; the "Drummond Islander I" performs in ice quite well. If a decision is made to keep the "Drummond Islander II" rather than replace it with a new vessel, the problem of not having a capable ice-going backup vessel in case of a breakdown still exists.

The "Drummond Islander II" is not a viable alternative in ice operations. It can operate in ice as it did this last spring; however, it is extremely inefficient. It should be noted that increasing the vessel's length, as proposed in the next section, will probably result in further decreasing its efficiency in ice due to the increase in hull surface area.

3.3 Modification to Increase the Carrying Capacity

3.3.1 Modification Criteria

The following criteria were used in determining the proposed lengthening of the "Drummond Islander II" by 32 feet.

a. Increase carrying capacity from 12 to 19.2 cars. This is based on the design hour high direction forecast which shows that, for the low case, the volume for the year 2000 will increase by 60% over that of 1985. (See Appendix B).

b. Maintain the present manning requirements of one Captain and one deckhand.

c. Provide for easier loading and unloading of large vehicles: motor homes, trucks, trailers, etc.

3.3.2 Meeting the Criteria

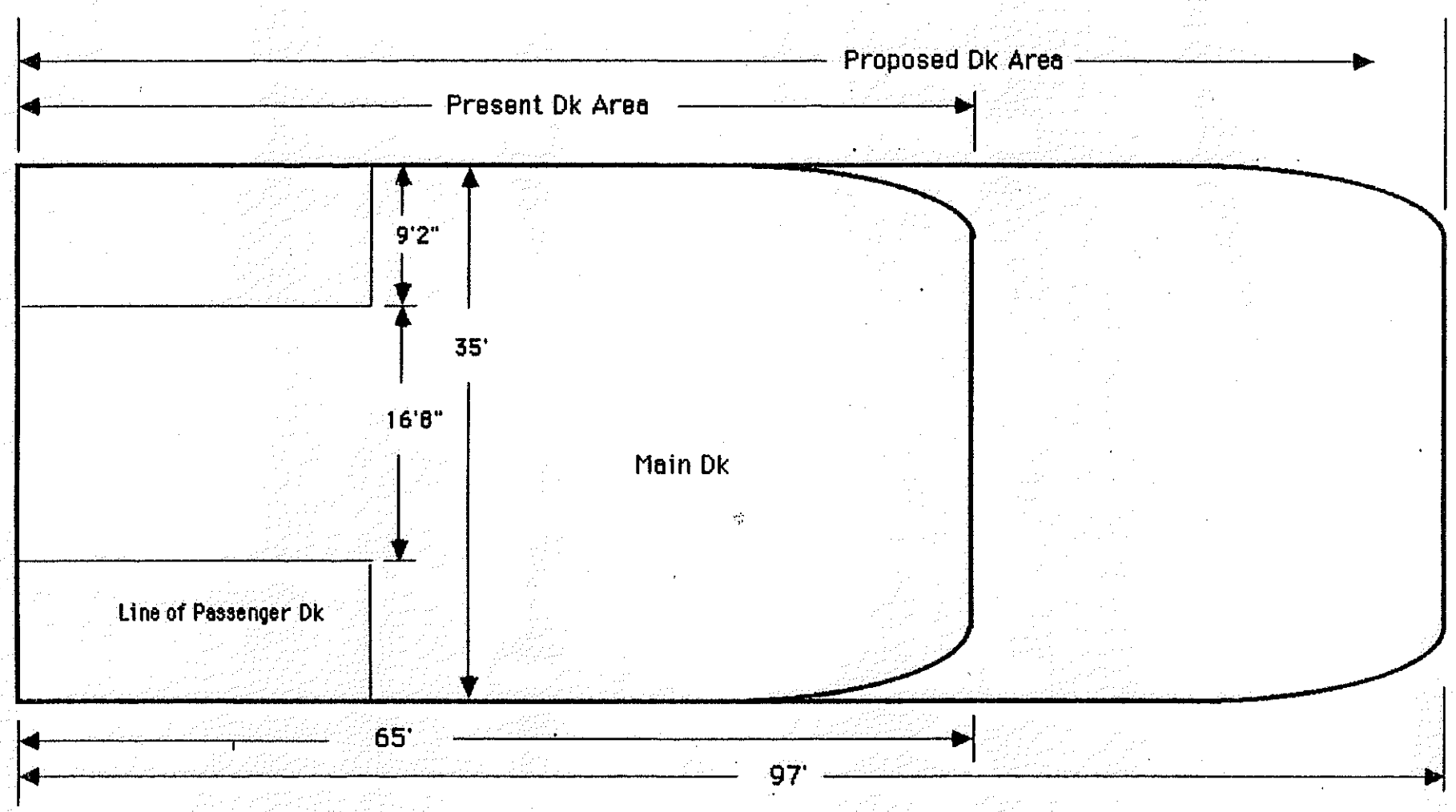
Of the three criteria listed above, the manning requirements turned out to be the controlling factor. The "Drummond Islander II" was built under the regulations outlined in subchapter T of the the Code of Federal Regulations (CFR). Vessels built under this subchapter of the CFR are often referred to as "T" boats. The rules originally specified that, for vessels to operate under the more lenient regulations of subchapter T, they had to be less than 100 gross tons and not more than 65 feet in length. Hence, there exist a large number of 65 foot passenger boats. The regulations were later amended to remove the restriction of 65 feet. Today the requirement is that the vessel must be under 100 gross tons and carry less than 150 passengers. (It should

be noted here that gross tonnage is not a measurement of weight, but rather a volumetric measure that is dependent on the layout of the vessel.)

The reason for detailing the information concerning the CFR is to highlight the fact that the manning requirements for vessels under Subchapter T is a judgemental call by the Officer in Charge, Marine Inspection, of the U.S. Coast Guard. [2] The possibility of modifying the "Drummond Islander II" was therefore discussed with the Commander of the Marine Inspection Office in St. Ignace, Michigan. It was his recommendation that if the present crew complement is to be maintained, the vessel should be kept under 100 feet in length.

Two other factors, average auto length and original vessel design, lead to the recommendation that a 32-foot section be added. First, the average overall length of 1986 passenger cars is 15'5"[3]. Two car lengths is the maximum that could be added to remain under the 100 foot length recommended by the Coast Guard. Finally, the vessel was originally designed with watertight bulkheads every 16 feet. In keeping with this design, a 32-foot section is proposed to accommodate the additional two vehicle car lengths. Figure 6.0 shows the deck area increase.

The addition of the 32 foot section meets the criteria of increasing the carrying capacity of the vessel by 60% to help meet the future needs of the ferry system. Figure 7.0 shows the layout of vehicle units of 16 feet x 6.0 feet in the deck area with the recommended lengthening.



Drummond Islander II
Proposed Deck Area Increase
32' Lengthening
Scale 1"=10'
John Jessup, UMTRI, 7/23/86

Figure 6.0 Deck Area Increase

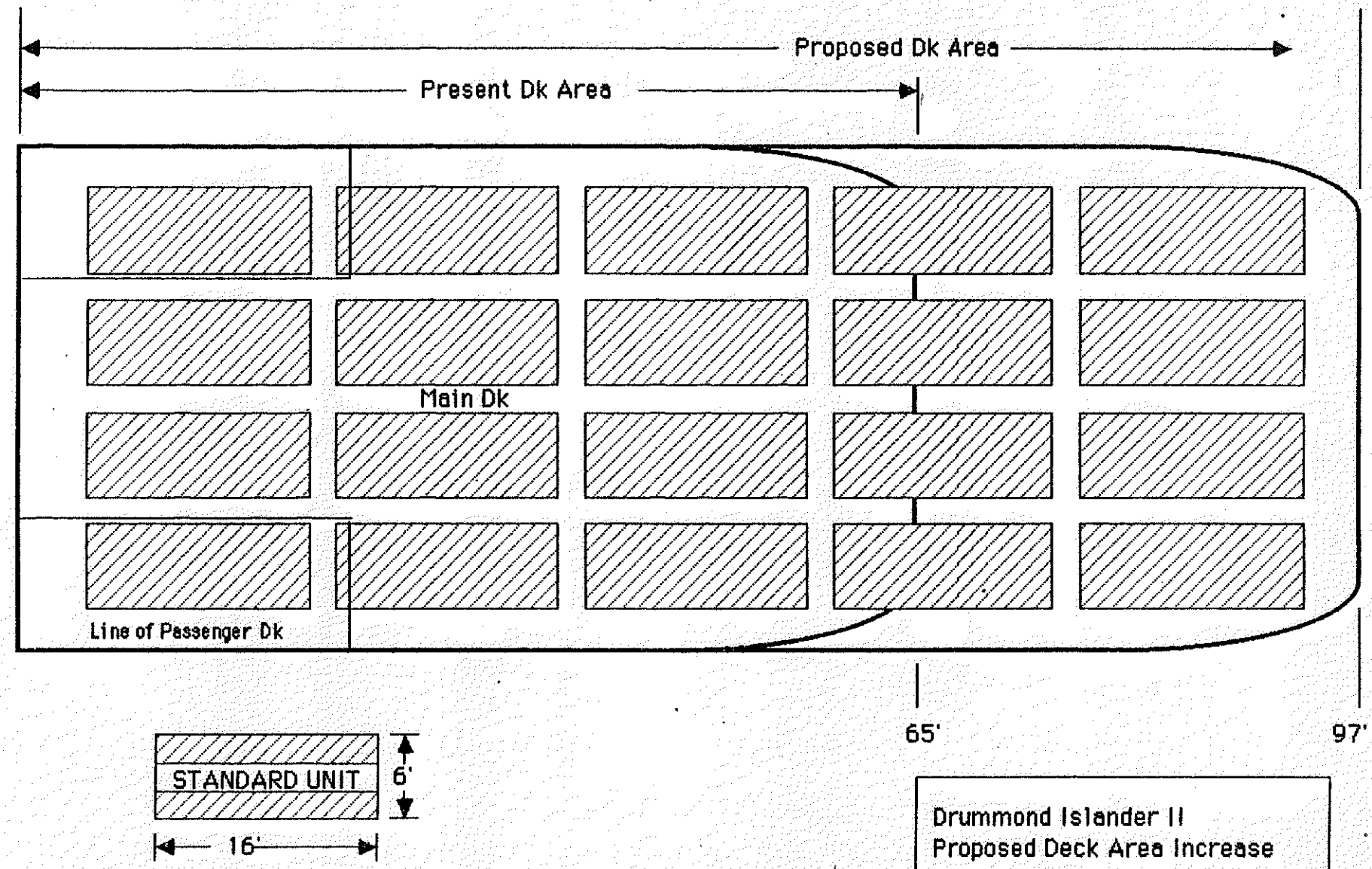


Figure 7.0 - Carrying capacity increased from 12 to 20 units.

The lengthening of the vessel by this amount facilitates loading and unloading of large vehicles--the third modification criteria. Motor homes, trucks, and trailers that are unable to fit under the overhang of the passenger cabins will be able to maneuver off to the side as shown in Figure 8.0.

The overhanging cabins (Figures 9.0 a & b) have been the subject of much discussion for the "Drummond Islander II." The design of ferry cabins allows for complete utilization of all deck space. These cabins were decreased in width in 1970. It was recently proposed that one of the cabins be completely removed to allow more open deck space. Public response to this proposal was not favorable, and the cabin was not removed. Further cabin modification, in addition to lengthening, would not enhance the loading and unloading of the vessel enough to justify the cost.

3.3.3 Cost Estimate for Lengthening

The total estimated cost of the proposed 32 ft. lengthening of the "Drummond Islander II" is $250,000. This cost represents $200,000 in shipyard costs and $50,000 in engineering costs.

The shipyard cost is based on a steel weight of the 75,500 lb. section to be added, at a shipyard cost of $2.00 per pound. (See Appendix C for calculations). A 30% factor was added for additional modifications such as new fuel tanks and the upgrade of electrical and safety systems that may be necessary with the lengthening. It should be assumed that upgrade of the systems will be required by the Coast Guard.

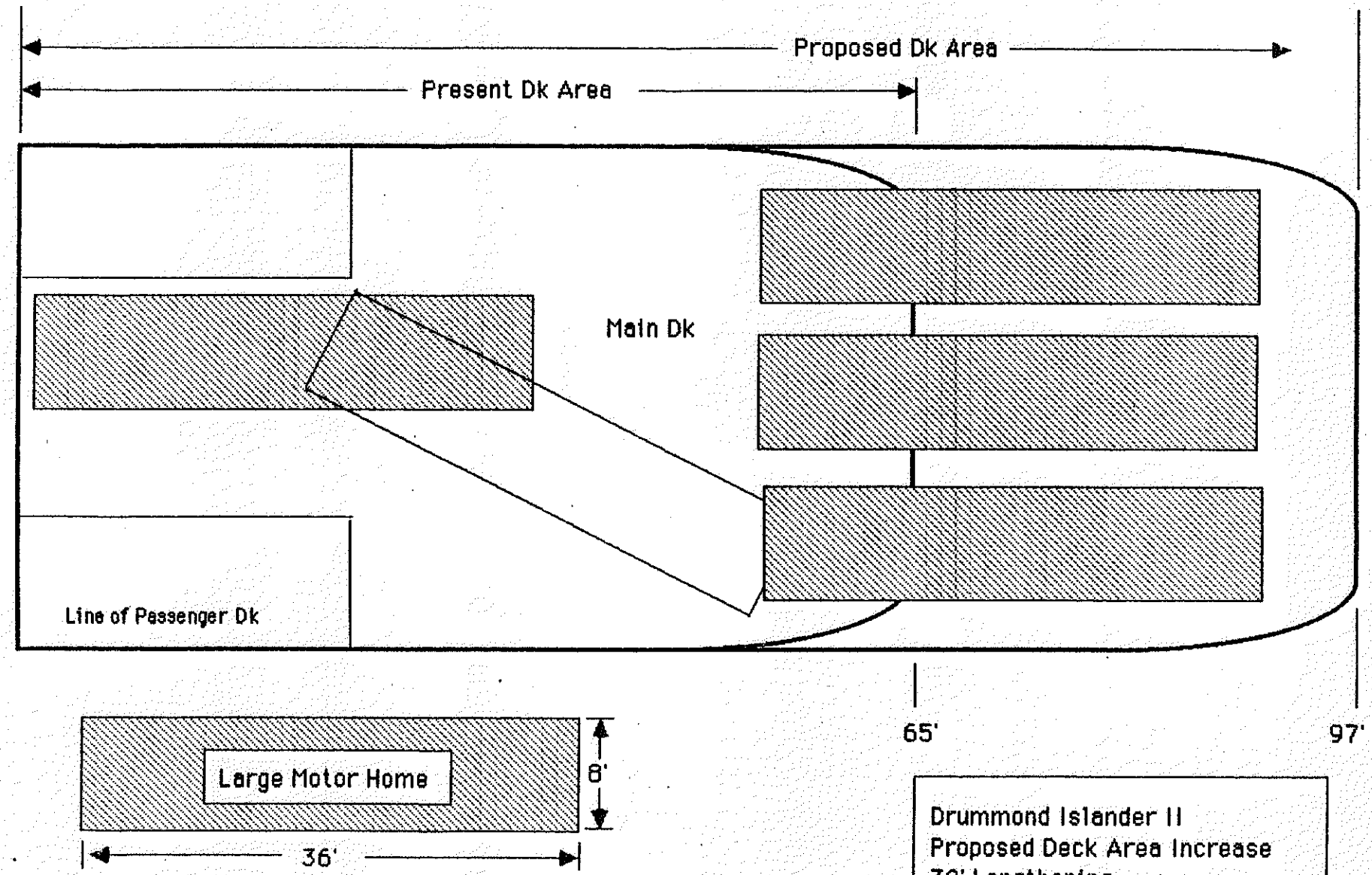


Figure 8.0 - Improved large vehicle loading.

Figure 9.0a - Overhanging Passenger Cabins, Looking Aft

Figure 9.0b - Four Vehicles Across, Under Passenger Cabins

Engineering construction costs and costs for interfacing with regulatory agencies were estimated to be 25% of the shipyard costs.

At this time, it should be noted that the sister ship to the "Drummond Islander II" is the "Voyageur." This ferry is operated by the Washington Island Ferry Line. In 1985 they put forward an RFP to modify their ferry (as shown in Appendix D). Complete refitting of the deckhouse, lengthening, and repowering the vessel were suggested modifications. They proved to be too costly and were not pursued.

The difference between the modification of the "Drummond Islander II" and the "Voyageur," is in the state of the vessel prior to its modification. The "Voyageur" had only a 9 foot clearance under the deckhouse; the "Drummond Islander II" has a 14 foot clearance amidships. Additionally, the "Voyageur" needed to be repowered; the "Drummond Islander II" was repowered in 1984 and presently has only 5000 hours on her engines. Improving the carrying capacity and loading characteristics of the "Drummond Islander II" is achievable without making engine and cabin modifications. This makes the proposed 32 foot lengthening a viable alternative to that of purchasing a new vessel.

4.0 Replacement/Additional Vessel Purchase Options

4.1 Replacement/Additional Vessel Criteria

Based on the review of the operational profile of the Drummond Island Ferry Service and the vessel requirements outlined in section 2.0, the following criteria for purchase of a new or used vessel have been established:

1. The ferry must be capable of efficient ice operations.
2. The ferry must be compatible with existing dock facilities.
3. The ferry carrying capacity must be:
   a. 19 vehicles to operate in conjunction with a second 12 vehicle ferry to meet the needs projected for the year 2000,

or

   b. 44 vehicles to operate alone as a replacement ferry to handle all traffic year around.

4.2 Availability of Existing Vessel or Design

The possibility of finding an existing vessel for purchase that would meet the outlined criteria is remote. Although at least one ferry has been identified as a possibility, it is a twin screw vessel. As discussed earlier, it has been determined that a single screw vessel is necessary in order to achieve acceptable ice operations.

Vessel designs for the type of ferry required to meet the design criteria exist. A number of naval architecture firms were contacted and indicated that the building of a double-ender, that could withstand the rigors of ice operations, is well within the state-of-the-art. A

double-ended ferry is the most desirable since the present crossing time of 20 minutes could be reduced to 15 minutes by eliminating vessel turnabouts.

Examples of existing ferries in operation are not provided in this report in order to avoid any possibility of bias toward one design firm over another. Suffice it to say that, if the Michigan Department of Transportation were to formally solicit a design, the architectural community would be able to provide existing vessels and designs off the shelf that could be economically modified to meet the design criteria.

4.3 Cost Estimate for New Vessel

The "going price" for a ferry that is capable of carrying 15-20 cars is estimated to be 1-1.5 million dollars. The cost of a ferry that will carry 35-45 cars is estimated to be between 3.2 and 4.0 million dollars. These figures are based on data from design firms and discussions with ferry operators that have recently purchased, or are about to purchase, similar vessels.

5.0 Comparison of Alternatives

5.1 Estimate of Operating Costs

In order to provide a basis for comparing alternatives, an analysis of the daily operating costs for the ferries was done. The present operation and three other scenarios, alternatives A, B, and C, were reviewed. A twenty year time frame was used for projecting these costs.

Alternative A envisions selling the "Drummond Islander II" and purchasing a new double-ended ice class ferry capable of carrying 20-25 automobiles at 12 mph. The "Drummond Islander I" will be retained to provide relief during the peak summer season. Figure 10.0 shows the carrying capacity of this alternative plotted against the projected increase in ridership levels for the year 2000 per the design day described in section 2.0.

Alternative B envisions the lengthening of the "Drummond Islander II" by 32', as detailed in section 3.0. The "Drummond Islander I" would continue to be the vessel used for ice operations and both ferries would operate during the peak summer hours. Figure 11.0 shows the carrying capacity of this alternative plotted against the projected increase in ridership.

Alternative C envisions selling the "Drummond Islander II" and purchasing a new double-ended ice class ferry capable of carrying 30-40 vehicles. The "Drummond Islander I" would be retained only as a backup vessel in case of a breakdown. An increase in crew size from two to three persons was assumed for operating the ferry. Figure 12.0 shows the carrying capacity of this alternative plotted against the projected increase in ridership.

Figure 10.0 - Alternative A Capacity, Ridership
60% increase for the year 2000.

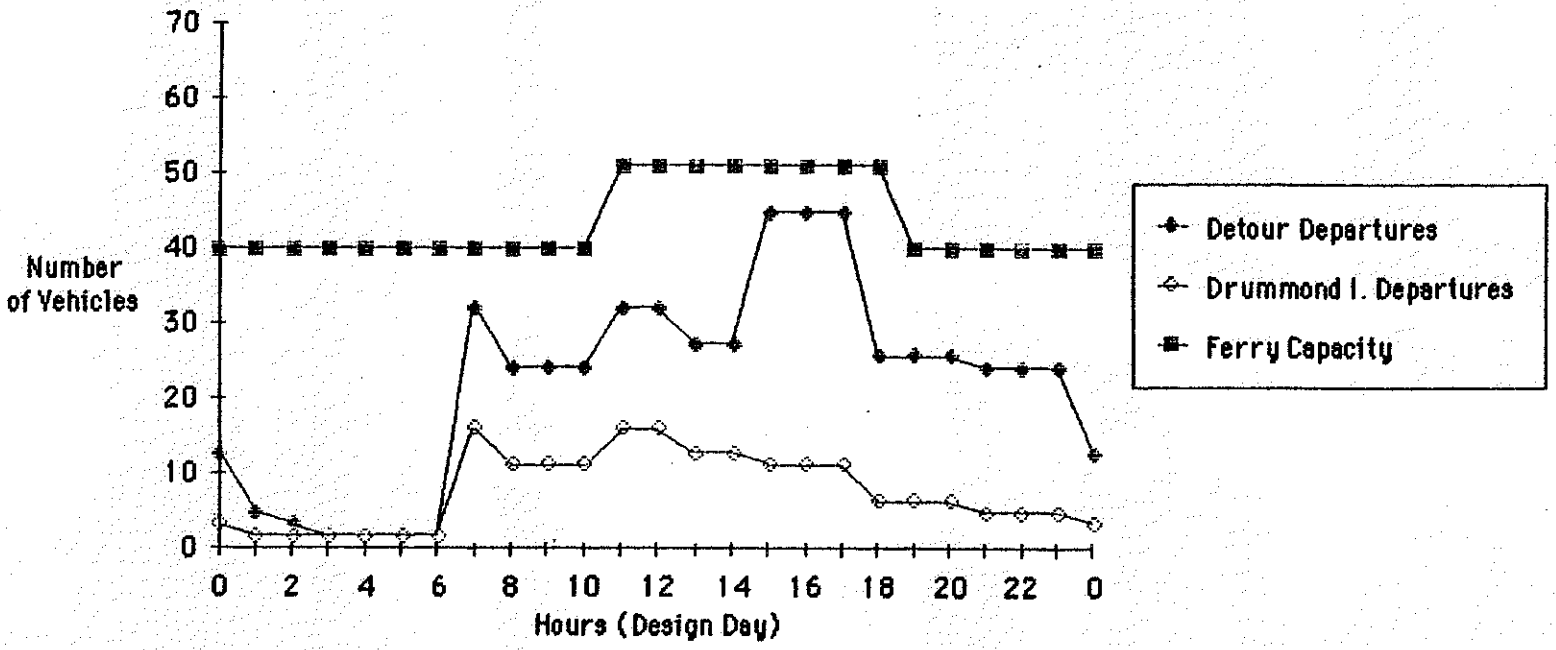


Figure 11.0 - Alternative B Capacity, Ridership
60% increase for the year 2000.

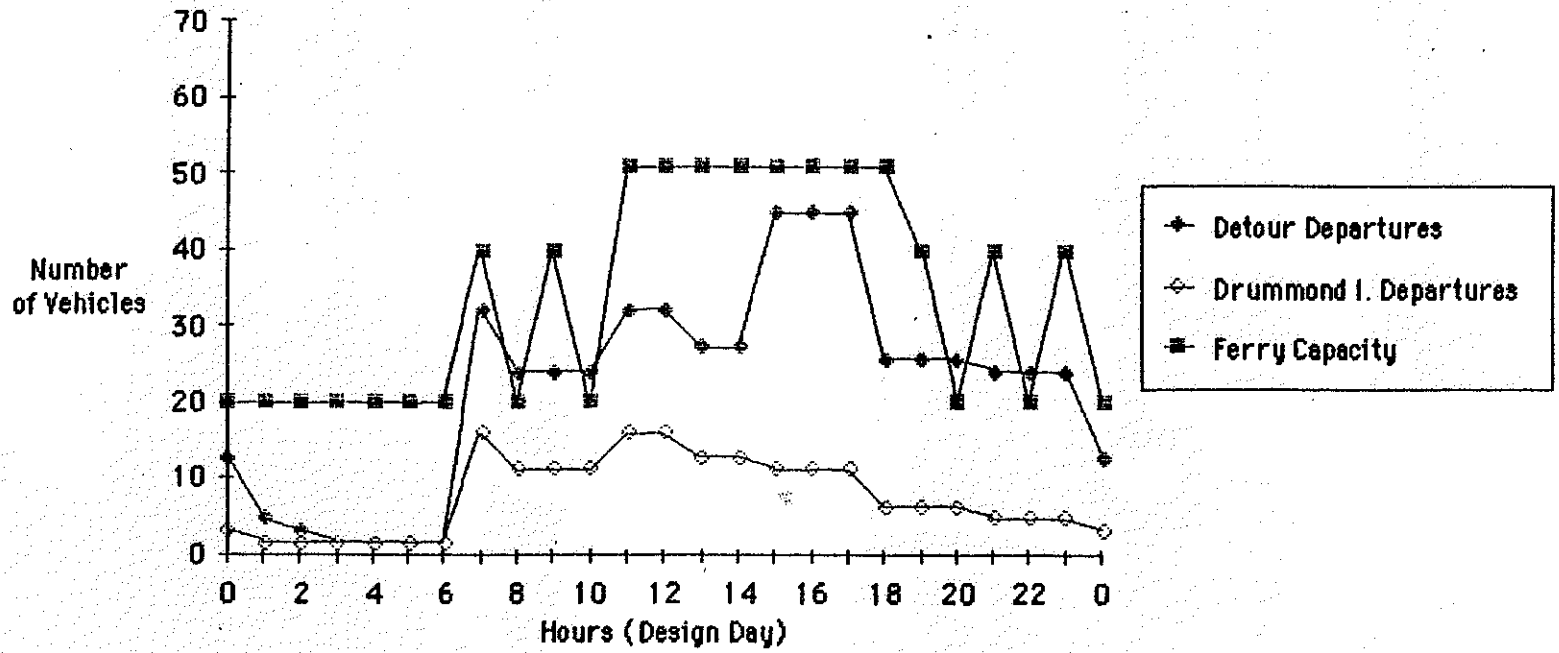


Figure 12.0 - Alternative C Capacity, Ridership
60% increase for the year 2000.

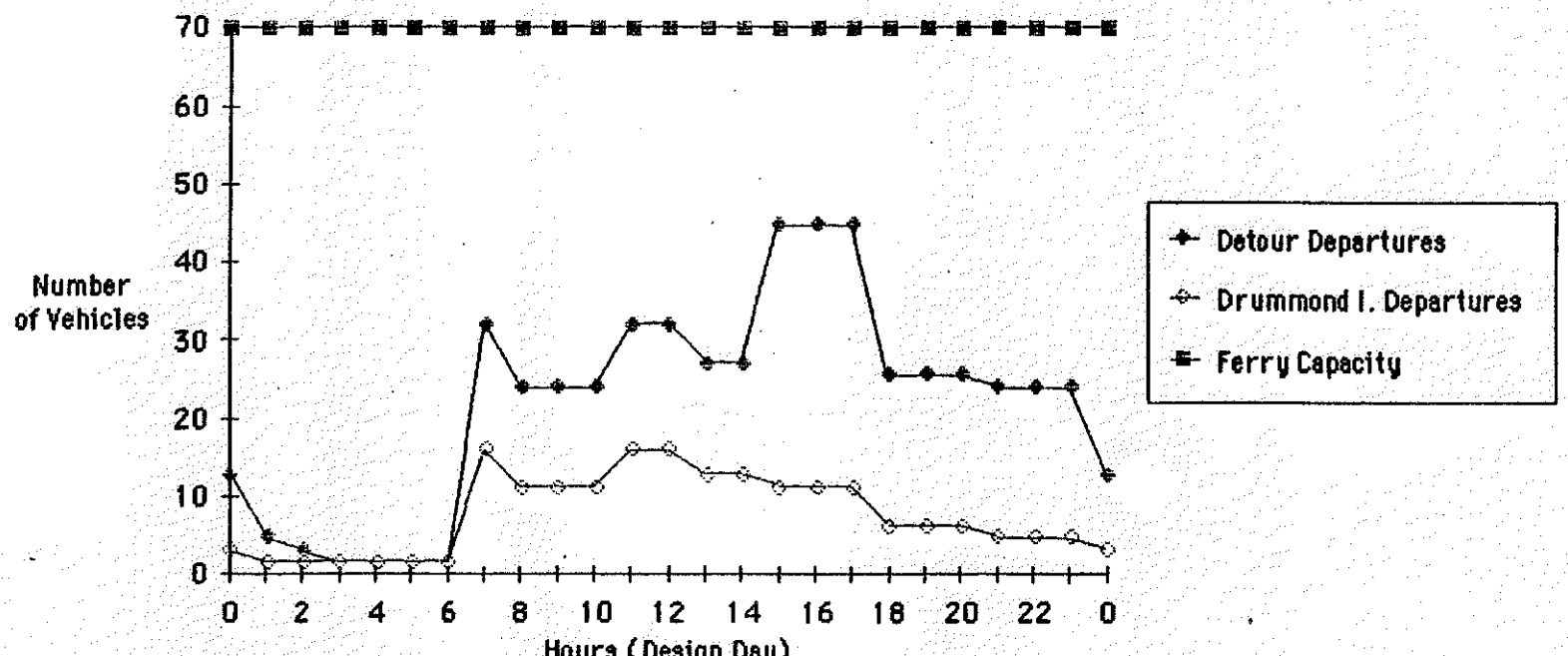


Figure 13 summarizes the results of each operating scenario. The calculations for each ferry are contained in Appendix E. The differences in yearly operating costs for each of the alternatives is shown in Table 5.1 below.

	Yearly Operating Cost	Difference Between Present and Alternative
Present Operation	$ 428,636	N/A
Alternative A	$ 600,019	$ 171,383
Alternative B	$ 460,832	$ 32,195
Alternative C	$ 1,011,808	$ 583,171

Table 5.1 Differences in yearly operating costs.

5.2 Relative Scoring of Alternatives

There are a number of factors associated with the operation of the Drummond Island ferry system which are not quantifiable in terms of dollars and cents. These factors range from the aesthetic appeal of the ferry and its ability to attract tourism dollars, to the area of safety and reliability of the ferry operation during adverse weather conditions. These variables are addressed in Table 5.2 below. The factors for each alternative are scored using "!" for superior, "+" for good, "(-)" for fair, and "-" for undesirable.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**Present Operation**		--"Drummond Islander I" Full time until May,												Totals Check
2			then 5days/week until end of October.												
3		Total Yearly Exper	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
4	Drummond Islander I	$215,106	$26,252	$26,252	$26,252	$29,154	$8,148	$8,148	$8,148	$8,148	$8,148	$8,148	$29,154	$29,154	
5	Drummond Islander II	$213,531	$1,313	$1,313	$1,313	$1,313	$34,276	$34,276	$34,276	$34,276	$34,276	$34,276	$1,313	$1,313	
6	Total Cost	$428,636	$27,565	$27,565	$27,565	$30,467	$42,423	$42,423	$42,423	$42,423	$42,423	$42,423	$30,467	$30,467	$428,636
7															
8															
9	**Alternative A**		-- Replace "Drummond Islander II" with new 20 - 25unit vessel,												
10			run Drummond Islander I as summer relief.												
11		Total Yearly Exper	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
12	new vessel 15m	$543,258	$41,317	$41,317	$41,317	$46,590	$46,590	$46,590	$46,590	$46,590	$46,590	$46,590	$46,590	$46,590	
13	Drnd Isle I, Aux vessel	$56,761	$1,313	$1,313	$1,313	$1,313	$8,148	$8,148	$8,148	$8,148	$8,148	$8,148	$1,313	$1,313	
14	Total Cost	$600,019	$42,629	$42,629	$42,629	$47,902	$54,737	$54,737	$54,737	$54,737	$54,737	$54,737	$47,902	$47,902	$600,019
15															
16	**Alternative B**		--Lengthen "Drummond Islander II" to 97ft.,												
17			Run Drummond Islander I in winter and as summer relief boat.												
18		Total Yearly Exper	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
19	Drummond Islander I	$215,106	$26,252	$26,252	$26,252	$29,154	$8,148	$8,148	$8,148	$8,148	$8,148	$8,148	$29,154	$29,154	
20	Drmnd Isle II (97')	$245,726	$3,996	$3,996	$3,996	$3,996	$36,959	$36,959	$36,959	$36,959	$36,959	$36,959	$3,996	$3,996	
21	Total Cost	$460,832	$30,248	$30,248	$30,248	$33,150	$45,106	$45,106	$45,106	$45,106	$45,106	$45,106	$33,150	$33,150	$460,832
22															
23		Total Yearly Exper	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
24															
25			New vessel handles all traffic (35-45 vehicles),												
26	**Alternative C**		Drummond Islander I is idle but maintained for backup.												
27	new vessel 35 m	$996,056	$68,604	$68,604	$68,604	$87,805	$87,805	$87,805	$87,805	$87,805	$87,805	$87,805	$87,805	$87,805	
28	Drummond Islander I	$15,752	$1,313	$1,313	$1,313	$1,313	$1,313	$1,313	$1,313	$1,313	$1,313	$1,313	$1,313	$1,313	
29		$1,011,808	$69,916	$69,916	$69,916	$89,118	$89,118	$89,118	$89,118	$89,118	$89,118	$89,118	$89,118	$89,118	$1,011,808
30	**DATA**														
31		Cost/Day	Cost/Day	Cost/Day											
32		Full Time Summer	Smmr Rlf	Winter	Idle										
33	Drummond Islander I	$958	$407	$863	$43										
34	Drmnd Isle II (65')	$1,127			$43										
35	new vessel 15m	$1,532		$1,358											
36	Drmnd Isle II (97')	$1,215			$131										
37	new vessel 35 m	$2,886		$2,255											

Figure 13.0 - Summary of Operating Costs

(See Appendix E for detailed calculations)

FACTORS/CONTENDERS	Present Operation	ALTERNATIVES A	B	C
Vehicle Capacity 1986	-	!	!	!
Vehicle Capacity 2000	-	!	+	!
Ice Navigation	(-)	!	(-)	!
Operating Costs	!	(-)	+	-
Reliability	(-)	!	(-)	!
Ridership Appeal	(-)	!	(-)	!

"!" = superior
"+" = good
"(-)" = fair
"-" = undesirable

Table 5.2 Relative Scoring of Alternatives

6.0 Conclusions

6.1. Alternative C

Alternative C (purchase of a 35-45 vehicle ferry), with a cost increase in yearly operating that is more than double that of the present ferry operation, is not a viable alternative. The number of empty vehicle spaces that would be moved throughout the winter months is what drives this alternative out of consideration.

6.2 Alternative B

Alternative B (lengthening "Drummond Islander II") will adequately meet the needs of the ferry system during the peak summer traffic flow. The

increase in yearly operating costs is a modest $32,195. The major drawback, however, is the unreliability of the ferry service during the winter months.

6.3 Alternative A

Alternative A (purchase of a new double-ended ice class 20-25 vehicle ferry) best meets the long term needs of the ferry system. The increase in yearly operating costs is estimated to be $172,000. This cost can be offset somewhat by the projected increase in ridership.

It was indicated that, if the cost/benefit analysis favors construction of a new vessel, consideration should be made in this report regarding the disposition of the remaining vessels. As stated earlier, it is appropriate for the "Drummond Islander I" to be retained as a relief summer vessel and a backup winter vessel. This vessel should be retained in preference to the "Drummond Islander II" because it is the more capable vessel in ice. (Appendix F gives a listing of local Great Lakes ferry operators, a national organization of ferry operators, and trade magazines that would give ample exposure for the sale.)

The ultimate decision for choosing one of the alternatives provided in this report is largely dependent on the funding support that the State is willing to provide. Alternative A would provide a reliable and flexible ferry service that would take the system to the turn of the century. Although the increased cost per year for the system is significant over that of Alternative B, an aesthetically appealing ferry

that is efficiently moving traffic may be a drawing factor that will boost the projected increase in traffic, and in turn, revenues.

7.0 Recommendations for Further Investigation

7.1 Dock Facilities

Investigation should be made into the possibility of establishing two ferry docks on each side of the route. Presently there is only one dock on each side.

Two ferry docks on each side would provide greater flexibility of the ferry operation during the summer months when two ferries are operating at the same time. The situation of one ferry standing off to wait for the other to clear would be eliminated. In addition, the design of an additional ferry slip could be done in such a way as to minimize ice build up and thus enhance the winter operation as well.

7.2 Assessment of Needs -- St. Marys River Ferry System

Investigation should be made into the needs of the entire St. Marys River ferry system so that any new ferry purchase would be capable of integrating into the system as a whole. A careful assessment of all shore facilities, vessels, and of the operating structure should be made at the three ferry sites (Neebish, Sugar, and Drummond Island) so that all assets may be programmed toward meeting the total needs of the system.

REFERENCES

1.0 St. Mary's River Ferry Study, Report 6. September 1984, Michigan Department of Transportation.

2.0 Code of Federal Regulations, Title 46. 1985, Office of the Federal Register, National Archive and Records Service Administration, U.S. Government Printing Office.

3.0 Parking Dimensions, 1986 Model Year Passenger Cars. 1986, Motor Vehicle Manufacturers Association of the United States, Inc.

APPENDIX A

DRUMMOND ISLANDER I & II PRINCIPAL CHARACTERISTICS

M/V "Drummond Islander II" Principal Characteristics:

Length = 65 ft
Beam = 36'2" overfenders
Draft = 4'3" (design water line)
Gross Tonnage = 97 gross tons
Speed = 12mph

Propulsion:

Propellers: Twin screw, 4 blade stainless steel

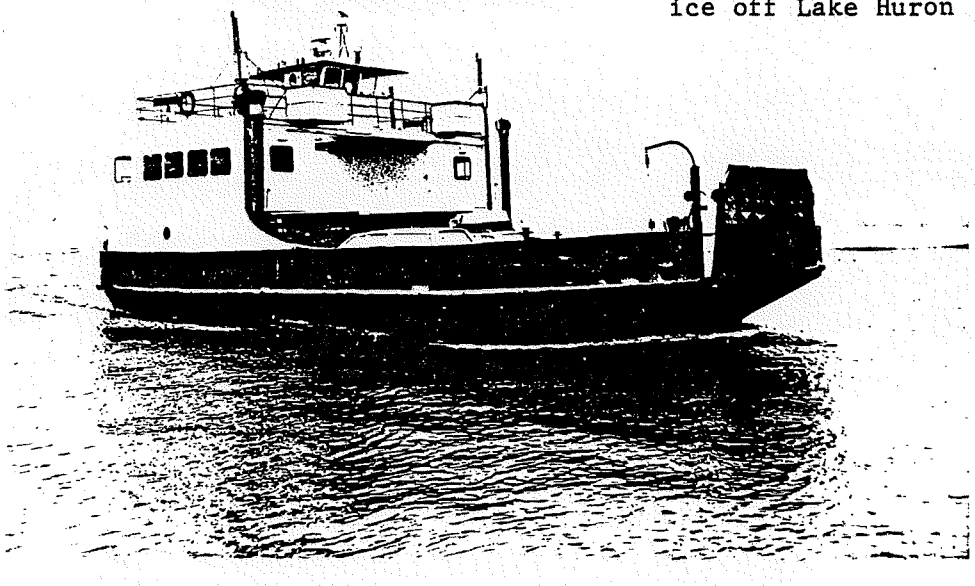
Engines: Two 1150 KTM Cummings, 365 hp each
Repowered 1984 -85, 5000 hrs on engines

Reduction Gears: 4 1/2 to 1

Cargo Capacity
12 vehicles
115 passengers rated (has enclosed seating for 36 passengers)
Roll on/ Roll off vehicles with ramps on vessel

Operating Environment:

Location:	Mouth of the St. Marys River between Detour Village and Drummond Island
Distance:	0.8 miles
Crossing Time:	8-10 minutes
Loading /Unloading Time:	10 minutes
Average Round Trip	40 minutes
Sea conditions:	Area is somewhat protected however severe winds in the spring and fall can create 8-10ft seas.
Ice conditions:	Local ice can be up to 18 inches thick, brash ice 2-3 ft thick, and some blue ice off Lake Huron 2-3 ft thick.



M/V "Drummond Islander I" Principal Characteristics:

Length = 84' 9"
Beam = 30'
Draft = 8' (design water line)
Gross Tonnage = 99 gross tons
Speed = 12mph

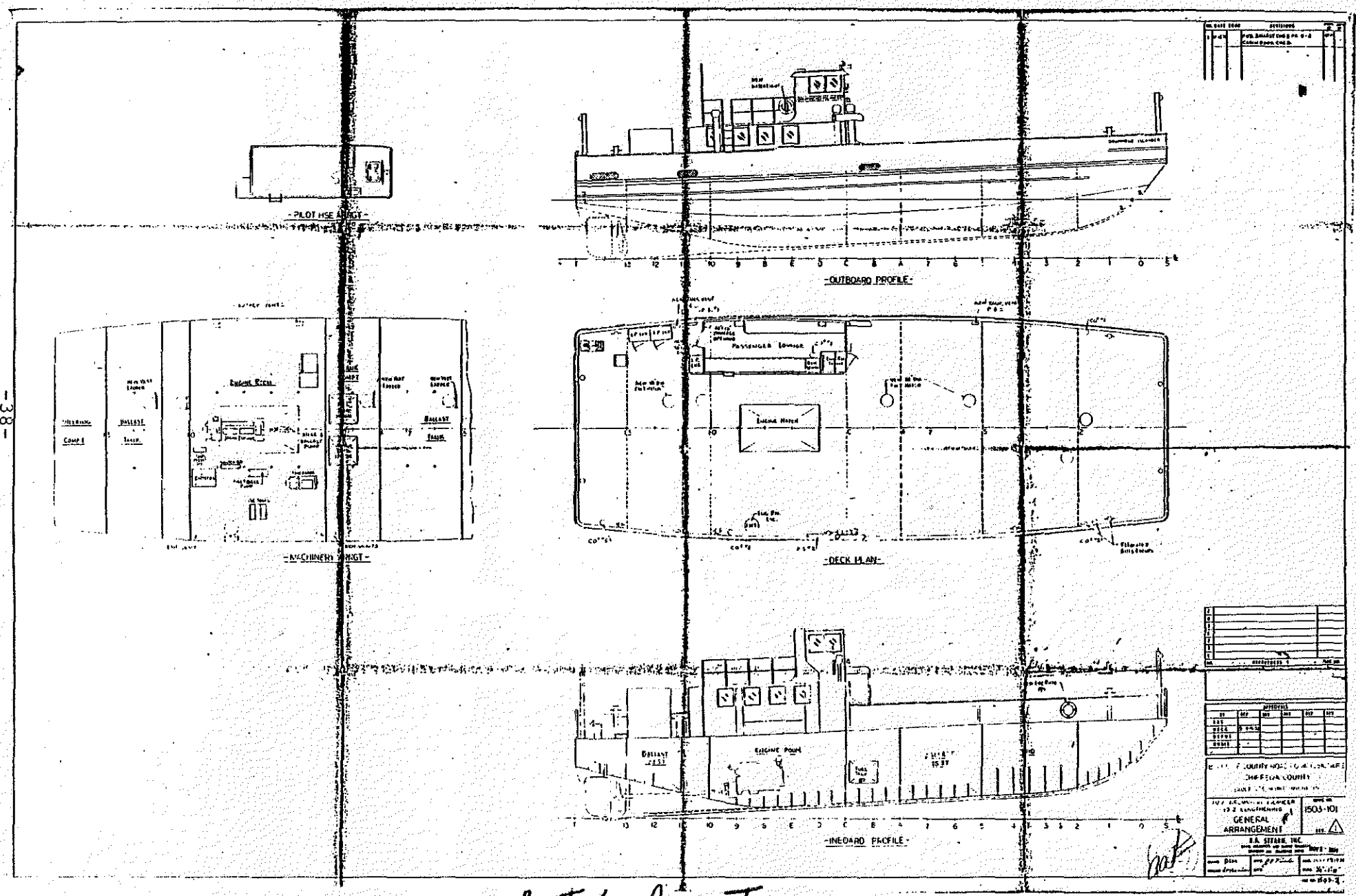
Propulsion:

Propellers:	Single Screw
Engines:	365 hp

Cargo Capacity
12 vehicles
Roll on/ Roll off vehicles with ramps on vessel

Operating Environment:

Location:	Mouth of the St. Marys River between Detour Village and Drummond Island
Distance:	0.8 miles
Crossing Time:	8-10 minutes
Loading /Unloading Time:	10 minutes
Average Round Trip	40 minutes
Sea conditions:	Area is somewhat protected however severe winds in the spring and fall can create 8-10ft seas.
Ice conditions:	Local ice can be up to 18 inches thick, brash ice 2-3 ft thick, and some blue ice off Lake Huron 2-3 ft thick.



Drummond Islander I

APPENDIX B

DRUMMOND ISLAND FERRY SYSTEM OPERATIONAL PROFILE

OFFICE MEMORANDUM

DATE: June 4, 1986

TO: John Kiser, Technical Assistant
Bureau of Urban and Public Transportation

FROM: Edgerton W. Bailey, Administrator
Bureau of Transportation Planning, Intercity Division

SUBJECT: Drummond Island Ferry Service Analysis

This operating profile for the subject service is being submitted in response to your verbal request of April 17, 1986. Vehicle estimates for the design hour high direction have been developed for each year through 1990 and for 1995 and 2000. These figures are intended to provide the basis for determining vessel size and service configuration between De Tour and Drummond Island.

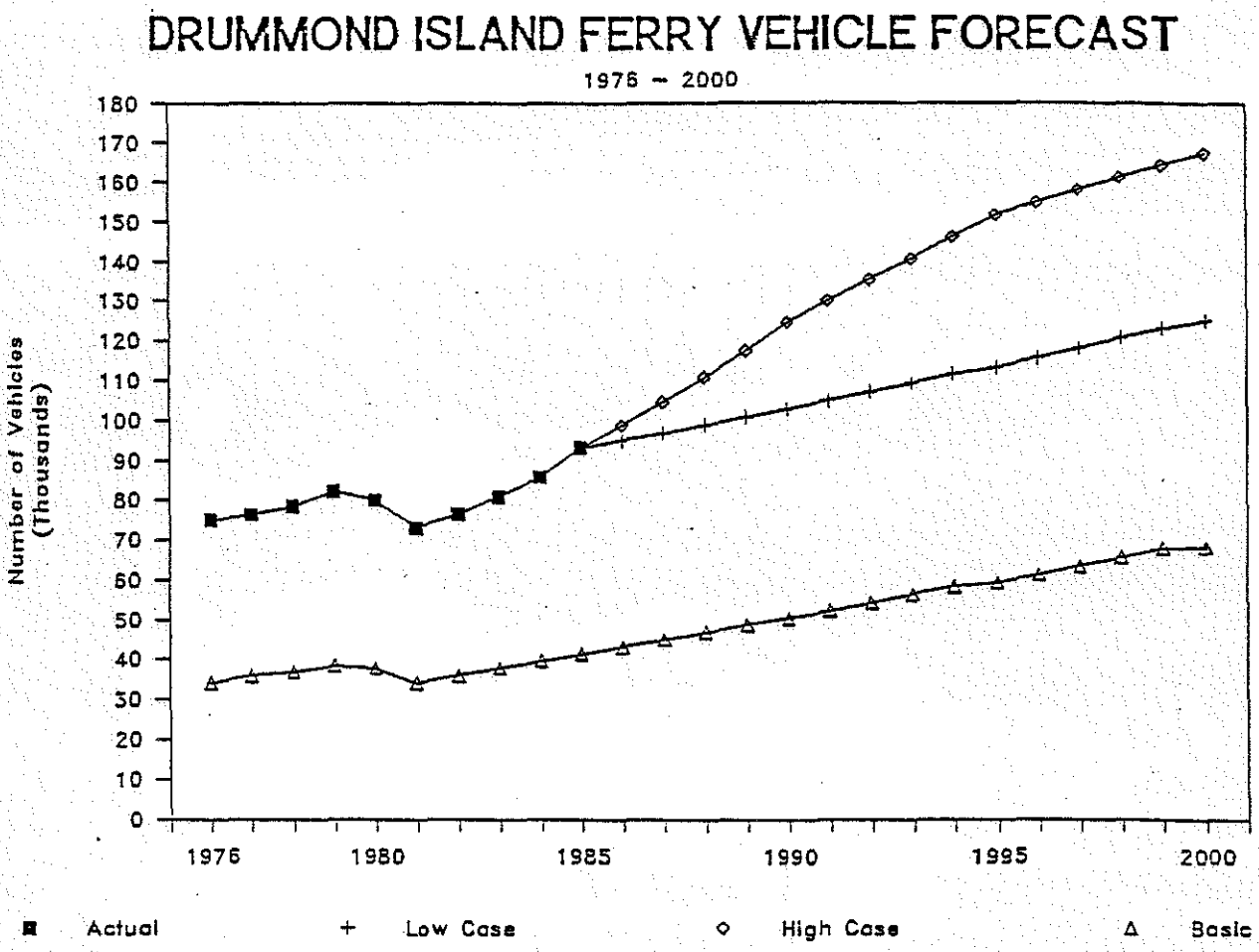
Design Hour High Direction Vehicles Carried Forecasts

The design hour high direction vehicles carried for the low and high case are presented below.

Year	Low Case	High Case
1985 (actual)	28	28
1986	29	31
1987	31	33
1988	32	36
1989	33	39
1990	34	42
1995	39	53
2000	44	60

The low case is the minimum volume which should be considered in vessel design (see attachments A and B). The high case represents a desirable volume and ideally any vessel or combination of vessels should provide the capacity to accommodate the high case demand (see attachments C and D).

Part of the low and high case demand forecasts is composed of basic trips. These include trips made to access employment, school, medical-dental services, and financial services. With the exception of school trips, they are generally made year-round. The tripmakers are generally permanent island residents, non-island residents working on the island, and those performing services on the island. While this volume does not constitute the basis for vessel sizing, it does indicate the need for a dependable year-round ferry service.



Existing Service and Use

The Drummond Island ferry service operates year-round between the village of De Tour at the easternmost tip of the Upper Peninsula and Drummond Island (see attachments E and F). Between April 1 and January 1, the ferry is scheduled to make 22 round trips each day, including three trips between 12:30 a.m. and 6:10 a.m. The winter schedule (January 2 to March 31) consists of 13 daily round trips with no service provided between 11:30 p.m. and 6:10 a.m. (see Attachment G).

Three items affect the scheduling of service: quarry shift changes, school trips, and general demand. Quarry shift changes are accommodated by scheduling De Tour departures at 6:40 a.m., 2:40 p.m. and 10:40 p.m., and Drummond Island departures at 7:10 a.m., 3:10 p.m. and 11:10 p.m. School trips are accommodated between the months of September and June. The general demand for service is composed primarily of those making vacation and other social-recreation trips (approximately two-thirds of all trips are made for these purposes).

Drummond Island Ferry Service Analysis

There are two vessels used for the Drummond Island ferry service. Both are capable of carrying 12 average size vehicles, as well as pedestrians. The larger of the two ferries is used primarily during peak periods and as a backup vessel because structural characteristics make it difficult to accommodate high vehicles. If only one vessel is in operation during peak periods, vehicle queues up to three hours or more occur (see Attachment H).

The demand for ferry service is generally greatest between the hours of 10:00 a.m. and 6:00 p.m. with both ferries operating as needed during this period. Higher traffic volumes are usually experienced on the weekends and both vessels may be used at times on a continuous basis to accommodate the demand. Traffic volumes are highest during the summer months of July and August and, beginning in June, both vessels are in service from Thursday through Monday. A significant level of use is also experienced in the months preceding and following the months of July and August. May, June, September, and October generate about two-thirds of the July and August volumes with April and November showing some indications of increased use.

Annual passengers and vehicles carried have fluctuated over the last 10 years, ranging from 161,644 passengers in 1976 to 229,107 passengers in 1981; 73,196 vehicles in 1981 to 93,182 vehicles in 1985. Between October 1, 1984 and September 30, 1985 (FY 1984-85), the Drummond Island ferry carried 220,705 passengers, 93,182 vehicles (see attachments I, J, K, L, M, N, O and P), and made a total of 20,196 crossings or 10,098 round trips.

Fares for the Drummond Island ferry are based on the type of vehicle and include the driver. Additional passengers are charged a separate fare (see attachments Q, R, and S). Fares were increased on October 16, 1985. This increase is a surcharge which will be set aside for capital expenditures.

Design Day, Period, Hour, and High Direction

The design day is the average Friday in July and August. The highest volume months are July and August (see Attachment L) which comprise some 30 percent of the annual use. Fridays and Saturdays are the highest ridership days in July and August. Fridays experience higher peak hour volumes and directional splits than Saturdays, although some Saturdays have a higher daily ridership. Therefore, Friday has been selected as the design day.

The design period is 2:00 p.m. to 5:00 p.m. on the design day. Approximately 25 percent of the design day use occurs during this three hour block of time. Also, the directional split is greater during these hours, approximately 80/20 favoring the De Tour to Drummond Island direction.

Drummond Island Ferry Service Analysis

The design day vehicle volume in 1985 was estimated to be 450 with the design three hour period being 105 vehicles or 35 vehicles per hour. The design hour high direction vehicle volume was estimated to be 28, or 80 percent of the design hour (see Attachments B and D).

Assumptions

The Low Case assumes that the change in vehicles transported by the Drummond Island Ferry Service will be similar to the forecasted change in vehicle miles of travel (VMT) for the state and average daily traffic (ADT) for the Mackinac Bridge.

	State Trunkline VMT (billions)	% Change in 5 Years	Mackinac Bridge ADT	% Change in 5 Years
1985	68.0	9.7%	7,074	14.6%
1990	79.3	10.6%	8,200	15.9%
1995	89.3	12.6%	9,500	15.9%
2000	99.3	11.2%	11,000	15.8%

This results in an increase for the next 10 years similar to that experienced in the past 10 years, about 20,000 vehicles. Population and employment estimates support this level of demand (see Attachments T, U, and V).

The High Case assumes that the vehicles carried trend for the last five years will continue throughout the next 15 years to the year 2000. Several conditions are necessary for this to occur including (1) relatively low gasoline prices, (2) high employment, and (3) a stable economy.

Annual Passengers and Revenues Estimates

Estimates of annual passengers and revenues available to offset operating costs are presented below.

	1985 Actual	1990 Estimate	1995 Estimate	2000 Estimate
Passengers (000)				
Low Case	221	247	273	301
High Case	221	299	364	402
Revenues (000)				
Low Case	$289	$319	$352	$389
High Case	$289	$387	$470	$519

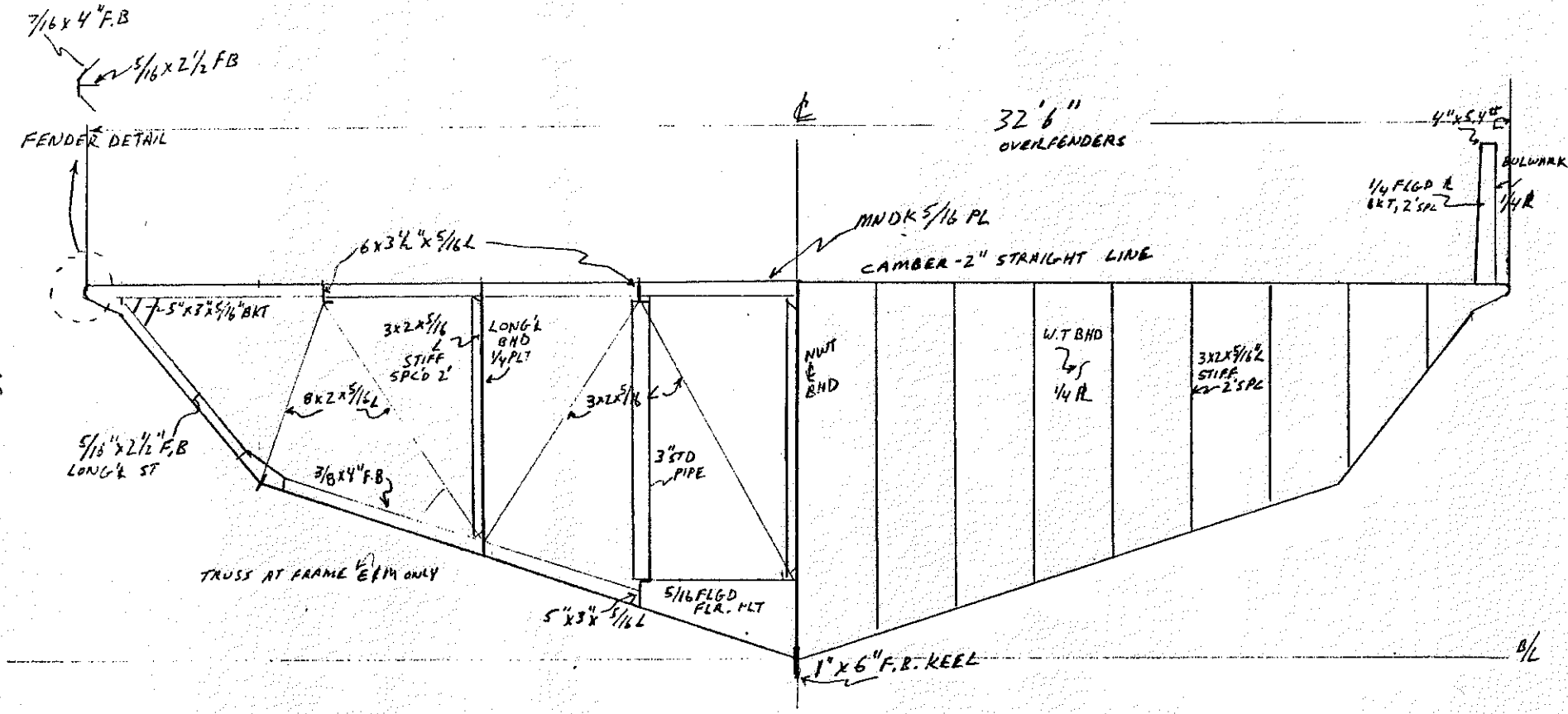
These estimates have been determined using vehicles carried as the independent variable and assuming future passengers/vehicle carried and revenue/vehicle carried to approximate those experi-

enced in 1985 (2.4 and $3.10 respectively).

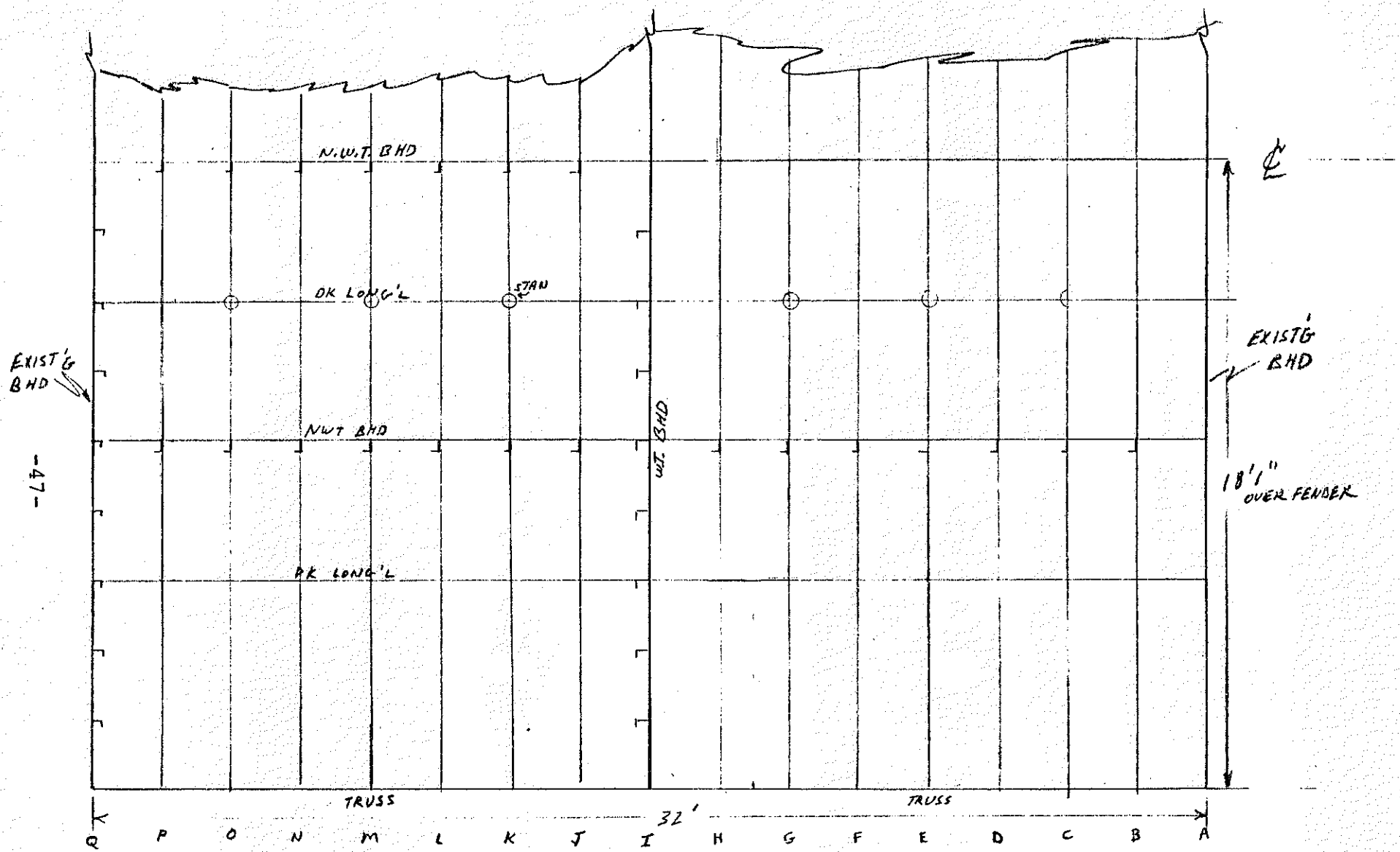
Attachments

APPENDIX C

MIDSHIP SECTION WEIGHT ESTIMATE



MIDSHIP SECTION FOR PROPOSED STRETCH
DRUMMOND ISLANDER II
DWG. FOR REF. ONLY, SCALE 1/4" = 1'
JOHN JESSUP, UMTRI, 7/21/86



PLAN VIEW of 32' PROPOSED STRETCH
DRUMMOND ISLANDER II
DWG FOR REF ONLY, SCALE 1/4"=1'
JOHN JESSUP, UMTRI

	A	B	C	D	E	F	G
1	Transportation Research Institute				Drummond Islander II		
2	Marine Systems Division				Weight estimate for 16ft midship section		
3	John Jessup				21-Jul-86		
4							
5	Longitudinal Members		Weight. (lbs)				
6	1	Deck Plating	8813	3/8" PLTG			
7	2	Keel	326	1"x6" FB			
8	3	Hull Plating	10037	3/8 PLTG			
9	4	Chine F.B.	109	1/2 x 4" FB			
10	5	Fender Face	274	4"x3/16" FB & 2"x 5/16 FB.			
11	6	NWT Long. bhd	2122	1/4" PLT			
12	7	Mn Dk long Stiff	624	6 x 3 1/2 x 5/16 L			
13	8	Floor Long. Stiff	263	5"x3"x5/16 L			
14	9	Ctr line Bhd	1347	1/4 PLT			
15	10	Long Stgr. Intercstl	85	2 1/2 x 5/16 FB.			
16							
17	Transverse Members						
18	11	Flng Plt, Floor	714	5/16" PLT			
19	12	F.B. Framing	2261	4" F.B.			
20	13	Chine & fender Bkts	214	3/8" PLT.			
21	14	Bhd Stiff					
22		a. NWT long Bhd	403	5/16 L			
23		b. Ctr line Bhd	236	5/16 L			
24		c. Trns Wt bhd	470	5/16 L			
25	15	Wt. Bhd	2081	1/4 PLT			
26	16	Pipe Stantions	324	3" Pipe			
27	17	Truss frame	534	5/16 x 8x2" L			
28	18	Bulwark					
29		a. Channel	173	4"x5.4# C			
30		b. Bulwark pltg	852	3/16 PLT.			
31		c. Brkt	454	1/4 PLT.			
32							
33		Total	32716	lbs - 16 ft section			

for 32' section - double wt & subtract for WT. BHD

TOTAL WT FOR WT BHD = 2081 lbs + 450 = 2531
BHD STIFF

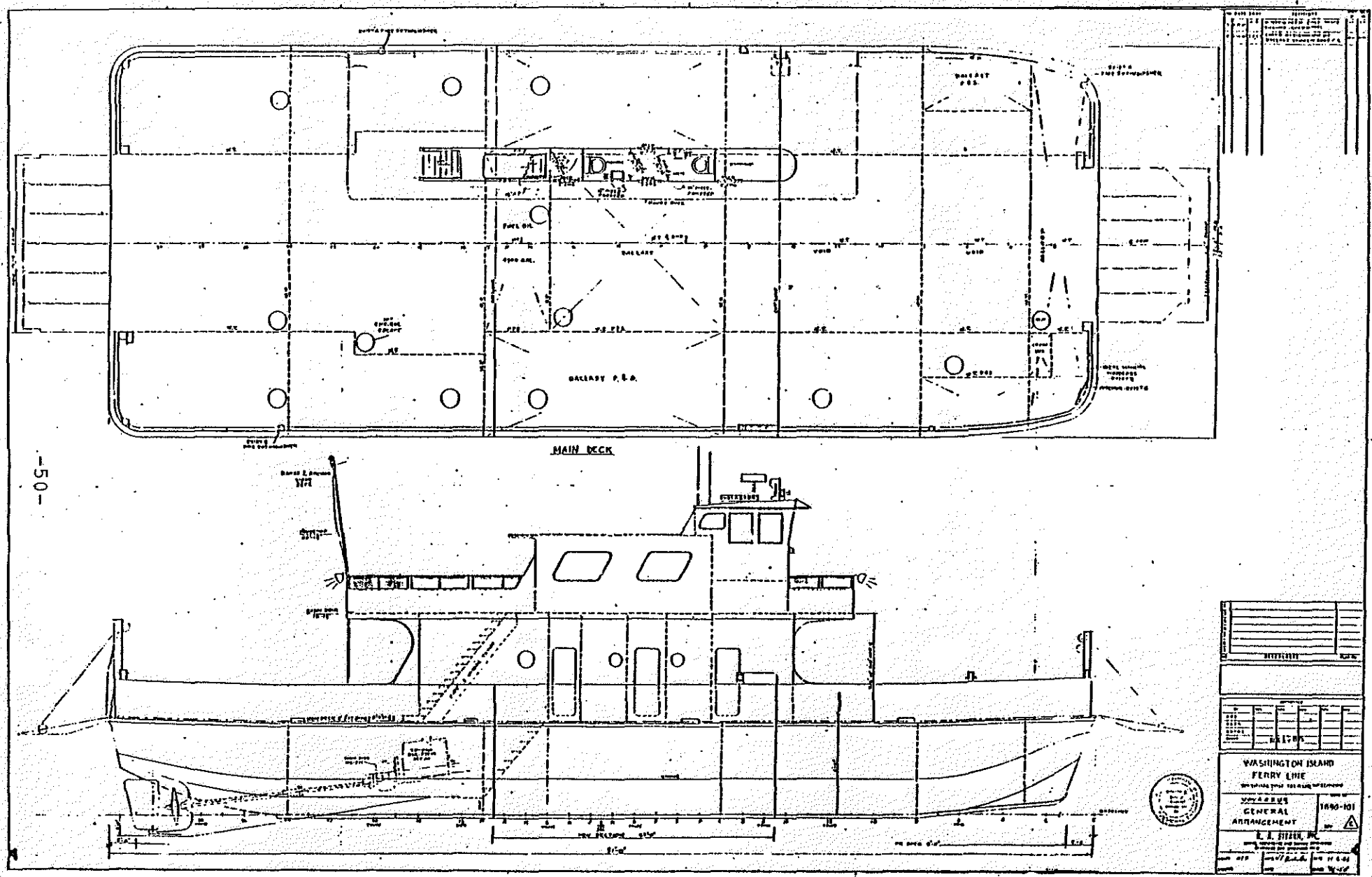
(2 x 32716 lbs) - 2531 = 62901 lbs

Add 20% for STRAPPING & NEW FUEL TANKS
62901 x 1.2 = 75481

Estimated wt of 32 ft section = 75,500 lbs.

APPENDIX D

SISTER SHIP "VOYAGEUR" PROPOSED MODIFICATIONS



SISTER SHIP "VOYAGEUR"

PROPOSED LENGTHENING & CABIN MODIFICATION 1985

APPENDIX E

CALCULATIONS OF FERRY OPERATING COSTS

APPENDIX E
Calculations Operating Cost

Outlined below are the steps and assumptions that were made in calculating the daily operating costs of the ferry. Following this outline is a the base spread sheet showing formulas. The spread sheet for each ferry under study is then included in this appendix.

The daily operating costs were then summarized and applied to the operating scenerio for the present operation and for each alternative i.e. The number of days per month ferry is operating. The summary sheet with values follows the individual ferry analysis and is also contained in the main body of the report as Figure 12.0.

I. Capital Expenditure.

A. Straight line depreciation payment schedule over a 20 year period at an annual percentage rate of 8 %.

B. Construction Engineering Costs
   1. For new vessels, 6% of the estimated new vessel construction.
   2. For modification of existing vessel, 25% of modification.

II. Operating Costs

C. Wages
   1. Present EUPTA wage scale was used with 31% fringe benefits. The highest 1986 wage for each class of crew was used.
      a. Master $11.55/hr
      b. Dk. hand $9.92/hr

D. Fuel Costs - Main Engines
   1. Fuel Rate based on Shaft Horse Power (shp)
      a. Rate in gallons/hr =
         shp (.38#fuel/shp/hr)/7.25#fuel/gallon
   2. Determination of daily fuel usage.
      a. Underway Power Useage
         (1). For new vessels a one way crossing time of 15 minutes was assumed with 30% of that time running at full power, 15% of that time running at half power and 55% of that time running at idle.
         (2). For existing vessels a one way crossing time of 20 minutes was assumed with 40% of that time running at full power, 10% of that time running at half power and 50% of that time running at idle.
      b. Determination of running time.
         (1) The number of trips for the summer and winter shedules was applied to the round trip crossing time. For the summer schedule running time was divided into peak and off peak hours.

E. Fuel Costs - Auxiliaries
   1. Rate in gallons/hr =
      KW power*(1.341 hp/kw)*(.4#fuel/shp/hr)*24 hr.

F. Other costs

1. Lube oil and supplies -	10% of fuel cost
2. Maintenance & Repair -	2% vessel value
3. Misc. supplies -	$25 per day

II. Applying Daily Cost to Monthly Costs

A. In the summary sheet (Figure 12.0 in report), the following calcualtions were used to determine the monthly operating cost.

   1. For the primary vessel, daily operating cost was multiplied by 30.42 days for each month of operation. A winter daily operating cost was applied for the months January through March, and a summer operating cost was applied for the other months of the year.

   2. For a secondary vessel in the months of May through October the vessel was assumed to operate 20 days per month, one shift per day. This is consistent with the present peak traffic operation where the secondary vessel operates 5 days per week, Thursday - Monday.

   3. For vessels not in use, a daily idle boat cost was estimated using the insurance, maintainence, and capital expenditure payment costs multiplied by 30.42 days per month.

Formula Example

	A	B	C	D
1	**New Vessel Purchase, 20 -25 vehicle units**			////
2				////
3	Summer Schedule --		Daily Cost	////
4	Capital Cost			////
5	Const Eng Costs (6% New)	=6%*B6		////
6	New Vessel	1500000		////
7	sale D.Isle II	-250000		////
8	Principal	=B5+B6+B7		////
9	Monthly pymt to principal			////
10	(8% for 20 yrs)	=PMT(0.666667%,240,B8)		////
11	Cost /day		=B10/30	////
12				////
13	Operating Costs April 1 - Jan 1)			////
14	Wages	$/hr		////
15	Master	11.55		////
16	Crew (one)	9.92		////
17	Total Wages	=B15+B16		////
18	Fringe Benefits(31%)	=31%*B17		////
19	Total Labor Cost	=B17+B18		////
20	Daily cost (three - eight hr shifts)		=-(24*B19)	////
21				////
22	Fuel		=-G6	////
23	Lube oil & Supplies @10% fuel cost		=0.1*C22	////
24	Maintenance &Repair @1.5% vessel cost		=-1.5%*B6/365	////
25	Insurance @ 1.9% vessel cost		=-1.9%*B6/365	////
26	Other (misc. supplies)		-25	////
27				////
28	Total Daily Expenses (April 1- Jan 1)		=-(C11+C20+C22+C23+C24	////
29			+C25+C26)	///
30				////
31				////
32				////
33				////
34				////
35				////

Formula Example

	E	F	G
1	**FUEL REQUIREMENTS-- Summer Schedule**		
2			
3	Mn Engine Fuel Consumption per day (gal)		=G17+G23
4	Auxiliary Fuel Consumption per day (gal)		=F34
5	Total Fuel Consumption per day		=G3+G4
6	Fuel Cost/ day @.80/gallon		=0.8*G5
7			
8	**FUEL CALCULATIONS**		
9	Mn. Engines Shaft hp	760	
10	Rate (gallons / hr)	=F9*(0.38)/7.25	
11	shp(.38#/shp/hr)/(7.25#/gal)		
12			
13	Peak - 12 hrs/day@2r.t./hr	12	gal/12hr
14	percent running at Full power	0.3	=F13*F10*F14
15	percent running at 1/2 power	0.15	=F13*F10*0.5*F15
16	percent running at 1/10 power	0.55	=F13*F10*0.1*F16
17	Total Gallons/ 12hr @2r.t./hr		=SUM(G14:G16)
18			
19	Off Peak - 12 hrs/day@1r.t./hr	6	gal/12hr
20	percent running at Full power	0.3	=F19*F10*F20
21	percent running at 1/2 power	0.15	=F19*F10*0.5*F21
22	percent running at 1/10 power	0.55	=F19*F10*0.1*F22
23	Total Gallons/ 12hr @1r.t./hr		=SUM(G20:G22)
24			
25	Assumptions:		
26	30minutes for round trip		
27	15 minute trip running at full power 30%,		
28	1/2power 15%, and idle power 55% of the time		
29			
30	Auxiliary Power (KW)	30	
31	Horsepower	=1.341*F30	
32	# of fuel/shp/hr	0.4	
33	hrs of operation	24	
34	Gallons of fuel/day	=F31*F32/7.25*F33	
35			

	A	B	C	D	E	F	G
1	**Drummond Islander I - Year Around Operation**			////	FUEL REQUIREMENTS -- summer Schedule		
2				////			
3	SUMMER SCHEDULE		COST/DAY	////	Mn Engine Fuel Consumption per day (gal)		191
4	Capital Cost			////	Auxiliary Fuel Consumption per day (gal)		53
5	Constrtn Engrng Costs	$0		////	Total Fuel Consumption per day		245
6	New Vessel	$0		////	Fuel Cost/ day @ .80/gallon		$196
7	sale D.Isle II	$0		////			
8	Principal	$0		////	FUEL CALCULATIONS		
9	Monthly pymt to principal			////	Mn. Engines Shaft hp	365	
10	(8% for 20 yrs)	$0		////	Rate (gallons / hr)	19	
11	Cost /day		$0	////	shp(.38#/shp/hr)/(7.25#/gal)		
12	vessel value	$350,000		////			
13	Operating Costs April 1 - Jan 1)			////	Peak - 12 hrs/day-nonstop		
14	Wages	$/hr		////	hrs running	12	gal/12hr
15	Master	$12		////	percent running at Full power	40%	92
16	Crew (one)	$10		////	percent running at 1/2 power	10%	11
17	Total Wages	$21		////	percent running at 1/10 power	50%	11
18	Fringe Benefits(31%)	$7		////	Total Gallons/ 12hr nonstop		115
19	Total Labor Cost	$28		////	Off Peak - 12 hrs/day@1r.t./hr		
20	Daily cost (three - eight hr shifts)		($675)	////	hrs running	8	gal/12hr
21				////	percent running at Full power	40%	61
22	Fuel		($196)	////	percent running at 1/2 power	10%	8
23	Lube oil & Supplies @10% fuel cost		($20)	////	percent running at 1/10 power	50%	8
24	Maintenance & Repair @2% vessel value		($19)	////	Total Gallons/ 12hr @1r.t./hr		77
25	Insurance @ 2.5% vesselvalue		($24)	////			
26	Other (misc. supplies)		($25)	////	Assumptions:		
27				////	40minutes for round trip		
28	Total Daily Expenses (April 1- Jan 1)		$958	////	20 minute trip running at full pover 40%,		
29				////	1/2power 10%, and idle power 50% of the time		
30				////			
31	IDLE EXPENSES (Mntc.& Ins.)		$43	////	Auxiliary Power (KW)	30	
32				////	Horsepower	40.23	
33				////	# of fuel/shp/hr	0.4	
34				////	hrs of operation	24	
35				////	Gallons of fuel/day	53	0

	A	B	C	D	E	F	G
36	**Drummond Islander I - Year Around Operation**				FUEL REQUIREMENTS -- WINTER Schedule		
37							
38	WINTER SCHEDULE		COST/DAY		Mn Engine Fuel Consumption per day (gal)		83
39	Capital Cost				Auxiliary Fuel Consumption per day (gal)		53
40	Constrtn Engrng Costs	$0			Fuel Consumption per day		136
41	New Vessel	$0			Fuel Cost/ day @.80/gallon		$109
42	sale D.Isle II	$0					
43	Principal	$0			FUEL CALCULATIONS		
44	Monthly pymt to principal				Fuel (Mn. Engines Shaft hp)	365	
45	(8% for 20 yrs)	$0			Rate (gallons / hr)	19	
46	Cost /day		$0		shp(.38#/shp/hr)/(7.25#/gal)		
47	vessel value	$350,000					
48	Operating Costs Jan 2 - March 31)				Winter 17 hrs/day-13r.t.		
49	Wages	$/hr			hours running	9	gal/24hr
50	Master	$12			percent running at Full power	40%	66
51	Crew (one)	$10			percent running at 1/2 power	10%	8
52	Total Wages	$21			percent running at 1/10 power	50%	8
53	Fringe Benefits(31%)	$7			Total Gallons/ 24hr @1r.t./hr		83
54	Total Labor Cost	$28					
55	Daily cost (three -- eight hr shifts)		($675)		Assumptions:		
56					30minutes for round trip		
57	Fuel		($109)		20 minute trip running at full power 40%,		
58	Lube oil & Supplies @10% fuel cost		($11)		1/2power 10%, and idle power 50% of the time		
59	Maintenance &Repair @2% vessel value		($19)				
60	Insurance @ 2.5% vesselvalue		($24)		Auxiliary Power (KW)	30	
61	Other (misc. supplies)		($25)		Horsepower	40.23	
62					# of fuel/shp/hr	0.4	
63	Total Daily Expenses (Jan 2-march31)		$863		hrs of operation	24	
64					Gallons of fuel/day	53	0

	A	B	C	D	E	F	G
1	**Drummond Islander I - Aux vessel may-oct only**				FUEL REQUIREMENTS-- Summer Schedule		
2					operation only between 1000 and 1800 hrs		
3	SUMMER SCHEDULE				Mn Engine Fuel Consumption per day (gal)		77
4	Capital Cost				Auxiliary Fuel Consumption per day (gal)		53
5	Constrtn Engrng Costs	$0			Fuel Consumption per day		130
6	New Vessel	$0			Fuel Cost/ day @.80/gallon		$104
7	sale D.Isle II	$0					
8	Principal	$0			FUEL CALCULATIONS		
9	Monthly pymt to principal				Mn. Engines Shaft hp	365	
10	(8% for 20 yrs)	$0			Rate (gallons / hr)	19	
11	Cost /day		$0		shp(.38#/shp/hr)/(7.25#/gal)		
12	vessel value	$350,000					
13	Operating Costs may1 - Oct.1)				Peak - 8 hrs/day-nonstop		
14	Wages	$/hr			hrs running	8	gal/8hr
15	Master	$12			percent running at Full power	40%	61
16	Crew (one)	$10			percent running at 1/2 power	10%	8
17	Total Wages	$21			percent running at 1/10 power	50%	8
18	Fringe Benefits(31%)	$7			Total Gallons/ 8hr nonstop		77
19	Total Labor Cost	$28					
20	Daily cost (one - eight hr shift)		($225)				
21					Assumptions:		
22	Fuel		($104)		40minutes for round trip		
23	Lube oil & Supplies @10% fuel cost		($10)		20 minute trip running at full power 40%,		
24	Maintenance &Repair @2% vessel value		($19)		1/2power 10%, and idle power 50% of the time		
25	Insurance @ 2.5% vesselvalue		($24)				
26	Other (misc. supplies)		($25)		Auxiliary Power (KW)	30	
27					Horsepower	40.23	
28	Total Daily Expenses (April 1- Jan 1)		$407		# of fuel/shp/hr	0.4	
29					hrs of operation	24	
30					Gallons of fuel/day	53	0

	A	B	C	D	E	F	G
1	**M/Y Drummond Islander II -- 65'**			////	FUEL REQUIREMENTS-- Summer Schedule		
2	Fulltime Summer Schedule Operation			////			
3	Summer Schedule --		Daily Cost	////	Mn Engine Fuel Consumption per day (gal)		383
4	Capital Cost			////	Auxiliary Fuel Consumption per day (gal)		53
5	Const Eng Costs	$0		////	Total Fuel Consumption per day		436
6	New Vessel	$0		////	Fuel Cost/ day @.80/gallon		$349
7	sale D.Isle II	$0		////			
8	Principal	$0		////	FUEL CALCULATIONS		
9	Monthly pymt to principal			////	Mn. Engines Shaft hp	730	
10	(8% for 20 yrs)	$0		////	Rate (gallons / hr)	38	
11	Cost /day		$0	////	shp(.38#/shp/hr)/(7.25#/gal)		
12	Insured Vessel Value	$350,000		////			
13	Operating (Costs April 1 - Jan 1)			////	Peak - 12 hrs/day@2r.t./hr	12	gal/12hr
14	Wages	$/hr		////	percent running at Full power	40%	184
15	Master	$12		////	percent running at 1/2 power	10%	23
16	Crew (one)	$10		////	percent running at 1/10 power	50%	23
17	Total Wages	$21		////	Total Gallons/ 12hr @2r.t./hr		230
18	Fringe Benefits(31%)	$7		////			
19	Total Labor Cost	$28		////	Off Peak - 12 hrs/day@1r.t./hr	8	gal/12hr
20	Daily cost (three - eight hr shifts)		($675)	////	percent running at Full power	40%	122
21				////	percent running at 1/2 power	10%	15
22	Fuel		($349)	////	percent running at 1/10 power	50%	15
23	Lube oil & Supplies @10% fuel cost		($35)	////	Total Gallons/ 12hr @1r.t./hr		153
24	Maintenance &Repair @2% vessel value		($19)	////			
25	Insurance @ 2.5% Insured Vessel Value		($24)	////	Assumptions:		
26	Other (misc. supplies)		($25)	////	30minutes for round trip		
27				////	15 minute trip running at full power 30%,		
28	Total Daily Expenses (April 1- Jan 1)		$1,127	////	1/2power 15%, and idle power 55% of the time		
29				////			
30	IDLE EXPENSES(Mntc.&Ins)		$43	////	Auxiliary Power (KW)	30	
31				////	Horsepower	40.23	
32				////	# of fuel/shp/hr	0.4	
33				////	hrs of operation	24	
34				////	Gallons of fuel/day	53	
35				////			

	A	B	C	D	E	F	G
1	**M/V Drummond Islander II -- 97'**			////	**FUEL REQUIREMENTS-- Summer Schedule**		
2	Fulltime Summer Schedule Operation			////			
3	Summer Schedule --		Daily Cost	////	Mn Engine Fuel Consumption per day (gal)		383
4	Capital Cost			////	Auxiliary Fuel Consumption per day (gal)		53
5	Const Eng Costs (25% New	$50,000		////	Total Fuel Consumption per day		436
6	Vessel Lengthening	$200,000		////	Fuel Cost/ day @.80/gallon		$349
7	sale D.Isle II	$0		////			
8	Principal	$250,000		////	**FUEL CALCULATIONS**		
9	Monthly pymt to principal			////	Mn. Engines Shaft hp	730	
10	(8% for 20 yrs)	($2,091)		////	Rate (gallons / hr)	38	
11	Cost /day		($70)	////	shp(.38#/shp/hr)/(7.25#/gal)		
12	Insured Vessel Value	$500,000		////			
13	Operating Costs April 1 - Jan 1)			////	Peak - 12 hrs/day@2r.t./hr	12	gal/12hr
14	Wages	$/hr		////	percent running at Full power	40%	184
15	Master	$12		////	percent running at 1/2 power	10%	23
16	Crew (one)	$10		////	percent running at 1/10 power	50%	23
17	Total Wages	$21		////	Total Gallons/ 12hr @2r.t./hr		230
18	Fringe Benefits(31%)	$7		////			
19	Total Labor Cost	$28		////	Off Peak - 12 hrs/day@1r.t./hr	8	gal/12hr
20	Daily cost (three - eight hr shifts)		($675)	////	percent running at Full power	40%	122
21				////	percent running at 1/2 power	10%	15
22	Fuel		($349)	////	percent running at 1/10 power	50%	15
23	Lube oil & Supplies @10% fuel cost		($35)	////	Total Gallons/ 12hr @1r.t./hr		153
24	Maintenance &Repair @2% vessel value		($27)	////			
25	Insurance @ 2.5% Insured Vessel Value		($34)	////	Assumptions:		
26	Other (misc. supplies)		($25)	////	30minutes for round trip		
27				////	15 minute trip running at full power 30%,		
28	Total Daily Expenses (April 1- Jan 1)		$1,215	////	1/2power 15%, and idle power 55% of the time		
29				////			
30				////	Auxiliary Power (KW)	30	
31	IDLE EXPENSES (Mntc., Ins. & pmt)		$131	////	Horsepower	40.23	
32				////	# of fuel/shp/hr	0.4	
33				////	hrs of operation	24	
34				////	Gallons of fuel/day	53	
35				////			

	A	B	C	D	E	F	G
1	**New Vessel Purchase, 20 -25 vehicle units**			////	**FUEL REQUIREMENTS-- Summer Schedule**		
2				////			
3	Summer Schedule --		Daily Cost	////	Mn Engine Fuel Consumption per day (gal)		308
4	Capital Cost			////	Auxiliary Fuel Consumption per day (gal)		53
5	Const Eng Costs (6% New)	$90,000		////	Total Fuel Consumption per day		362
6	New Vessel	$1,500,000		////	Fuel Cost/ day @.80/gallon		$289
7	sale D.Isle II	($250,000)		////			
8	Principal	$1,340,000		////	**FUEL CALCULATIONS**		
9	Monthly pymt to principal			////	Mn. Engines Shaft hp	760	
10	(8% for 20 yrs)	($11,208)		////	Rate (gallons / hr)	40	
11	Cost /day		($374)	////	shp(.38#/shp/hr)/(7.25#/gal)		
12				////			
13	Operating Costs April 1 - Jan 1)			////	Peak - 12 hrs/day@2r.t./hr	12	gal/12hr
14	Wages	$/hr		////	percent running at Full power	30%	143
15	Master	$12		////	percent running at 1/2 power	15%	36
16	Crew (one)	$10		////	percent running at 1/10 power	55%	26
17	Total Wages	$21		////	Total Gallons/ 12hr @2r.t./hr		206
18	Fringe Benefits(31%)	$7		////			
19	Total Labor Cost	$28		////	Off Peak - 12 hrs/day@1r.t./hr	6	gal/12hr
20	Daily cost (three - eight hr shifts)		($675)	////	percent running at Full power	30%	72
21				////	percent running at 1/2 power	15%	18
22	Fuel		($289)	////	percent running at 1/10 power	55%	13
23	Lube oil & Supplies @10% fuel cost		($29)	////	Total Gallons/ 12hr @1r.t./hr		103
24	Maintenance &Repair @1.5% vessel cost		($62)	////			
25	Insurance @ 1.9% vessel cost		($78)	////	Assumptions:		
26	Other (misc. supplies)		($25)	////	30minutes for round trip		
27				////	15 minute trip running at full power 30%,		
28	Total Daily Expenses (April 1- Jan 1)		$1,532	////	1/2power 15%, and idle power 55% of the time		
29				////			
30				////	Auxiliary Power (KW)	30	
31				////	Horsepower	40.23	
32				////	# of fuel/shp/hr	0.4	
33				////	hrs of operation	24	
34				////	Gallons of fuel/day	53	
35				////			

	A	B	C	D	E	F	G
36	**New Yessel Purchase, 20 -25 vehicle units**			////	**FUEL REQUIREMENTS-- Winter Schedule**		
37				////			
38	WINTER SCHEDULE		Cost/Day	////	Mn Engine Fuel Consumption per day (gal)		111
39	Capital Cost			////	Auxiliary Fuel Consumption per day (gal)		53
40	Constrtn Engrng Costs	$90,000		////	Fuel Consumption per day		165
41	New Yessel	$1,500,000		////	Fuel Cost/ day @.80/gallon		$132
42	sale D.Isle II	($250,000)		////			
43	Principal	$1,340,000		////	**FUEL CALCULATIONS**		
44	Monthly pymt to principal			////	Mn. Engines Shaft hp	760	
45	(8% for 20 yrs)	($11,208)		////	Rate (gallons / hr)	40	
46	Cost /day		($374)	////	shp(.38#/shp/hr)/(7.25#/gal)		
47				////			
48	Operating Costs(Jan 2 - March 31)			////			
49	Wages	$/hr		////	Winter 17hrs/day--13r.t./hr	6.5	gal/24hr
50	Master	$12		////	percent running at Full power	30%	78
51	Crew (one)	$10		////	percent running at 1/2 power	15%	19
52	Total Wages	$21		////	percent running at 1/10 power	55%	14
53	Fringe Benefits(30%)	$7		////	Total Gallons/ 12hr @1r.t./hr		111
54	Total Labor Cost	$28		////			
55	Daily cost (three - eight hr shifts)		($675)	////	Assumptions:		
56				////	30minutes for round trip		
57	Fuel		($132)	////	15 minute trip running at full power 30%,		
58	Lube oil & Supplies @10% fuel cost		($13)	////	1/2power 15%, and idle power 55% of the time		
59	Maintenance &Repair @1.5% vessel cost		($62)	////			
60	Insurance @ 1.9% vessel cost		($78)	////	Auxiliary Power (KW)	30	
61	Other (misc. supplies)		($25)	////	Horsepower	40.23	
62				////	# of fuel/shp/hr	0.4	
63	Total Daily Expenses (Jan 2 - mar 31)		$1,358	////	hrs of operation	24	
64				////	Gallons of fuel/day	53	
65				////			
66				////			
67				////			
68				////			
69				////			
70				////			

New vessel 3.5 m

	A	B	C	D	E	F	G
1	**New Yessel Purchase, 35-45 vehicle units**			////	**FUEL REQUIREMENTS-- Summer Schedule**		
2				////			
3	Summer Schedule --		Daily Cost	////	Mn Engine Fuel Consumption per day (gal)		568
4	Capital Cost			////	Auxiliary Fuel Consumption per day (gal)		107
5	Const Eng Costs (5% New)	$175,000		////	Total Fuel Consumption per day		674
6	New Yessel	$3,500,000		////	Fuel Cost/ day @.80/gallon		$540
7	sale D.Isle II	($250,000)		////			
8	Principal	$3,425,000		////	**FUEL CALCULATIONS**		
9	Monthly pymt to principal			////	Mn. Engines Shaft hp	1400	
10	(8% for 20 yrs)	($28,648)		////	Rate (gallons / hr)	73	
11	Cost /day		($955)	////	shp(.38#/shp/hr)/(7.25#/gal)		
12				////			
13	Operating Costs April 1 - Jan 1)			////	Peak - 12 hrs/day@2r.t./hr	12	gal/12hr
14	Wages	$/hr		////	percent running at Full power	30%	264
15	Master	$12		////	percent running at 1/2 power	15%	66
16	Crew (two)	$20		////	percent running at 1/10 power	55%	48
17	Total Wages	$31		////	Total Gallons/ 12hr @2r.t./hr		379
18	Fringe Benefits(31%)	$10		////			
19	Total Labor Cost	$41		////	Off Peak - 12 hrs/day@1r.t./hr	6	gal/12hr
20	Daily cost (three - eight hr shifts)		($987)	////	percent running at Full power	30%	132
21				////	percent running at 1/2 power	15%	33
22	Fuel		($540)	////	percent running at 1/10 power	55%	24
23	Lube oil & Supplies @10% fuel cost		($54)	////	Total Gallons/ 12hr @1r.t./hr		189
24	Maintenance &Repair @1.5% vessel cost		($144)	////			
25	Insurance @ 1.9% vessel cost		($182)	////	Assumptions:		
26	Other (misc. supplies)		($25)	////	30minutes for round trip		
27				////	15 minute trip running at full power 30%,		
28	Total Daily Expenses (April 1- Jan 1)		$2,886	////	1/2power 15%, and idle power 55% of the time		
29				////			
30				////	Auxiliary Power (KW)	60	
31				////	Horsepower	80.46	
32				////	# of fuel/shp/hr	0.4	
33				////	hrs of operation	24	
34				////	Gallons of fuel/day	107	
35				////			

	A	B	C	D	E	F	G
36	**New Vessel Purchase, 35-45 vehicle units**			////	**FUEL REQUIREMENTS-- Winter Schedule**		
37				////			
38	WINTER SCHEDULE		Cost/Day	////	Mn Engine Fuel Consumption per day (gal)		205
39	Capital Cost			////	Auxiliary Fuel Consumption per day (gal)		107
40	Constrtn Engrng Costs	$175,000		////	Fuel Consumption per day		312
41	New Vessel	$3,500,000		////	Fuel Cost/ day @.80/gallon		$249
42	sale D.Isle II	($250,000)		////			
43	Principal	$3,425,000		////	**FUEL CALCULATIONS**		
44	Monthly pymt to principal			////	Mn. Engines Shaft hp	1400	
45	(8% for 20 yrs)	($28,648)		////	Rate (gallons / hr)	73	
46	Cost /day		($955)	////	shp(.38#/shp/hr)/(7.25#/gal)		
47				////			
48	Operating Costs(Jan 2 - March 31)			////			
49	Wages	$/hr		////	Winter 17hrs/day--13r.t./hr	6.5	gal/24hr
50	Master	$12		////	percent running at Full power	30%	143
51	Crew (one)	$10		////	percent running at 1/2 power	15%	36
52	Total Wages	$21		////	percent running at 1/10 power	55%	26
53	Fringe Benefits(30%)	$7		////	Total Gallons/ 12hr @1r.t./hr		205
54	Total Labor Cost	$28		////			
55	Daily cost (three - eight hr shifts)		($675)	////	Assumptions:		
56				////	30minutes for round trip		
57	Fuel		($249)	////	15 minute trip running at full power 30%,		
58	Lube oil & Supplies @10% fuel cost		($25)	////	1/2power 15%, and idle power 55% of the time		
59	Maintenance &Repair @1.5% vessel cost		($144)	////			
60	Insurance @ 1.9% vessel cost		($182)	////	Auxiliary Power (KW)	60	
61	Other (misc. supplies)		($25)	////	Horsepower	80.46	
62				////	# of fuel/shp/hr	0.4	
63	Total Daily Expenses (Jan 2 - mar 31)		$2,255	////	hrs of operation	24	
64				////	Gallons of fuel/day	107	
65				////			
66				////			
67				////			
68				////			
69				////			
70				////			

Summary work Sheet

	A	B	C	D	E	F	G	H	I
1	**Present Operation**		--"Drummond Islander I" Full time until May,						
2			then 5days/week until end of October.						
3		Total Yearly Expense	Jan	Feb	Mar	Apr	May	Jun	Jul
4	Drummond Islander I	$215,106	$26,252	$26,252	$26,252	$29,154	$8,148	$8,148	$8,148
5	Drummond Islander II	$213,531	$1,313	$1,313	$1,313	$1,313	$34,276	$34,276	$34,276
6	Total Cost	$428,636	$27,565	$27,565	$27,565	$30,467	$42,423	$42,423	$42,423
7									
8									
9	**Alternative A**		-- Replace "Drummond Isander II" with new 20 - 25unit vessel,						
10			run Drummond Islander I as summer relief.						
11		Total Yearly Expense	Jan	Feb	Mar	Apr	May	Jun	Jul
12	new vessel 1.5m	$543,258	$41,317	$41,317	$41,317	$46,590	$46,590	$46,590	$46,590
13	Dmd Isle I, Aux vessel	$56,761	$1,313	$1,313	$1,313	$1,313	$8,148	$8,148	$8,148
14	Total Cost	$600,019	$42,629	$42,629	$42,629	$47,902	$54,737	$54,737	$54,737
15									
16	**Alternative B**		--Lengthen "Drummond Islander II" to 97ft.,						
17			Run Drummond Islander I in winter and as summer relief boat.						
18		Total Yearly Expense	Jan	Feb	Mar	Apr	May	Jun	Jul
19	Drummond Islander I	$215,106	$26,252	$26,252	$26,252	$29,154	$8,148	$8,148	$8,148
20	Drmnd Isle II (97')	$245,726	$3,996	$3,996	$3,996	$3,996	$36,959	$36,959	$36,959
21	Total Cost	$460,832	$30,248	$30,248	$30,248	$33,150	$45,106	$45,106	$45,106
22									
23		Total Yearly Expense	Jan	Feb	Mar	Apr	May	Jun	Jul
24									
25			New vessel handles all traffic (35-45 vehicles),						
26	**Alternative C**		Drummond Islander I is idle but maintained for backup.						
27	new vessel 3.5 m	$996,056	$68,604	$68,604	$68,604	$87,805	$87,805	$87,805	$87,805
28	Drummond Islander I	$15,752	$1,313	$1,313	$1,313	$1,313	$1,313	$1,313	$1,313
29		$1,011,808	$69,916	$69,916	$69,916	$89,118	$89,118	$89,118	$89,118
30	**DATA**								
31		Cost/Day	Cost/Day	Cost/Day					
32		Full Time Summer	Smmr Rlf	Winter	Idle				
33	Drummond Islander I	$958	$407	$863	$43				
34	Drmnd Isle II (65')	$1,127			$43				
35	new vessel 1.5m	$1,532		$1,358					
36	Drmnd Isle II (97')	$1,215			$131				
37	new vessel 3.5 m	$2,886		$2,255					

Summary work Sheet

	J	K	L	M	N	O
1						Totals Check
2						
3	Aug	Sep	Oct	Nov	Dec	
4	$8,148	$8,148	$8,148	$29,154	$29,154	
5	$34,276	$34,276	$34,276	$1,313	$1,313	
6	$42,423	$42,423	$42,423	$30,467	$30,467	$428,636
7						
8						
9						
10						
11	Aug	Sep	Oct	Nov	Dec	
12	$46,590	$46,590	$46,590	$46,590	$46,590	
13	$8,148	$8,148	$8,148	$1,313	$1,313	
14	$54,737	$54,737	$54,737	$47,902	$47,902	$600,019
15						
16						
17						
18	Aug	Sep	Oct	Nov	Dec	
19	$8,148	$8,148	$8,148	$29,154	$29,154	
20	$36,959	$36,959	$36,959	$3,996	$3,996	
21	$45,106	$45,106	$45,106	$33,150	$33,150	$460,832
22						
23	Aug	Sep	Oct	Nov	Dec	
24						
25						
26						
27	$87,805	$87,805	$87,805	$87,805	$87,805	
28	$1,313	$1,313	$1,313	$1,313	$1,313	
29	$89,118	$89,118	$89,118	$89,118	$89,118	$1,011,808
30						
31						
32						
33						
34						
35						
36						
37						

APPENDIX F

LISTING OF LOCAL FERRY OPERATORS FOR EXPOSURE OF POSSIBLE SALE

Listing of Addresses for Notification of Sale of Ferry

Ferry Operators

Arnold Transit Co.
P.O. Box 220
Mackinac Island, MI 49757

Beaver Island Co.
P.O. Box 148
St. James, MI 49728

Champion's Auto Ferry
3647 Pt. Tremble Rd.
Algonac, MI

Grand Portage & Isle royale Trans.
366 Lake Ave. South
Duluth, MN 55802

Mackinac Island Passenger Service
590 N. State St
St. Ignace, MI 49781

Madeline Island Ferry Line
Box 66
La Point, WI 54850

Manitou Island Transit
Leland, MI 49654

Miller Boat Line
Put-in-Bay, OH 43456

Neuman Boat Line
101 East Shoreline Dr.
Sandusky, OH 44870

Parker Boat Line
Put-in-Bay, OH 43456

Shepler's, Inc
Mackinaw City, MI 49701

Washington Island Ferry Line
Washington Island, WI 54246

National Association of Passenger Vessel Owners
P.O. Box 44186
Ft. Washington, MD 20744

Trade Magazines

"Marine Engineering Log"
ME/LOG Classified
345 Hudson Street
New York, N.Y. 10014

"Maritime Reporter"
118 East 25th Street
New York, NY 10010

"The Waterways Journal"
666 Security BLDG.
319 N. Fourth St.
St. Louis, MO. 63102