



## **I Background and History of RIPTA's Water Ferry Service**

RIPTA's Providence to Newport water ferry service was introduced on June 27, 2000. The ferry service is a demonstration project made possible by funding from the Congestion Mitigation and Air Quality Improvement Program (CMAQ) administered by the Federal Highway Administration and in conjunction with the Rhode Island Department of Transportation.

### **PROJECT GOALS**

The primary goal of the Providence to Newport ferry service is to reduce vehicle traffic congestion on Rhode Island roads and reduce vehicle pollution to improve air quality.

This project was also designed to:

- § Demonstrate the overall feasibility and potential of utilizing the State of Rhode Island's waterways as a practicable alternative mode of surface transportation
- § Provide RIPTA and other key decision makers within the State of Rhode Island with data necessary to make informed long-term decisions on the potential viability of water transportation in Rhode Island
- § Identify markets and opportunities where water transportation will and will not flourish and the obstacles to water transportation success
- § Develop recommendations for enhancing the long term success of this water ferry service project

The water demonstration project was publicly solicited on October 18, 1999 and the firm of Boston Harbor Cruises (BHC) of Boston, Massachusetts was selected to operate the water ferry service.

In the fall of 2002, RIPTA issued a new Request for Proposals for water ferry service and the Boston-based New England Fast Ferries LLC was selected to replace BHC as the operator of the service, starting with the 2003 ferry season, which began on May 1<sup>st</sup>.

At the start of the 2006 season, RIPTA expanded its water ferry project goals to include the evaluation of three different fuels—biodiesel, regular diesel and ultra low sulfur—in order to assess their impact on air quality and the vessel’s performance. Each fuel alternative is being tested for a single season. Regular diesel was tested in 2006, ultra low sulfur was tested this season, and biodiesel will be tested in 2008. Each season the pollutant outputs are sampled and engine/vehicle performance evaluated. This evaluation and analysis of water transportation fuel alternatives is being conducted on RIPTA’s behalf by a chemical engineer from the RI Center for Pollution Prevention at the University of Rhode Island.

### **RIPTA FERRY SERVICE HISTORY 2000-2006**

Launched initially as a year round service, RIPTA’s Providence to Newport ferry, operated by Boston Harbor Cruises, serviced Newport’s Perrotti Park, the Portsmouth Marine Terminal, and Providence’s Point Street Landing in its first year of operation. The ferry provided four roundtrips per day to and from Newport and one commuter trip each day to and from Portsmouth seven days a week.

The M/V *Anna*, a 17-year-old aluminum mono-hull vessel with a capacity of 149 passengers and a top speed of 20 knots was used for the service. The speed limitations of the *Anna* combined with speed restrictions in Newport Harbor resulted in a 75 to 80 minute trip time from Newport to Providence and a 45 minute ride from Portsmouth to Providence.

In December 2000, upon approval from the Public Utilities Commission (PUC), Portsmouth was discontinued as a stop because of very low ridership.

Between the launch date of June 26, 2000 and May 28, 2001, 40,276 people rode the ferry, exceeding the goal of 40,000 passengers for the first year of service. However, because of

minimal passenger traffic in the “off-season” and heavy ridership in the peak tourist season (35,698 passengers from July 1 – Oct 15), RIPTA petitioned the PUC in October 2001 for permission to change to a seasonal ferry program, eliminating service from November 1 through April 30.

With approval from the PUC, RIPTA introduced a seasonal only service in 2002 operating from May 1 through October 31, a schedule that was modified in 2005 to May 16 through October 16 in order to limit the service to the fair weather period in New England. The elimination of the off-season service yielded cost savings since the monthly ferry costs are relatively fixed regardless of passenger traffic.

The ferry service began its 2003 season with an 87 passenger capacity mono-hull vessel, the *Dewitt Clinton*, which was supplied by New England Fast Ferries LLC while that company built a new catamaran to provide the service. The *Dewitt Clinton* made the trip between Providence and Newport in 70 to 75 minutes and remained in service until July 3, 2003.

On July 4, 2003, the high-speed catamaran, *Ocean State*, began serving the public. Accommodating 146 passengers and three crew members, *Ocean State* operated at 30 knots, enabling it to make the Providence to Newport trip in 45 minutes. It made five roundtrips per day Sunday through Thursday and six roundtrips per day Friday and Saturday, 30 % more trips than had been operated by the BHC. The new catamaran operated successfully through October 31, 2003, the conclusion of the ferry service’s fourth season.

The catamaran *Ocean State* provided service for the entire fifth season, which began on May 1, 2004 and ended on October 31, 2004. To accommodate passenger requests for a more leisurely ride across Narragansett Bay, the 2004 catamaran schedule was designed to provide for a trip length of one hour and five minutes instead of the previous season’s 45 minute catamaran trips. During the 2004 season, the *Ocean State* made 5 roundtrips per day Sunday through Thursday, and six roundtrips per day on Friday and Saturday, the same number of trips as it made in the

2003 season. A recorded ridership of 42,740 made the 2004 season the highest since the service's inception.

Five consecutive seasons of ferry service demonstrated that the vast majority of passengers preferred to ride the ferry when the weather was fair, i.e., from June through early September. In 2005, therefore, New England Fast Ferry and RIPTA jointly petitioned the PUC to shorten the season (previously May 1 - October 31) to May 16 through October 16. The PUC approved this petition in April 2005. In August, the PUC imposed a \$1.00 fuel surcharge on ferry ticket prices.

In 2006, RIPTA relocated its Providence ferry dock from Point Street to Conley's Wharf at Providence Piers (180 Allens Avenue), a new waterfront development on the edge of downtown. This relocation eliminated the need for the ferry to pass through the City's narrow Hurricane Barrier and also provided more parking for ferry passengers than had been available at Point Street.

In 2007 in response to a customer survey (conducted in 2006) that included trip time preferences the ferry schedule was modified. Reflecting customer preferences, ferry trips in 2007 started later in the mornings with the first ferry trip out of Providence departing at 8:30 am (instead of 7:45 am as in the past). Ferry trips also ended later at night on Saturdays, with the last trip out of Providence departing at 11:30 pm instead of 10:45 pm and the final Saturday trip departing from Newport at 1 am rather than 12:15. In addition, the late night Friday trip was eliminated to reflect customer travel patterns.

For the 2007 season, the *Ocean State* made 5 roundtrips per day Sunday through Friday, and six roundtrips per day on Saturday, one fewer trip than it made in 2006 when the Friday schedule included a late night trip.

The recorded ridership for the 2007 season, the service's sixth season was 47,002, the highest ridership in the service's eight-year history.

## **II RIPTA’s Ferry Service Operations—2007**

### **RIDERSHIP**

The total ridership for the May 16 through October 16, 2007 ferry season was 47, 002, the highest ridership in the ferry’s eight-year history.

This represents an increase of 7,451 passengers or 17.8 percent over the May 16 through October 16, 2006 ferry season when ridership was 39,551. *In 2006, the five month season averaged 7,910 passengers per month, whereas in 2007, the monthly average was 9,400, an increase of 17.8 percent.*

The monthly ridership figures for the 2007 season are as follows:

May	2,220
June	8,316
July	11,935
August	12,580
September	8,652
October	3,299

**Total Ridership for the Season                    47,002 passengers**

A chart showing the total ridership for each month during the ferry service’s 2006 season is included as Appendix A.

### **TRAFFIC MITIGATION**

With a demonstrated ridership of 47,100 passengers and applying the Travel Association of America’s factor of 1.9 persons per vehicle, it is possible to calculate the number of vehicles

(passenger cars and SUVs) that were removed from the State highways as 24,789. The 24,789 vehicles removed represents 43,194 gallons of gasoline that *were not consumed* and 928,673 miles *not driven*.

Using Environmental Protection Agency data for pollution reduction and information from the American Tourist Information Center of America, it is possible to determine the amount of pollutants that were eliminated from the atmosphere through the use of the ferry (rather than passenger vehicles) over the five months of the ferry season. The following table illustrates the amount of vehicle pollutants kept from entering the atmosphere because people chose to use the ferry rather than their personal vehicles.

<u>POLLUTANTS</u>	<u>MOTOR VEHICLE EMISSIONS</u> <u>Per 928,673 Miles</u>
Hydrocarbons	5,645 lbs.
Carbon Monoxide	42,572 lbs.
Nitrogen Oxide	2,802 lbs.
Carbon Dioxide	838,416 lbs.

SEE APPENDIX C FOR ADDITIONAL POLLUTANT REMOVAL INFORMATION

### FACILITIES AND TICKETING

The Providence/Newport ferry operates between two floating dock systems with handicapped accessible ramps at both docks. In Providence, the landing is located at Conley’s Wharf at Providence Piers at 180 Allens Avenue on the edge of downtown. The ferry dock includes an accessible ticketing office staffed 7 days a week during peak hours by New England Fast Ferries

LLC personnel. Parking is available seven (7) days a week in the parking lot at the Providence Piers dock.

In Newport, the dock is located in Perrotti Park on America's Cup Avenue, a central downtown roadway. The ticketing office at the Perrotti Park Landing is located in the Harbormaster's Building and staffed 7 days a week during peak hours by New England Fast Ferries LLC personnel. Discounted all-day parking is available at the Gateway Visitors' Center (across from the ferry dock) with a same-day ferry ticket stub.

An advance reservation system is also in operation and can be accessed with a toll-free phone call. In addition, tickets are available online at nefastferry.com. Due to the ferry's popularity, reservations are recommended in the promotional literature.

### **Trolley and Bus Connections for Ferry Passengers**

During the 2007 ferry season, RIPTA again operated trolley service between Kennedy Plaza and the Providence ferry landing, coordinating service with the ferry's departures and arrivals at its Providence dock at Conley's Wharf.

In Newport, ferry passengers were able to access RIPTA trolleys and buses at the Gateway Visitors' Center, which is located across the street from the Perrotti Park Landing.

### **2007 FERRY SCHEDULE**

For the 2007 season, the ferry schedule was modified to reflect trip time preferences expressed by customers in a survey conducted during the previous season.

In 2007, ferry trips started later in the mornings with the first ferry trip out of Providence departing at 8:30 am (instead of 7:45 am as in the past). Ferry trips also ended later at night on Saturday, with the last trip out of Providence departing at 11:30 pm instead of 10:45 pm and the final Saturday trip departing from Newport at 1 am rather than 12:15 am. In addition, the late night Friday trip was eliminated to reflect customer travel patterns.

The 2007 schedule allows for a one hour five (5) minute ride and reflects the preference first expressed by passengers in 2003. By the end of the 2003 season, they had let the crew know that a 45 minute trip was too fast, because it prevented them from enjoying the catamaran’s upper deck, which is subject to strong winds when traveling at a higher speed.

The *Ocean State* made 5 roundtrips per day Sunday through Friday, and six roundtrips per day on Saturday during the 2007 season—one fewer trip than it made in 2006 when the Friday schedule included a late night trip.

**Ferry Schedule: May 16 – October 16 2007**

**Providence to Newport**

<b>DEPART</b>	<b>ARRIVE</b>
8:30 a.m.	9:35 a.m.
11:15 a.m.	12:20 a.m.
2:00 p.m.	3:05 p.m.
5:30 p.m.	6:35 p.m.
8:30 p.m.	9:35 p.m.
11:30 p.m.* *	12:35 p.m.* *

**Newport to Providence**

<b>DEPART</b>	<b>ARRIVE</b>
9:50 a.m.	10:55 a.m.
12:40 p.m.	1:45 p.m.
4:00 p.m.	5:05 p.m.
7:00 p.m.	8:05 p.m.
10:00 p.m.	11:05 p.m.
1:00 a.m.* *	2:05 a.m.* *

**\*\* Saturday Night Only**

### **FARES FOR THE 2007 FERRY SEASON**

Fares in 2007 remained the same as in the previous season. In August of 2005, a fuel surcharge, requested and approved by the PUC, had added \$1.00 to the cost of each ferry ticket; and in 2006 a \$1.00 fare increase was approved administratively. .

	<b>One -Way</b>	<b>Round Trip</b>
<b>Adult</b>	\$8.00	\$16.00
<b>Seniors, Disabled/ ADA/ Medicare Card and Children 5-11</b>	\$6.00	\$12.00
<b>Children &lt; 5 yrs</b>	FREE	FREE



### III Passenger Survey Results

On Monday, August 6 and Tuesday, August 7, 2007, 227 surveys were collected from passengers aboard the Authority's Providence/Newport catamaran ferry. The survey was designed to measure customer satisfaction with the ferry service and also yield demographic data with regard to ridership.

Passengers were asked to rate the ferry schedule, overall ferry service, ferry ticket value and food and beverages available on the boat as either *excellent*, *good*, *fair*, or *poor*. Passengers were also asked to choose which feature of their trip they liked best from among 7 options. In addition, ferry riders were queried about their place of residence, the primary purpose of their trip; the mode of travel they used to reach the docks; their gender, age and income categories; and if they would take the Providence/Newport ferry again. Ferry passengers were also asked if they would prefer a different schedule and at what time of day they would prefer more trips.

The surveys revealed a high level of customer satisfaction with the overwhelming majority of respondents—86% or 196 people—stating they would take the ferry again. 75.7% of riders rated the overall ferry service excellent and 55.5% ranked the ferry schedule as *excellent*. 59% also rated the ferry ticket value as *excellent*.

Of the respondents, 66% identified themselves as Rhode Island residents and 27% identified themselves as from “out of state”. 44% cited “sightseeing” as their trip’s primary purpose, 19% said “entertainment”, 12% cited “business” and 15% identified their primary purpose as “other”. Regarding what riders liked best about the ferry trip, 26.6 %cited the view/beauty of Rhode Island, 20 % avoiding traffic, 17% “being on the water”, another 17 % the “comfortable ride” , 7% the price of the trip, 5% cited “convenient/easy” , and 7% checked “other” as their reason for liking the trip.

In Providence, a total of 50% of passengers said they arrived at the dock “ with a car,” another 5% were “dropped off,” 4% “took a RIPTA trolley/bus,” and no one cited having “walked”. In Newport, 39% arrived by car, 3% were “dropped off” , 3% arrived by RIPTA bus/trolley, and 12 % “walked” to the dock. (43% declined to respond to this category.)

58 % of riders were male. 15% of all respondents were under 25 years of age, 25% identified themselves as between 25 and 34 years old, 31% were in the 35 to 49 year old range, 11% between 50 and 64 years of age, and 10% identified themselves as 65 or older.

15% of passengers placed themselves in the “ \$25,000 -\$ 34,000” income group and, 28% placed themselves in the” \$35,000 – \$49,000” group, 10% identified their income as “ \$50,000 - \$74,000” , 2% selected \$75,000 - \$99,000 and 1% selected the “\$100,000 - \$149,000” range. No one checked off less than \$25,000 and 44% of the respondents preferred not to respond to this category.

In response to “Would you prefer a different schedule?”, a yes or no question, the majority of respondents—72%— answered “yes” and 27% replied no.

Passengers were also asked: “At what time of day would you prefer more trips?” 69% checked mid-day, 12% preferred morning and 11% selected “evening.

A more detailed report on the Providence/Newport Ferry Survey is included as Appendix B.

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## **IV Lessons Learned**

### **POSITIVE ASPECTS**

47,002 people rode the ferry in the five (5) month 2007 season. This ridership equals 9,400 ferry riders per month—*more than any previous season in the history of RIPTA's Providence/Newport ferry service.*

The August 2007 surveys of passengers revealed a high level of customer satisfaction with the overwhelming majority of respondents (196 out of a total of 227 respondents) stating that they would take the ferry again. The majority of riders rated the overall ferry service (76%) and ferry schedule (55.5 %) as *excellent*. 59% rated the ferry ticket value as *excellent*.

The service drew 66% of its passengers from Rhode Island residents while 27% passengers identified themselves as from out of state and 7% declined to answer.

Regarding what riders liked best about the ferry trip, the most commonly cited features were “view/beauty of Rhode Island” (27%), avoiding traffic (20%), comfortable ride (17%), “being on the water” (17%), price of the trip (7%), followed by “other” (7%) and “convenient/easy” (5%).

44% said the primary purpose of their trip was “sightseeing”, 19% specified “entertainment”, 15% said “other” and 12% cited “business” .

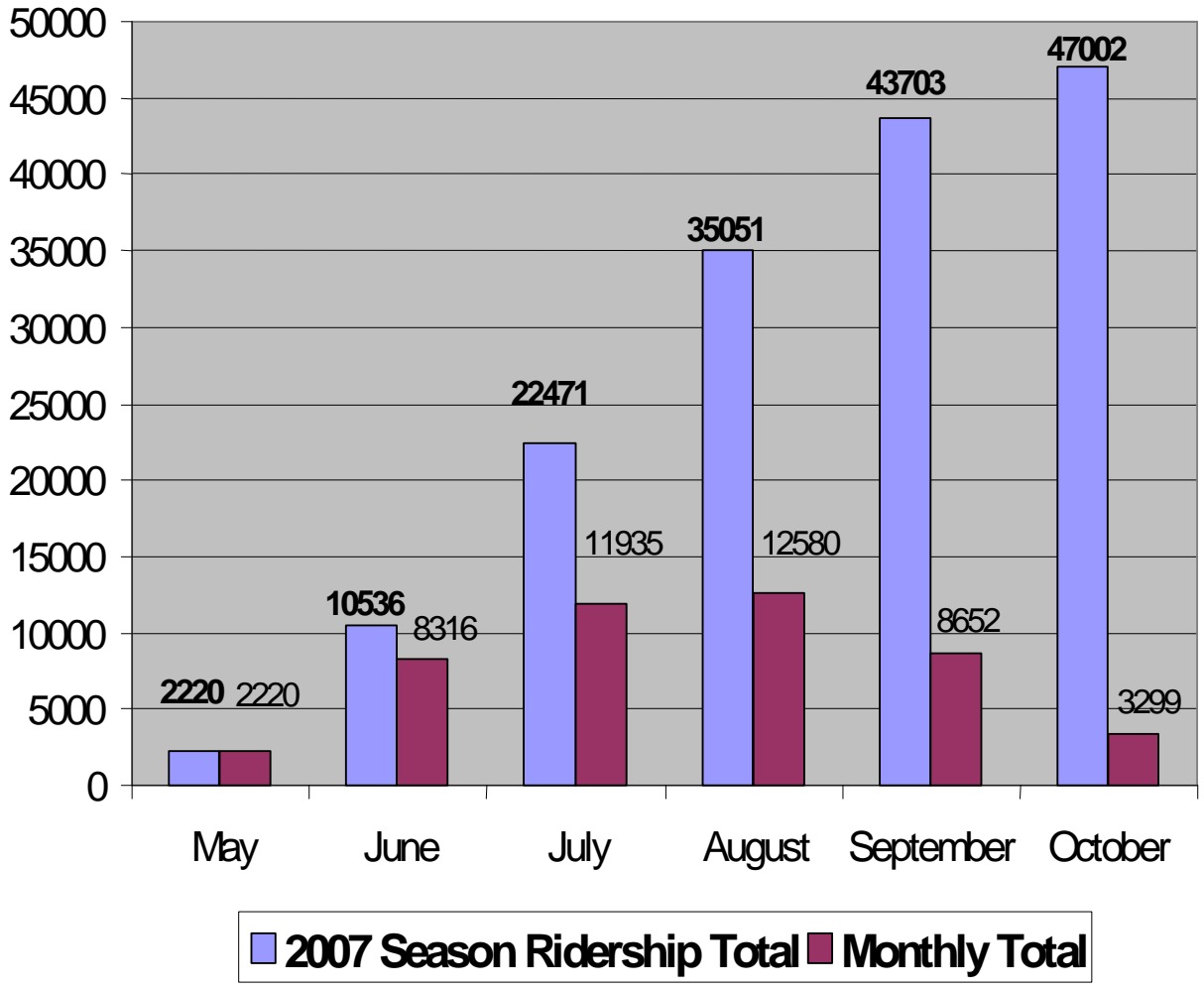
### **RIPTA Issues**

§ Lack of a back up boat in the event the vessel must be taken out of service for repair or Coast Guard inspections

## V Looking Ahead

- Unfortunately, RIPTA's Providence/Newport Ferry Service will end after its 2008 season because CMAQ program funding for the ferry, which enabled RIPTA to provide this service for almost a decade, will have expired.

### Appendix A: RIPTA Ferry Ridership May 2007 - October 2007



## Appendix B

### Providence/Newport Ferry Survey October 2007

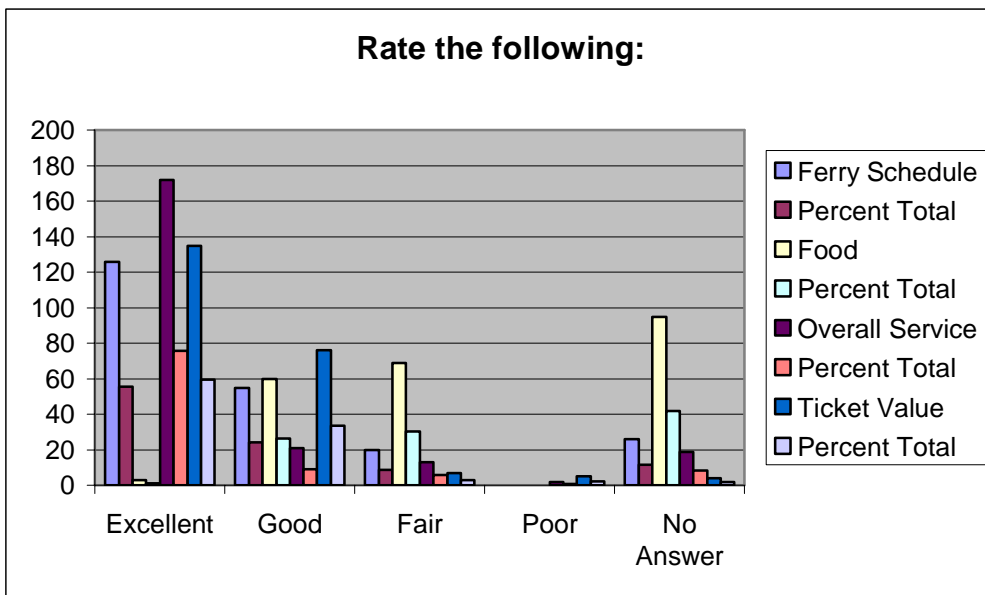
#### I. Introduction

On Monday, August 6 and Tuesday, August 7, 2007, 227 surveys were collected from passengers aboard the Authority's Providence/Newport catamaran ferry. The survey consisted of eleven (11) questions regarding rider's satisfaction with their trip, rider information such as age and income, and the ferry's trip schedule.

#### II. Data

##### Question #1

**Please rate the following:** Ferry Schedule, Food and Beverage, Overall Ferry Service and Ferry Ticket Value. Respondents were asked to rate all four categories as either "excellent," "good," "fair" or "poor."



	Schedule	Food	Service	Value
Excellent	55.51%	1.32%	75.77%	59.47%
Good	24.23%	26.43%	9.25%	33.48%
Fair	8.812%	30.40%	5.73%	3.08%1
Poor	0.00%	00.0%	0.88%	2.20%
No Answer	11.45%	41.85%	8.37%	1.76%

**Rating of Ferry Schedule:** Of the 227 respondents on this question, 56% rated the ferry schedule as “excellent,” 24% rated it as “good,” 9% felt it was “fair,” 0% thought it was “poor,” and 11% did not answer.

**Rating of Food and Beverage:** 1% rated it as “excellent,” 26% of respondents rated the food and beverage as “good,” 30% felt it was “fair,” 0% thought it was “poor,” and 42% did not answer.

**Rating of Overall Ferry Service:** 76% of respondents rated the overall ferry service as “excellent,” 9% rated it as “good,” 5% felt it was “fair,” 0% thought it was “poor,” and 8% did not answer.

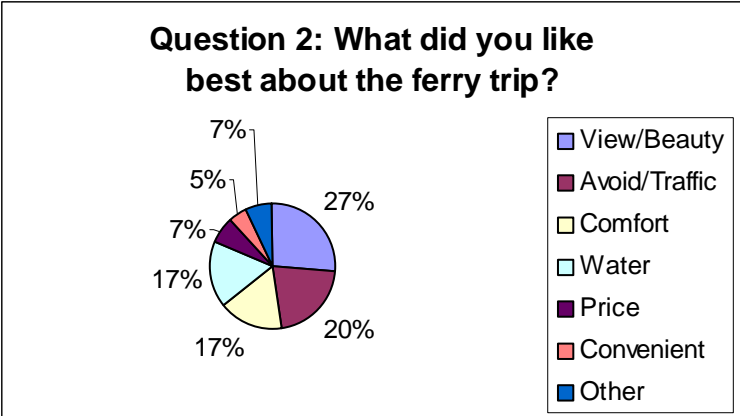
**Rating of Ferry Ticket Value:** Of the 227 answers, 59% of respondents rated the ferry ticket value as “excellent,” 33% rated it as “good,” 3% felt it was “fair,” 2% thought it was “poor,” and 2% did not answer.

## Question #2

**What did you like best about the ferry trip?** In this question, respondents were asked to choose which aspect of their trip they liked the best. Although the intention of this question was that each respondent would check off only one aspect, many respondents checked off multiple answers. The options were:

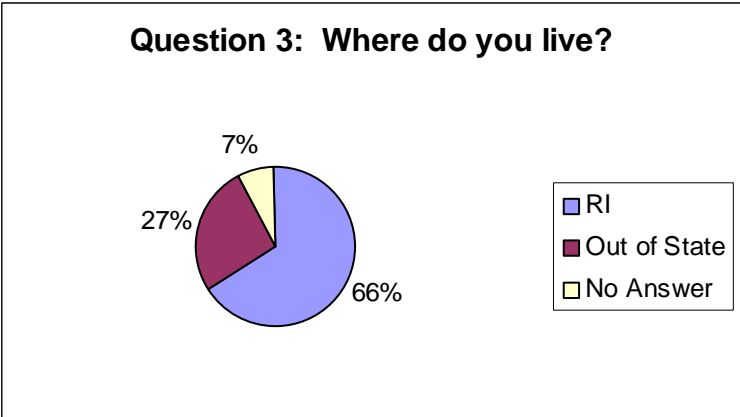
- View/Beauty of Rhode Island
- Avoiding Traffic
- Comfortable Ride
- Price of the Ferry Service Trip
- Being on the Water
- Convenient/Easy
- Other

The percentage of responses each aspect received is depicted graphically. 26.6% of the riders like the “view/beauty of Rhode Island,” 17% of the riders like the fact that they were on the water (“being on the water”), 17% of the riders thought that it was a “comfortable ride,” 20% of riders enjoyed the fact that they were “avoiding traffic,” 5% thought the ferry was “convenient/easy,” 7% of riders liked the “price of the ferry service trip,” and 7% stated “other” as their reason for liking the trip.



**Question #3**

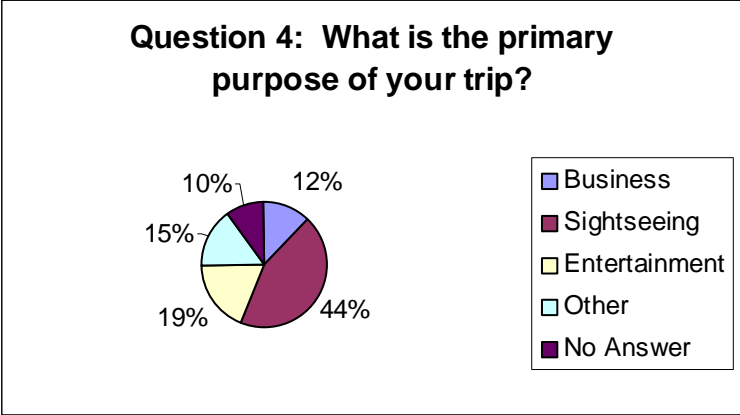
**Where do you live?** Respondents were provided with two possible answers to this question, “Rhode Island” or “Out of State.” Of the 227 respondents who provided an answer to this question, 66% were from “Rhode Island” while 27% were from “Out of State.”



**Question #4**

**What is the primary purpose of your trip today?** There were four possible answers to this question: “business,” “sightseeing,” entertainment,” and “other.” Of the 227 total responses received some respondents provided multiple answers.

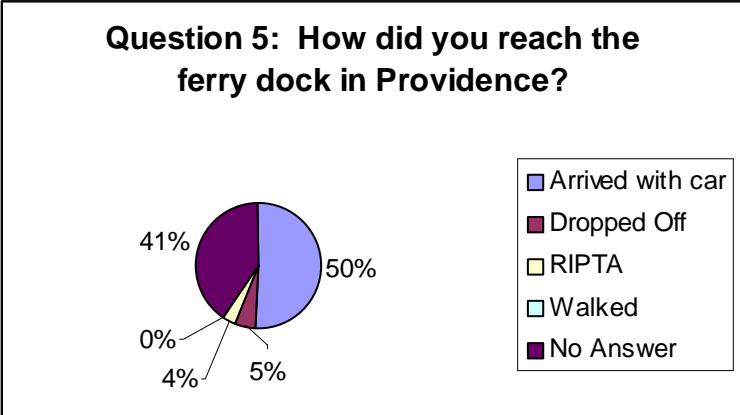
44% cited “sightseeing,” 19% “entertainment,” 15% “other” and 12% said “business.”



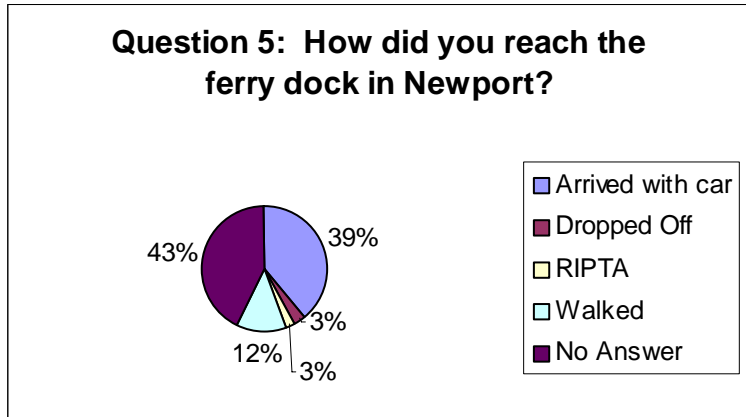
**Question #5**

**How did you reach the ferry dock?** For this question, riders were given four options for how they reached the ferry dock in both Providence and Newport. “Arrived w/car,” “dropped off,” “took RIPTA bus/trolley” and “walked” were the possible answers.

**How did your reach the ferry dock in Providence?** 50% reported that they “arrived with a car” at the ferry dock in Providence, 4% took a “RIPTA bus/trolley,” 0% of respondents reported that they “walked”, and 5.2% reported that they were “dropped off.”

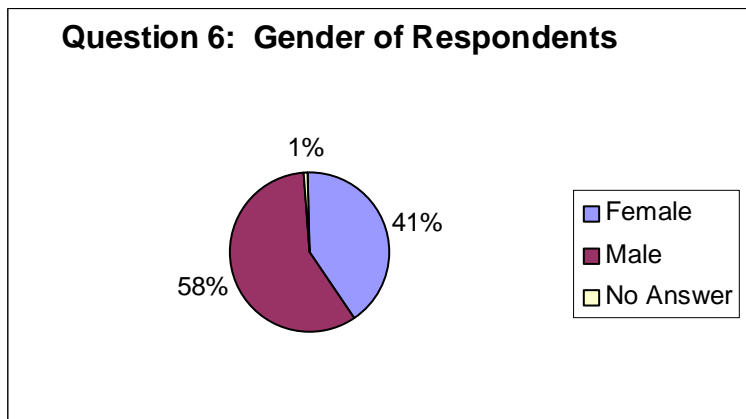


**How did you reach the ferry dock in Newport?** In Newport, 12% “walked” to the dock, 3% were ”dropped off” at the ferry, 39% of the respondents said they “arrived with a car” and 3% used a “RIPTA bus/trolley.”



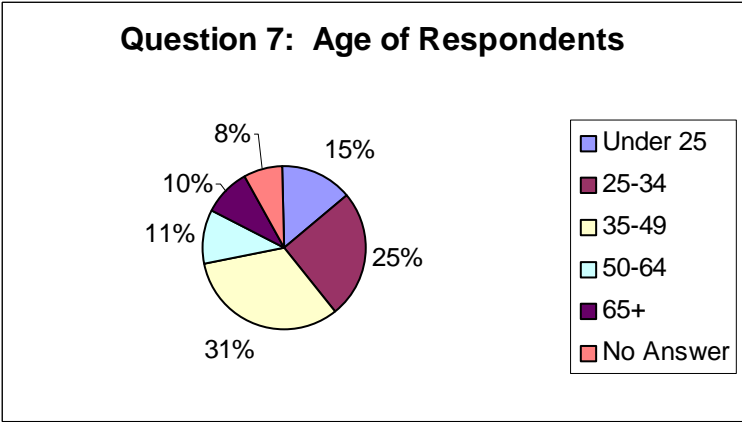
**Question #6**

**Gender of Respondents:** Out of 227 respondents, 41% stated “female” and 58% “male.”



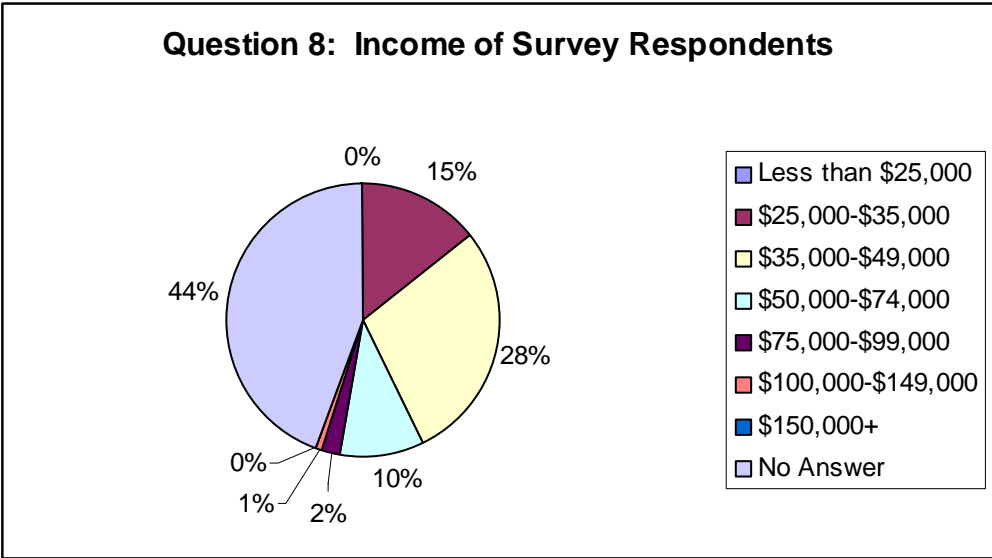
**Question #7**

**Age of Respondents:** Out of 227 respondents, 15% identified their age as “under 25”, 25% as “25-34,” 31 % as “35-49,” 11% said “50-64”, and 10% stated “65+.”



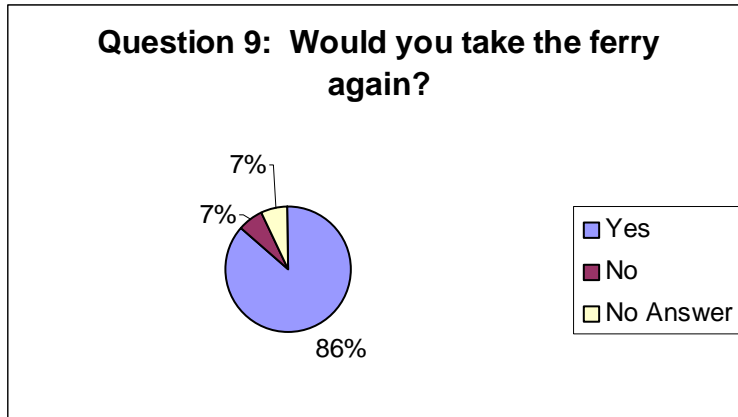
**Question #8**

**Income of Survey Respondents:** 28% of respondents identified their income as in the “\$25,000-\$49,000” range, while the next largest percentage of responses (15%) said “\$25,000-\$35,000”. Another 10% stated “\$50,000-\$74,000,” 2% identified their income category as “\$75,000-\$99,000,” 1% responded “\$100,000-\$149,000,” 0% said “\$150,000+,” 0% said “Less than \$25,000”. 44% preferred not to answer.



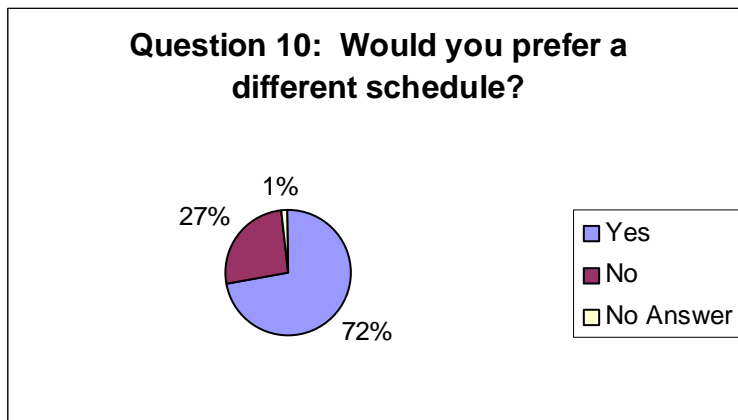
**Question #9**

**Would you take the Providence/Newport Ferry Service again?** This was a “yes” or “no” question. The overwhelming majority of respondents—86%—stated “yes” while 7% said “no.”



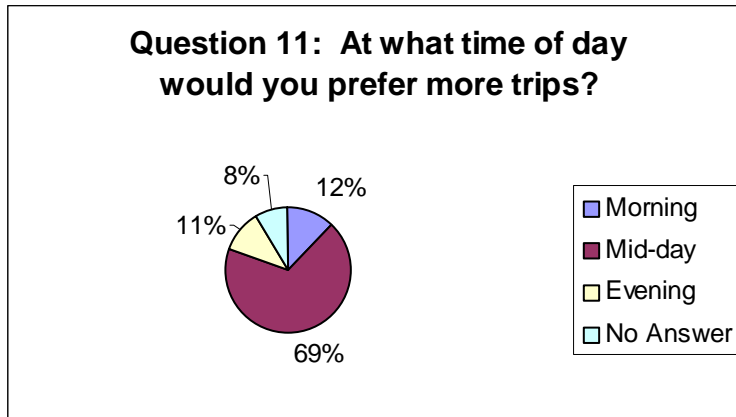
**Question # 10**

**Would you prefer a different schedule?** This was a “yes” or “no” question. The overwhelming majority of respondents—72%—stated “yes” while 27% said “no.”



### Question # 11

**At what time of day would you prefer more trips?** Riders were given three choices – Morning, Mid-day, or Evening. 12% stated they prefer morning trips, 69% prefer mid-day trips, 11% prefer evening trips.



### **III. Conclusion**

Overall, riders were very satisfied with the ferry service.

## Appendix C

### Pollutant Removal Information

#### 2007 Ferry Season

2007 Passenger Ridership:	47,002
Automobile Trips Removed From Road:	24,738 **
Automobile Miles Removed From Road:	915,302 ***
Gallon of Gasoline Not Used:	42,572 *****

#### Pollutants Eliminated

*Hydrocarbons:	5,645 lbs.
*Carbon Monoxide:	42,136 lbs.
*Nitrogen Oxides:	2,802 lbs
*Carbon Dioxide:	838,416 lbs.

\* Total pounds for 2007-ferry season (May 16, 2007 – October 16, 2007). Based upon EPA emission facts – converted from grams/mile to lbs/mile (**Appendix D**).

\*\* Based upon 1.9 passengers/vehicles

\*\*\* Based upon 37 miles/one way trip. Ferry passengers are counted by each one-way trip

\*\*\*\*\* Based upon 21.5 miles/gallon. From EPA emission facts (**Appendix D**).

## Appendix D

### Emission Facts

United States Environmental Protection Agency

Air and Radiation

[Office of Transportation and Air Quality](#)

EPA420-F-00-013

April 2000

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### Average Annual Emissions and Fuel Consumption for Passenger Cars and Light Trucks

*The figures presented in this document are averages only. Individual vehicles may differ in miles traveled and pollution emitted per mile than indicated here. Emission rates and fuel consumption totals may differ slightly from original sources due to rounding.*

### Background

The emission rates for hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NO<sub>x</sub>) shown in the following tables are from U.S. Environmental Protection Agency (EPA) highway vehicle emission factor models. They assume an average, properly maintained vehicle on the road in July 2000, operating on typical gasoline on a warm summer day (72-96 degrees F). Emissions may be higher in very hot (especially HC) or very cold (especially CO) weather.

The calculations for Total Annual Pollution Emitted and Fuel Consumed are based on an average annual passenger car mileage of 12,500 miles and an average annual light truck mileage of 14,000 miles. Fuel consumption is based on fleetwide average in-use fuel economy of 21.5 miles per gallon (mpg) for passenger cars and 17.2 mpg for light trucks, as reported in the 19th edition of the "Transportation Energy Data Book," prepared for the U.S. Department of Energy.

### Passenger Car

Component	Emission Rate and Fuel Consumption per mile (mi) <sup>1</sup>	Calculation	Total Annual Pollution Emitted and Fuel Consumed
Hydrocarbons	2.80 grams (g)	(2.80 g/mi) x (12,500 mi) x (1 lb/454 g)	77.1 pounds of hydrocarbons
Carbon Monoxide	20.9 grams	(20.9 g/mi) x (12,500 mi) x (1 lb/454g)	575 pounds of carbon monoxide
Oxides of Nitrogen	1.39 grams	(1.39 g/mi) x (12,500 mi) x (1 lb/454g)	38.2 pounds of oxides of nitrogen
Carbon Dioxide <sup>2</sup>	0.916 pound (lb)	(0.916 lb/mi) x (12,500)	11,450 pounds of carbon dioxide
Gasoline	0.0465 gallon	(0.0465 gallon/mi) x (12,500 mi)	581 gallons of gasoline

### Light Truck

Component	Emission Rate and Fuel Consumption per mile (mi) <sup>1</sup>	Calculation	Total Annual Pollution Emitted and Fuel Consumed <sup>3</sup>
Hydrocarbons	3.51 grams (g)	(3.51 g/mi) x (14,000 mi) x (1 lb/454 g)	108 pounds of hydrocarbons
Carbon Monoxide	27.7 grams	(27.7 g/mi) x (14,000 mi) x (1 lb/454g)	854 pounds of carbon monoxide
Oxides of Nitrogen	1.81 grams	(1.81 g/mi) x (14,000 mi) x (1 lb/454g)	55.8 pounds of oxides of nitrogen
Carbon Dioxide <sup>2</sup>	1.15 pounds (lb)	(1.15 lb/mi) x (14,000 mi)	16,035 pounds of carbon dioxide
Gasoline	0.0581 gallon	(.0581 gallon/mi) x (14,000 mi)	813 gallons of gasoline

Notes:

1. These emission factors and fuel consumption rates are averages for the entire in-use fleet. Newer cars and trucks will emit less pollution and use less gasoline; older cars and trucks may emit more pollution and use more gasoline.
2. Carbon dioxide, while not regulated as an emission, is the transportation sector's primary contribution to climate change. Carbon dioxide emissions are directly proportional to fuel economy--each 1% increase (decrease) in fuel consumption results in a corresponding 1% increase (decrease) in carbon dioxide emissions.
3. The total annual emissions and fuel consumption are greater for light trucks than was presented in the April 1998 version of this fact sheet. This reflects the increasing trend toward the largest, heaviest light trucks, which currently and in the past have had less stringent emission standards and lower fuel economy than do the lighter light trucks and cars. The new "Tier 2" emission standards taking effect starting with the 2004 model year will bring all light trucks into compliance with the same emission standards as cars (for HC, CO, and NOx)

## For More Information

You can access many additional documents on emissions and fuel consumption of passenger cars and light trucks electronically from the Office of Transportation and Air Quality Web site at:

<http://www.epa.gov/otaq>

You can also contact the National Vehicle and Fuel Emission Laboratory library for document information, by mail or phone at:

U.S. Environmental Protection Agency

Office of Transportation and Air Quality

NVFEL Library

2000 Traverwood Drive

Ann Arbor, MI 48105

(734) 214-4311

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