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TRANSPORTATION STRATEGIES FOR THE UNIVERSITY OF RHODE ISLAND KINGSTON CAMPUS

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TRANSPORTATION STRATEGIES FOR THE UNIVERSITY OF RHODE ISLAND KINGSTON CAMPUS

BY

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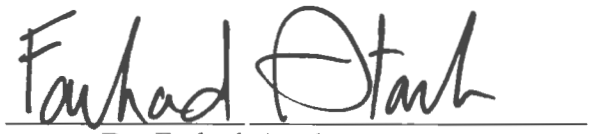
Approved:
Major Professor



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Acknowledged:
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ABSTRACT

This study examines transportation strategies that should be considered as alternatives to use of the single occupant vehicle on and around the Kingston Campus of the University of Rhode Island. It includes the results of a URI commuter survey which was conducted in the course of this research, and it analyzes the extent to which current bus transit service is meeting the needs of the URI community. It remains doubtful that any one transportation strategy will succeed in extracting commuters from their cars; but the committed implementation of a combination of strategies holds much promise in reducing the use of the single occupant vehicle at the University.

ACKNOWLEDGEMENTS

I would like to extend my thanks to a number of people that made the successful completion of this study possible: to Dr. Farhad Atash, whose open-door policy, accommodating nature, caring concern and substantive wisdom provided me with encouragement and guidance every step of the way; to Mr. Robert Shaw, for providing me with challenge and support, and for making clear to me what the literature had not; to Mr. Robert Letourneau and Mr. Thomas Conboy, for their valuable input and accommodation of my schedule; to Dr. Howard Foster, for listening and always providing me with good advice; to my family, for their patience; and to my husband, for his love and understanding.

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CHAPTER 1 - INTRODUCTION

The focus of this research project is on the transportation services and opportunities to the University of Rhode Island (URI) Kingston Campus and surrounding community. Its purpose is to serve as a general planning study and the basis for future transportation planning discussions.

The URI Kingston Campus is located in the Town of South Kingstown, thirty miles south of Providence. It is accessed by two two-lane roads: Routes 138 and 108. Route 138 serves as a principal arterial for the area's east-west transport of commercial goods, and as a connector between southern New England and Newport County. Route 108 begins at Point Judith, ends in Kingston Village, and serves as one of the area's north-south arterials.

URI is the largest employer and trip generator in Washington County (RIDOT 1993a: ii). A 1993 traffic study performed for the Rhode Island Department of Transportation (RIDOT) concluded that nearly 17,000 vehicular trips were generated into and out of the Kingston Campus each day.

The issues of weekday traffic congestion during the academic year on the road network around URI and throughout Kingston Village, and insufficient parking facilities on and around the Campus have been studied and debated by others. The focus of this study is on the potential that exists at URI to reduce the number of single occupant vehicles (SOV's) and minimize the environmental and other consequences of vehicular traffic.

Relevant issues addressed in this paper include reducing the use of SOV's on

and around the Kingston Campus, and meeting the needs of URI faculty, staff and students. A reduction in the number of SOV's will improve efficiency of traffic flow on area roadways, free up additional parking spaces, reduce energy consumption, and improve air quality to the benefit of URI, Kingston residents, and all Rhode Islanders. Measures that encourage the use of transit services and alternative modes of transportation, and discourage the use of SOV's are discussed.

Objectives of the Study

Numerous strategies have been formulated toward reducing the presence of, and the reliance on, the automobile at URI. Some include the use of incentives; some include the use of disincentives and restrictions; and some employ combinations of tactics. One solution, identified by RIDOT, is for members of the URI community to increase utilization of bus transit.

At the initiative of RIDOT and the Rhode Island Public Transit Authority (RIPTA), a two-year pilot program of expanded bus service to and from the University was begun in the Spring of 1994 in an effort to increase ridership, reduce the use of SOV's, and improve air quality in the area. This study will evaluate the level to which the increased bus service has been effective in reducing the number of SOV's on and around the Kingston Campus, and identify additional alternative transportation strategies.

The objectives of the research project are:

1. To provide background information on the Kingston Campus, including

descriptions of present and projected enrollment and facilities; and on the presence of the automobile on and around the Kingston Campus;

2. To evaluate the extent to which increased bus transit service to and from URI has resulted in increased ridership, and discuss the resulting benefits of such increased ridership; and

3. To discuss alternative transportation strategies for the reduction in use of SOV's, for future-use consideration.

Methodology

1. Analysis of Current and Proposed Land Use

The layout of the Kingston Campus was analyzed with regard to existing facilities and future needs, and the relationship of the built environment to critical natural resources. This was performed using relevant literature, photographs, plans, and maps of the area. These were obtained from the URI Office of Capital Projects. In addition, interviews were conducted with key University staff involved in campus planning.

2. Analysis of Current and Proposed Transportation Policies

Previous discussions regarding the predominant use of the automobile over other forms of transportation on Campus, have been summarized. Included are the incentive-, disincentive- and restriction-based policy changes that have been considered by the University. All data were secondary.

3. Analysis of URI Faculty, Staff & Student Needs

A survey of the URI faculty, staff and students was conducted in mid-March 1995 in order to ascertain travel patterns and factors that influence modal choice (see Appendix A). Copies of the survey were affixed to the windshields of cars parked in the faculty, staff and student commuter parking lots. Collection points for completed copies of the survey were established on campus. Two weeks were allowed for response.

4. Review of RIPTA's Expansion of Service

Ridership counts provided by RIDOT were analyzed to determine if increased service resulted in the increased use of the bus system.

5. Identification and Evaluation of Alternative Transportation Strategies

This study focuses primarily on three alternative transportation strategies. These are:

- ridesharing
- bus transit
- utilization of Park & Ride lots

These three alternatives are evaluated using the following criteria:

- reduction in SOV's
- reduction in energy consumption
- impact upon air quality
- economic consequences
- restrictions to personal freedom

Moreover, the study reviews the University's activities regarding the following:

- the establishment of parking fees
- the establishment of parking bans/restrictions
- parking regulation enforcement

Sources of Information

A variety of references were used in this study in order to fully analyze the subject and identify potential remedies. These references are divided into the following three groups.

1. Land Use and Transportation-related Literature on the University of Rhode Island Kingston Campus

Literature relating to land use, transit ridership, and use of the SOV at URI was analyzed. Relevant information on demographics, economics, and plans for future development was collected. These references were available through RIDOT, RIPTA, and the URI Offices of Capital Projects and Institutional Research.

2. Literature on Alternative Modes of Transportation

Literature describing successful transportation alternatives was analyzed, specifically looking toward the relevance and applicability of the documented system to the conditions that exist at URI. Professional and academic journals were the source of these articles.

3. Case Studies of Transit Strategies

Research regarding other similarly-sized, similarly-situated universities and their success with transit service and alternative modes of transportation was conducted. Methods of implementation and techniques being used elsewhere were examined. Literature and interviews with key individuals from other universities were sought.

Organization of the Study

The study is organized into six chapters. Following this introduction, Chapter 2 provides an overview of the University of Rhode Island, including its history, land usage, parking and circulation, and enrollment. Chapter 3 discusses implementation of the survey, and its results.

In Chapter 4, the expanded bus service to URI is evaluated. Estimated ridership is analyzed with regard to both the ridership figures and the levels of emissions reductions that had been projected for the program.

Various alternative transportation strategies are presented in Chapter 5. A brief description is provided for each strategy, followed by a discussion of how it has been employed at URI, and the level to which it has been effective.

Chapter 6 states the conclusions of this study. Appendices A through D close the study, providing the reader access to information utilized in the formulation of its findings.

CHAPTER 2 - UNIVERSITY OF RHODE ISLAND OVERVIEW

In order to comprehend commuting patterns on and around the Kingston Campus, it is necessary to understand its development: its history, size, and land use. The University of Rhode Island (URI) is a large-sized state university on 1,200 acres in a rural setting (College Entrance Exam Board 1995: 83). It was founded in 1892 as a land grant college. Since then, the University has expanded to include a wide range of educational programs.

The main campus of URI is located in southern Rhode Island in the Village of Kingston, thirty miles south of Providence. At the center of the campus is a quadrangle of old granite buildings, their age dating back to the University's infancy. Surrounding these are the newer academic buildings and student resident halls. On a lower plain is the athletic complex and fields, tennis courts, and agricultural fields.

Campus Planning and Construction

The first campus plan was prepared by Frederick Law Olmstead in 1895, establishing the quadrangle concept of URI's campus development (Yu 1994:2). For decades, on-campus construction adhered to Olmstead's vision.

In 1960 a master plan for the campus was done by Sasaki, Walker & Associates. Its purpose was to analyze the existing conditions, estimate future building needs, and formulate physical development policies and building programs for the years 1960 to 1975 (Sasaki, Walker & Associates 1960: 2). The plan reinforced Olmstead's

quadrangle concept, and recommended that housing be carried down the hill to the playing fields.

Nonetheless, thirty buildings were built on-campus between 1953 and 1963; and having succumbed to the pressures of rapid growth, few of them were built in accordance with the quadrangle concept (Yu 1994: 23). Among these were Memorial Union, the Child Development Center, Potter Infirmary, the engineering halls of Wale, Kelley, Gilbreth and Crawford, and Carlotti, Tyler, Woodward and Independence Halls.

An accelerated rate of construction continued through the 1960's, as additional dorms were needed to accommodate the number of baby-boomers arriving on campus. The Roger Williams Housing Complex, and Burnside, Aldrich and Coddington Halls were built during this period, as were the main library and the Fine Arts Center.

Additions to the campus since 1970 include the Tootel Physical Education Center, the Biological Science Building, the Chaffee Social Science Center, White Hall, the Mackal Fieldhouse, and the Dining Services Warehouse. Also, the main library and Memorial Union have undergone extensive renovations, including the addition of new space (See Figure 2.1).

Open Space and Natural Features

Existing URI buildings are organized around open spaces, including the Quadrangle, and the area to the west of Heathman Hall, east of the White Horn Brook. The courtyard formed by the engineering buildings, and the areas north of Ballantine Hall and east of Rodman Hall also constitute significant open spaces. As well, the

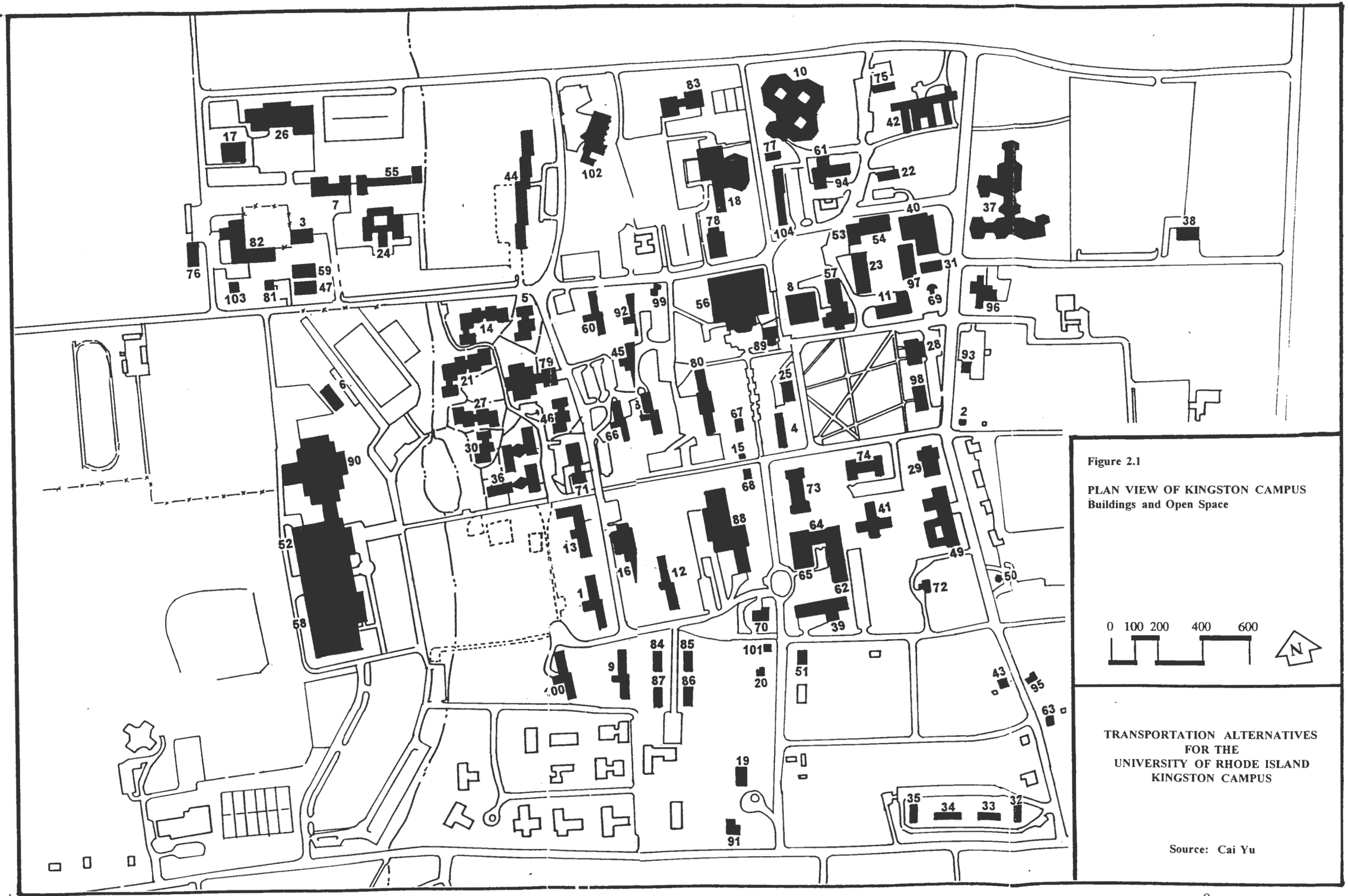

Figure 2.1

PLAN VIEW OF KINGSTON CAMPUS
Buildings and Open Space

0 100 200 400 600

N

TRANSPORTATION ALTERNATIVES FOR THE UNIVERSITY OF RHODE ISLAND KINGSTON CAMPUS

Source: Cai Yu

Building Index

No#	Building Name
1	Adams Hall
2	Adams House
3	Administrative Services Center
4	Albert E Carlotti Bldg (Admin Bldg)
5	Aldrich Hall
6	Athletic Fieldhouse
7	Automotive Garage
8	Ballentine Hall
9	Barlow Hall
10	Biological Sciences Bldg
11	Bliss Hall
12	Bressler Hall
13	Browning Hall
14	Burnside Hall
15	Business Services Office
16	Butterfield Hall
17	Central Receiving Warehouse
18	Chafee Social Science Center
19	Child Development Center
20	Christopher House
21	Coddington Hall
22	Consevatory,Greenhouse
23	Crawford Hall
24	Dairy Barn
25	Davis Hall
26	Dining Service Warehouse
27	Dorr Hall
28	East Hall
29	Edwards Hall
30	Ellery Hall
31	Engineering Inst.Shop
32	Faculty Apt A
33	Faculty Apt D
34	Faculty Apt E
35	Faculty Apt H
36	Fayerweather-Gorham
37	Fine Arts Center
38	Fire Station
39	Fogarty Hall
40	Gilbreth/Kirk Applied Engrg
41	Green Hall
42	Greenhouse, Headhouse
43	Hart House
44	Heathman Hall
45	Hope Dining Hall
46	Hopkins Hall
47	Housing Storage
48	Hutchinson Hall
49	Independence Hall
50	Information Center
51	International Students Center
52	Keaney Gymnasium
53	Kelley Annex
54	Kelley Hall
55	Landscaping & Grounds
56	Library Memorial
57	Lippitt Hall
58	Mackal Fieldhouse
59	Maint Bldg Housing
60	Merrow Hall
61	Micro-Computer Center
62	Morrill Hall
63	Oceanography House
64	Pastore Annex
65	Pastore Hall
66	Peck Hall
67	Personnel Bldg
68	Placement Office
69	Planetarium
70	Police & Psychology
71	Potter Infirmary
72	Presidents House
73	Quinn Hall
74	Ranger Hall
75	Resource Development Lab
76	Rifle Range
77	Robert A. Dewolf Anatomy Lab
78	Rodman Hall
79	Roger Williams Commons Bldg.
80	Roosevelt Hall
81	Safety & Health Bldg
82	Sherman Bldg
83	Social Science Building
84	Student Apt F
85	Student Apt G
86	Student Apt J
87	Student Apt K
88	Student Memorial Union
89	Taft Hall
90	Tootell Gymnasium
91	Transition Center
92	Tucker Hall
93	Tucker House
94	Tyler Hall/Addn
95	Uhuru Sasa House
96	University Club
97	Wales Hall
98	Washburn Hall
99	Watson House
100	Weldin Hall
101	Weldin House
102	White Hall
103	Womens Center
104	Woodward Hall

University is bounded on the north and west by expanses of undeveloped land.

As such, many of these open spaces are constrained against future development (Yu 1994: 69). The Quadrangle acts as the center for many special events, carries historical meaning, and is enjoyed by the University community. The engineering courtyard and the area east of Rodman Hall offer relief in areas otherwise heavily developed, providing access to sunlight and air to the buildings surrounding them. These areas are likely to remain intact.

The open area to the north of Ballantine Hall was formerly a wetland - a small pond remains - and is, therefore, not suitable for future development. Similarly, the area between Heathman Hall and the White Horn Brook is constrained by a seasonal high water table and cannot support development. Further, the land in this area is considered to be glacial outwash with excellent water-bearing properties, and the protection of the aquifer beneath is recognized by the University as an utmost priority. Its use as productive agricultural land has been deemed appropriate, and is likely to be continued in the future.

The wooded area to the north of Flagg Road is the least environmentally-constrained of the open spaces. However, the University's property to the north is interrupted by a tract of privately-owned land, considered to be a deterrent against further expansion to the north.

Circulation and Parking

There are more than 10 miles of road and approximately 5,800 legal parking

spaces on the Kingston campus (see Figure 2.2). Only 624 of the legal parking spaces are "on street"; the remainder are accommodated in the more than 40 parking lots on campus. Complaints about insufficient parking on campus are commonly heard, but the parking lot at Keaney Gym, with over 1,100 spaces, is rarely if ever full (Waldo & Lombardi 1195:8; Shaw 1995; Gordon Archibald Associates 1994: 35; and observations by author). Roughly 70 acres of land is given over to roads and parking (area calculation by author). All of this area is paved.

Circulation is two-way everywhere on campus. Along the south-eastern border ofcampus, however, a portion of North Road has been made one-way to facilitate traffic flow on Route 138. Speeds along North, Upper College, and Flagg Roads have been measured in excess of 31 miles per hour (Gordon Archibald Associates 1994: 24), despite the posting of lower limits. Sidewalks exist only along Upper College and portions of Lower College Roads.

Numerous access roads traverse the campus. Most often these roads supplement the footpaths on campus, many experiencing heavy utilization by members of the URI community walking between buildings. Not infrequently, though, these roads are also used by non-delivery, non-service vehicles.

Enrollment

Presently, there are 9,141 students registered at URI, including 2,322 students enrolled in graduate studies (Institutional Research Office 1995). This reflects a 4.93 percent decrease in enrollment since 1993, and a 11.10 percent decrease since an

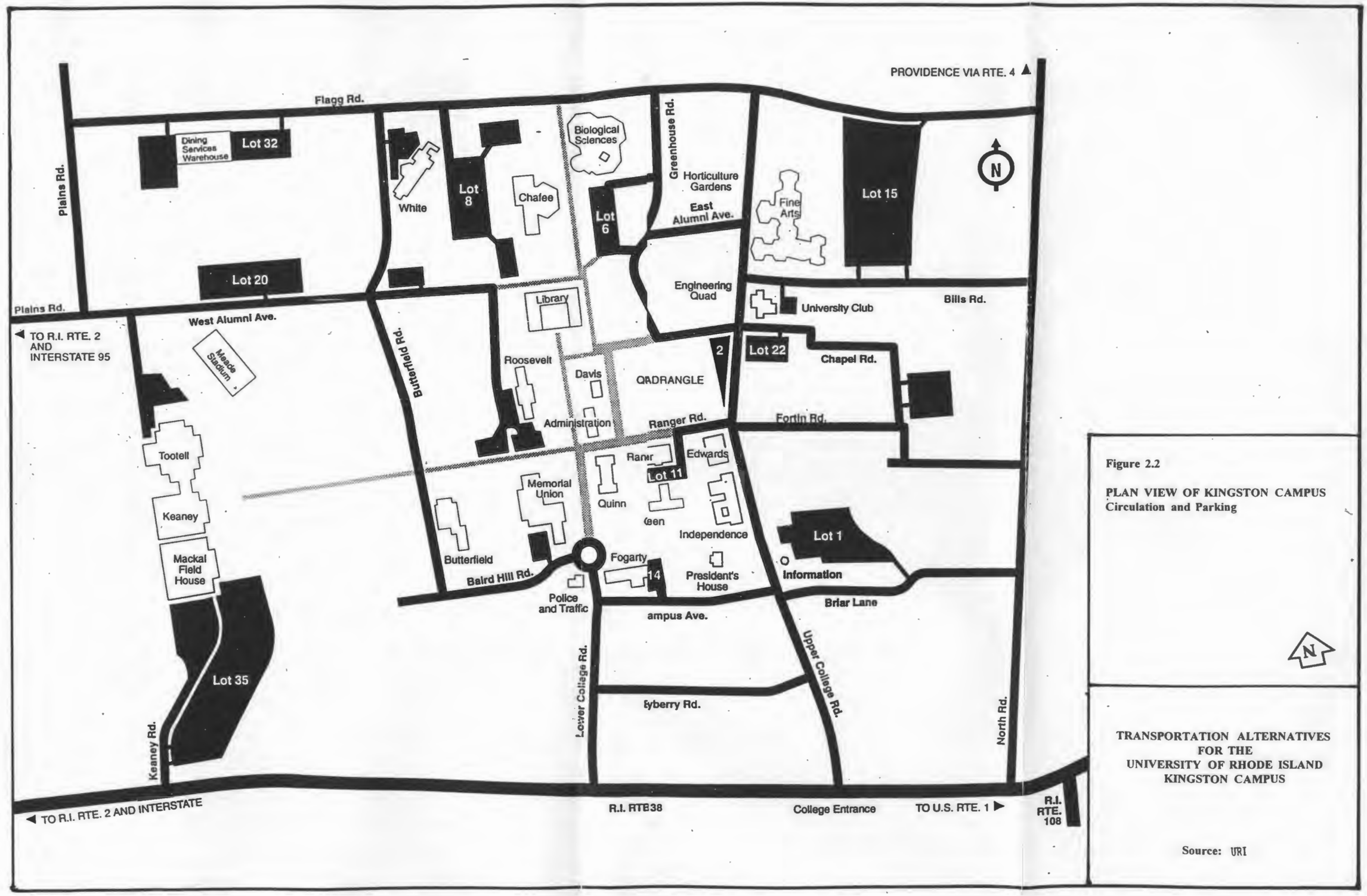

Figure 2.2

PLAN VIEW OF KINGSTON CAMPUS
Circulation and Parking

TRANSPORTATION ALTERNATIVES FOR THE UNIVERSITY OF RHODE ISLAND KINGSTON CAMPUS

Source: URI

enrollment high in 1989 (Table 2.1). Projections for future enrollment indicate a continued decline through 1995, and only modest increases thereafter.

The actual net increase in population at URI as a result of such projected increases is estimated to be 392 persons by the fall of 1998 (Institutional Research Office 1995). The implication is that as many automobiles as new students may also arrive on campus.

Future Development

Despite the decline in enrollment, shortages of certain types of space have been identified (Yu 1994:84). As the trend in higher education continues away from the large, lecture hall, and toward the smaller, seminar-style classrooms, a conversion of space at URI is required. Also, it is estimated that an additional 20-to-25,000 square feet of teaching laboratory space is needed now and in the future to conform to standards established by the Council of Educational Facility Planners, International. Recent cuts in state aid to the University have, however, mandated a period of retrenchment. While the construction of additional classroom space within the College of Engineering is under way, physical expansion of the University has been largely curtailed. In his 1993 Strategic Plan, President Carothers said that "... (t)he University should not continue to construct new buildings while its current building stock and infrastructure deteriorate" (Carothers 1993: 25).

Plans for other new facilities that remain active, however, include the following:

- the relocation of Adams House to a site near Mama Leone's Pizza on Fortin

Table 2.1: Enrollment History and Projection from 1980 to 1998

Year	Under-grad	% UG Change	Grad	% Grad Change	Total	% Total Change
1980	9231		1942		11173	
1981	9515	3.08%	1964	1.13%	11479	2.74%
1982	9095	-4.41%	1901	-3.21%	10996	-4.21%
1983	8931	-1.80%	2052	7.94%	10983	-0.12%
1984	8869	-0.69%	2086	1.66%	10955	-0.25%
1985	9134	2.99%	2034	-2.49%	11168	1.94%
1986	9317	2.00%	2070	1.77%	11387	1.96%
1987	10033	7.68%	2130	2.90%	12163	6.81%
1988	10491	4.56%	2196	3.10%	12687	4.31%
1989	10556	0.62%	2338	6.47%	12894	1.63%
1990	10493	-0.60%	2325	-0.56%	12818	-0.59%
1991	10091	-3.83%	2344	0.82%	12435	-2.99%
1992	9923	-1.66%	2437	3.97%	12360	-0.60%
1993	9735	-1.89%	2322	-4.72%	12057	-2.45%
1994	9141	-6.10%	2322	0.00%	11463	-4.93%
1995*	8969	-1.88%	2322	0.00%	11291	-1.50%
1996*	9004	0.39%	2322	0.00%	11326	0.31%
1997*	9213	2.32%	2322	0.00%	11535	1.84%
1998*	9361	1.61%	2322	0.00%	11683	1.28%

Note 1: * indicates enrollment projection

Note 2: Enrollment figures do not include non-degree, non-credit students, or students registered for off-campus study.

Source: The Institutional Research Office, University of Rhode Island, 1995.

Road, to make way for a new alumni center between the existing Adams and Tucker Houses;

- the renovation of the business office along Hammerschlag Mall, so as to accommodate a new multicultural center;
- the expansion of the boiler plant at Lippett Hall;
- the expansion of the cancer research center northward toward Flagg Road; and
- the construction of a new facility between the greenhouses and the Biological Science Building to house the new Coastal Institute, presently awaiting federal funding (Bascom 1995).

Projects that had been planned but have since been abandoned include the following:

- the construction of a 250-space parking lot between Heathman Hall and Flagg Brook;
- the expansion of the Keaney parking lot; and
- the expansion of the Fine Arts parking lot (Bascom 1995).

The elimination of these projects reflects reductions in the budget, as well as the University's stated commitment to encouraging the use of alternative modes of transportation (Miller 1995).

It is likely that construction projects in the future will be clustered around the campus center, increasing the density and improving the efficiency of land use (Yu

1994:73). Three-to-five story buildings will be encouraged, reducing buildings' footprints and their impact upon the land.

Implications for Commuters

As has already been stated, there are no plans to change the size, shape or composition of the Kingston Campus in any significant way within the foreseeable future. It is questionable as to the effect the net increase of 392 students over the next three years will have on the URI community. It is unlikely that all 392 will commute to campus by private automobile; but assuming they did, full or near-full utilization of the parking lot at Keaney Gym would become more common. It is even more unlikey that all 392 students would be keeping the same schedule, so their impact on traffic flow remains uncertain. Therefore, unless policies or programs that facilitate change in commuter patterns are adopted at URI, commuters may expect to face an only slightly more challenging commuting pattern than they do today.

CHAPTER 3 - COMMUTER SURVEY

The purpose of conducting an on-campus survey with regard to commuting patterns was to ascertain the needs and desires of the URI community members, and to garner an understanding of the attitudes and concerns surrounding the utilization of alternative transportation modes such as carpooling and bus transit.

The Survey and Its Administration

The questionnaire was formulated with input from RIDOT. To encourage response, the questionnaire was kept short. The survey form was printed on 8 1/2" x 11" paper, a copy of which appears in Appendix A. There were nine questions which asked the respondents their University status: faculty, staff or student; where they lived; how much money they spent for gas and maintenance on their car per week; and at what times they needed to arrive at and depart from URI. Other questions asked them about their preferences regarding alternative modes of transportation, and the factors influencing those preferences.

Surveys were attached to the windshields of cars present in faculty, staff and student commuter parking lots on campus on March 22 and 23, 1995. Three thousand two hundred and seventy five surveys were distributed in all. The distribution of the survey sheets was random in that only vehicles parked in the lots at the time of distribution received survey sheets. The method of distribution was chosen over all others because of its ability to target the drivers of vehicles on campus. Completed

surveys were collected through collection boxes at the Memorial Union Building, and through the campus mail system.

A total of 194 surveys were returned for a 1.78 percent sample of the URI commuting population. Of the 3,275 surveys that were distributed, the 194 that were returned reflect a 5.92 percent response rate. Additional limitations to the applicability of survey include the following:

1. The majority of survey sheets were distributed in the morning hours. While these were the hours when parking lots on campus were most full, it is possible that one or more user groups could be under-represented as a result of this approach.
2. Inclement weather, most notably in the afternoon of March 22, 1995, could have effected a number of distributed survey sheets, thereby impacting the participation of those recipients. However, parking lots targeted on that day were predominantly staff and faculty lots: groups well-represented in the survey responses. Further, of the approximately 600 surveys estimated to have been effected by the weather, 41 were returned, reflecting a response rate of 6.8 percent and surpassing the survey's overall rate of return.

Findings of the Survey

The responses from each survey were coded and statistically analyzed. Summary statistics were tabulated for each question for the overall population; selected questions were summarized for students and employees separately.

Question 1: Respondents were asked to identify their status at URI. (Respondents were asked to check one of three answers.)

Of the 194 responses received, 11.64% respondents indicated they were members of the faculty or staff, and 3.03% were students. Table 3.1 summarizes the response to this question.

Question 2: Respondents were asked to identify where they live. (Respondents were asked to check one of two answers.)

Of the 194 responses received, only 3.09% were commuting from locations on campus; 95.88% were commuting from off campus, and 1.03% gave no response.

Question 3: Respondents were asked to indicate the town from which they commute.

In previous studies conducted by URI, five zones were established reflecting the geographic distribution by zip code of all faculty, staff and students living in Rhode Island, and their commuting routes (RIDOT 1993c: 7). They include:

> Zone I - Southwest of URI: Exeter, Richmond, Charlestown, Hopkinton, Westerly, and a portion of South Kingstown (west of Route 110);
>
> Zone II - Southeast of URI: Narragansett and the remainder of South Kingstown;
>
> Zone III - Northwest of URI: West Greenwich, Coventry, Foster, Scituate, Glocester, and Burrillville;
>
> Zone IV - North of URI: North Kingstown, East Greenwich West Warwick, Warwick, Cranston, Johnston, Cumberland, Woonsocket, North Smithfield, Smithfield, Pawtucket, Lincoln, Central Falls, Providence, North Providence,

Table 3.1: Survey Distribution and Response Rate

Sample/Lot Type	Faculty/Staff	Student Commuter	Total
Number of Surveys Distributed	1100	2175	3275
Number Returned	128	66	194
Response Rate	11.64%	3.03%	5.92%

* reflects the 5298 undergraduate and 2322 graduate students known to live off campus (URI Office of Institutional Research, 1995).

East Providence, Barrington, Bristol, and Warren; and

Zone V - East of URI: Jamestown, Newport, Middletown, Portsmouth, Tiverton, and Little Compton.

Table 3.2 depicts the geographic distribution of the 186 survey respondents commuting from off-campus in relation to the geographic distribution of the URI population at large.

Question 4: Respondents were asked to indicate whether they currently used RIPTA service. (Respondents were asked to check either "yes" or "no".)

More than 84 percent indicated they did not use RIPTA service, 5.1 percent indicated they did, and 10.3 percent gave no response.

Question 5: Respondents were asked to indicate the times they needed to arrive at and depart from URI daily. (Respondents were given a choice of 12 time slots.)

More than three-quarters of the respondents indicated arrival at URI between 7:00 and 9:00 a.m., with the hour between 8:00 and 9:00 a.m. constituting the morning peak. However, times of arrival varied between faculty/staff, and student populations. Table 3.3 shows the time slots and the percentage of population group responses allocated to each one.

Likewise, more than two-thirds of the respondents indicated departure from URI between 4:00 and 5:00 p.m., that hour constituting the afternoon peak. Time of departure is, however, more well-defined for faculty and staff than for students, as can be seen in Table 3.4.

Table 3.2: Geographic Distribution of the Survey Respondents Commuting from an Off-Campus Location

Zone	Respondents	URI Community *
Zone I	23%	10%
Zone II	37%	45%
Zone III	5%	3%
Zone IV	27%	36%
Zone V	8%	6%

* Adjusted to exclude those living on campus.

Table 3.3: Times of Arrival for Faculty, Staff and Students

Time slot	Faculty/Staff	Students	Total
Before 7:00	9.2%	1.8%	6.8%
7 to 8:00	35.9%	30.6%	34.2%
8 to 9:00	43.4%	37.4%	41.4%
9 to 10:00	5.6%	21.7%	10.8%
10 to 12:00	2.2%	6.0%	3.4%
After 12:00	3.7%	2.5%	3.4%

Table 3.4: Times of Departure for Faculty, Staff and Students

Time slot	Faculty/Staff	Students	Total
12 to 3:00	4.2%	29.7%	12.2%
3 to 4:00	13.6%	10.2%	12.5%
4 to 5:00	52.6%	20.7%	42.6%
5 to 6:00	21.5%	15.0%	19.5%
6 to 9:00	7.3%	14.3%	9.5%
After 9:00	.8%	10.1%	3.7%

Question 6: Respondents were asked to indicate how much they spent on gas and maintenance for their car per week. (Respondents were asked to write in a dollar amount.)

Responses to this question were varied, and ranged from $10.00 to over $150.00. For the purpose of analysis, 5 slots were created, spanning the range of answers received. Table 3.5 shows the slots and the percentage of population group responses allocated to each one. More than 14 percent of the respondents gave no response for this question.

Question 7: Respondents were asked to rank alternative modes of transportation in order of their preference should the cost of driving to campus alone become prohibitive. (Respondents were given 6 alternatives.)

As shown in Table 3.6, respondents most frequently indicated use of the bus as their first preference. However, preferences among the student population is far more varied than those among the faculty and staff. (Complete depiction of Question 7 responses by population group and by location of commuter trip origin is shown in Appendix B.) Also, as shown in Table 3.7, those living closer to URI showed a greater interest in alternatives such as biking and walking.

Question 8: Respondents were asked to rank the level of importance they would assign to various transportation programs. (Respondents were given 8 transportation programs.)

Table 3.5: Weekly Car Expenses

Slot	Total
$10 to 49	28.9%
$50 to 99	42.2%
$100 to 150	23.5%
Over $150	5.4%

Table 3.6: Preferred Transportation Alternatives by Survey Respondents

Alternative	Faculty/Staff	Students	Total
a. Biking			
ranked 1st	7.4%	4.7%	6.4%
ranked 2nd	3.3%	4.7%	3.8%
ranked 3rd	4.9%	10.9%	7.0%
b. Taking the bus			
ranked 1st	45.9%	32.9%	41.4%
ranked 2nd	23.8%	20.4%	22.6%
ranked 3rd	12.3%	12.6%	12.4%
c. Carpooling			
ranked 1st	19.7%	28.1%	22.6%
ranked 2nd	16.4%	21.9%	18.3%
ranked 3rd	16.4%	12.5%	15.1%
d. Driving to bus stop or Park and Ride lot			
ranked as 1st	22.9%	28.1%	24.7%
ranked as 2nd	18.9%	20.3%	19.3%
ranked as 3rd	13.1%	14.1%	13.4%
e. Vanpooling			
ranked as 1st	4.9%	1.6%	3.8%
ranked as 2nd	9.0%	12.5%	10.2%
ranked as 3rd	14.7%	18.7%	16.1%
f. Walking			
ranked as 1st	.8%	3.1%	1.6%
ranked as 2nd	5.7%	4.7%	5.4%
ranked as 3rd	1.7%	1.6%	1.6%

Table 3.7: Preferred Transportation Alternatives of Survey Respondents by Location

Alt./Zone	1	2	3	4	5	6	7
a. Biking							
as 1st	0.0%	7.4%	0.0%	0.0%	4.8%	17.8%	2.9%
as 2nd	0.0%	3.7%	0.0%	0.0%	0.0%	11.1%	2.9%
as 3rd	0.0%	18.5%	0.0%	4.8%	4.8%	11.%	2.9%
b. Taking the bus							
as 1st	52.6%	29.6%	33.3%	28.5%	29.2%	51.1%	51.5%
as 2nd	15.8%	44.5%	13.3%	33.3%	12.5%	17.8%	20.0%
as 3rd	5.3%	11.1%	13.3%	4.8%	25.0%	13.3%	11.4%
c. Carpooling							
as 1st	26.3%	29.7%	26.7%	19.0%	25.0%	15.5%	22.9%
as 2nd	10.5%	25.9%	20.0%	4.8%	12.5%	20.0%	25.7%
as 3rd	21.1%	7.4%	13.3%	28.5%	4.8%	17.8%	14.3%
d. Driving to bus stop or Park and Ride lot							
as 1st	21.1%	25.9%	40.0%	33.3%	37.5%	8.9%	25.7%
as 2nd	36.8%	7.4%	26.7%	14.3%	20.8%	15.5%	22.9%
as 3rd	15.8%	14.9%	13.3%	4.8%	4.2%	15.5%	20.0%
e. Vanpooling							
as 1st	10.5%	0.0%	0.0%	4.7%	4.8%	6.7%	0.0%
as 2nd	10.5%	0.0%	20.0%	14.3%	16.6%	8.9%	8.6%
as 3rd	15.8%	14.8%	20.0%	14.3%	12.5%	11.1%	25.7%
f. Walking							
as 1st	0.0%	0.0%	0.0%	0.0%	4.1%	4.4%	0.0%
as 2nd	0.0%	0.0%	0.0%	0.0%	4.1%	15.6%	5.7%
as 3rd	0.0%	0.0%	13.3%	0.0%	0.0%	2.2%	0.0%

Note: Zone 1 = Kent County (excluding North Kingstown);
Zone 2 = Town of Narragansett;
Zone 3 = Newport County;
Zone 4 = Town of North Kingstown;
Zone 5 = Providence County;
Zone 6 = Town of South Kingstown; and
Zone 7 = Washington County (excluding S. Kingstown and Narragansett).

As Table 3.8 shows, the transportation program that ranked most important mostfrequently by faculty and staff was the provision of bus service to areas not now served. Students, however, indicated that the establishment of more Park and Ride lots was most important to them. (Complete depiction of Question 8 responses by population group and by location of commuter trip origin is shown in Appendix C.) Also, as Table 3.9 shows, and as in the responses to Question 7, those living closer to URI ranked the development of bikeways and bicycle facilities as being more important than those commuters living farther from URI.

Question 9: Respondents were asked to rank the factors that most influenced their decisions regarding alternative modes of transportation. (Respondents were given 4 factors.)

As Table 3.10 shows, the majority of respondents indicated that either time or freedom most influenced their modal decisions, while neither cost nor safety were significant factors in their modal choice. Time was only slightly more of a factor for faculty and staff than for students, while students said that freedom was only slightly more important than time.

Conclusions

The low rate of response to this survey makes it difficult to draw conclusions regarding the transportation needs and desires of members of the URI community as a whole. If any conclusion can be drawn, however, it is that time and freedom are of

Table 3.8: Ranking of Transportation Programs by Survey Respondents

Program	Faculty/Staff	Students	Total
a. Provide bus service to areas not now served.			
ranked 1st	23.8%	20.3%	22.6%
ranked 2nd	17.2%	17.2%	17.2%
ranked 3rd	6.6%	14.1%	19.1%
b. Establish bikeways and bicycle facilities.			
ranked 1st	10.6%	4.7%	8.6%
ranked 2nd	6.6%	10.9%	8.1%
ranked 3rd	4.1%	3.1%	3.8%
c. Increase number of buses per route.			
ranked 1st	18.8%	18.8%	18.8%
ranked 2nd	10.7%	20.3%	14.0%
ranked 3rd	11.5%	10.9%	11.3%
d. Establish more Park and Ride lots.			
ranked 1st	14.8%	21.9%	17.2%
ranked 2nd	18.9%	9.4%	15.6%
ranked 3rd	5.7%	14.1%	8.6%
e. Install bus shelters and schedule boards.			
ranked 1st	7.4%	6.2%	7.0%
ranked 2nd	7.4%	6.2%	7.0%
ranked 3rd	7.4%	17.2%	10.7%
f. Promote carpools and vanpools.			
ranked 1st	10.7%	7.8%	9.7%
ranked 2nd	7.4%	14.1%	9.7%
ranked 3rd	12.3%	9.4%	11.3%
g. Provide more express bus routes.			
ranked 1st	13.9%	18.8%	15.6%
ranked 2nd	15.6%	17.1%	16.1%
ranked 3rd	13.1%	12.5%	12.9%
h. Establish free shuttle service in S. Kingstown.			
ranked 1st	17.2%	18.7%	17.7%
ranked 2nd	12.3%	4.7%	9.7%
ranked 3rd	4.9%	7.8%	5.9%

Table 3.9: Ranking of Transportation Programs by Location

Prog./Zone	1	2	3	4	5	6	7
a. Provide bus service to areas not now served.							
as 1st	10.5%	25.9%	6.7%	14.3%	25.0%	15.6%	45.7%
as 2nd	36.8%	11.1%	6.7%	14.3%	20.8%	15.6%	17.1%
as 3rd	10.5%	11.1%	6.7%	9.5%	8.3%	8.9%	8.6%
b. Establish bikeways and bicycle facilities.							
as 1st	5.3%	0.0%	0.0%	0.0%	16.7%	17.8%	8.6%
as 2nd	5.3%	18.5%	13.3%	9.5%	4.2%	2.2%	8.6%
as 3rd	0.0%	3.7%	0.0%	4.7%	0.0%	4.4%	8.6%
c. Increase number of buses per route.							
as 1st	31.6%	14.8%	13.3%	23.8%	12.5%	15.6%	22.9%
as 2nd	5.3%	18.5%	13.3%	23.8%	16.7%	8.9%	14.3%
as 3rd	21.0%	7.4%	20.0%	0.0%	12.5%	11.1%	11.4%
d. Establish more Park and Ride lots.							
as 1st	26.3%	14.8%	20.0%	19.0%	33.3%	8.9%	11.4%
as 2nd	10.5%	18.5%	13.3%	9.5%	12.5%	15.6%	22.9%
as 3rd	5.3%	11.1%	6.7%	0.0%	16.7%	6.7%	11.4%
e. Install bus shelters and schedule boards.							
as 1st	15.8%	14.8%	0.0%	9.5%	8.3%	4.4%	5.7%
as 2nd	5.3%	7.4%	0.0%	4.7%	4.2%	11.1%	5.7%
as 3rd	5.3%	22.2%	6.7%	19.0%	4.2%	8.9%	8.6%
f. Promote carpools and vanpools.							
as 1st	15.8%	0.0%	6.7%	9.5%	4.2%	13.3%	14.3%
as 2nd	5.3%	11.1%	6.7%	0.0%	12.5%	6.7%	8.6%
as 3rd	5.3%	11.1%	13.3%	19.0%	16.7%	11.1%	14.3%
g. Provide more express bus routes.							
as 1st	15.8%	25.9%	26.7%	23.8%	16.7%	6.7%	11.4%
as 2nd	15.8%	7.4%	20.0%	0.0%	25.0%	22.2%	8.6%
as 3rd	21.0%	7.4%	13.3%	0.0%	16.7%	8.9%	2.9%
h. Establish free shuttle service in S. Kingstown.							
as 1st	0.0%	18.5%	6.7%	23.8%	0.0%	40.0%	11.4%
as 2nd	10.5%	14.8%	6.7%	0.0%	0.0%	17.8%	8.6%
as 3rd	0.0%	3.7%	0.0%	0.0%	12.5%	13.3%	2.9%

Note: See Table 3.7 for explanation of zones.

Table 3.10: Factors Influencing Transportation Modal Choice

Ranked as 1st	Faculty/Staff	Student	Total
a. Time	45.8%	44.4%	45.3%
b. Safety	6.5%	3.2%	5.5%
c. Cost	4.2%	4.8%	4.4%
d. Freedom	43.5%	47.6%	44.8%

the utmost importance to URI commuters. Therefore, the more comparable any transportation alternative is in terms of travel time and convenience to the SOV, the more likely that alternative is to take hold and flourish in the URI environment.

Also apparent in the results of this survey was the variation of preferred transportation alternatives and programs according to the status at the University and the origin of commuter trip lines. Faculty and staff, with regular schedules, indicated that they were more likely to take the bus than were students. Commuters from South Kingstown indicated that they were more likely to utilize bikeways, if provided. It is this variety that should be examined further in the formulation of University transportation policy and planning.

CHAPTER 4 - BUS TRANSIT RIDERSHIP

Prior to 1994, three bus routes serviced URI. There were 22 trips to and from the University on weekdays, 11 on Saturdays, and 6 on Sundays. Arrival and departure times were not convenient, routes were not direct, and frequency was inadequate (RIDOT 1993c: 3).

Bus service to URI was expanded in 1994 with funding provided under CMAQ through RIDOT as part of a two-year pilot program for the University. As such, it is important to analyze the extent to which: 1) the expanded service has resulted in increased ridership, and 2) the anticipated reductions in SOV's and subsequent air pollutants have been realized.

Bus Service Prior to 1994

The following are descriptions of the RIPTA routes that existed until 1994.

Newport/URI

The Newport/URI route made stops in Jamestown, at the Routes 1 and 138 Park and Ride, Bonnet Shores, Narragansett Pier, Wakefield Mall, and Kingston Station. There were ten round trips made per weekday, with service arriving at URI almost hourly between 9:15 a.m. and 4:45 p.m. Running time varied between sixty five and seventy minutes - effectively doubling the time it took to drive from Newport. Six round trips were made on Saturdays; there was no service on Sundays.

Galilee/Wakefield/URI

There were four round trips made per weekday between URI and Galilee, with stops at Wakefield Mall and Stop & Shop: two in the morning peak hours and two late in the afternoon. Running time was approximately 35 minutes. Mid-day service on weekdays from URI to Galilee was possible via the Providence/URI route with a transfer at the Wakefield Mall to the Wakefield Mall/Galilee route; but travel time was approximately one hour and forty five minutes, and the only way to return to Galilee was to wait for one of the late afternoon buses. Four round trips were made on Saturdays, and six on Sundays and holidays.

Providence/URI

The Providence/URI route serviced the University seven times per weekday. Stops included T.F. Green Airport, the Routes 1 and 138 Park and Ride lot, Wakefield and Peace Dale, though not all stops were made on every trip. Running time varied between 45 and 60 minutes depending upon the number of scheduled stops per trip. No buses arrived at URI during the morning peak hour; and no buses left the campus between 12:30 and 4:00 p.m. or after 6:10 p.m. There were four round trips made between Providence and URI on Saturdays, and six made on Sundays and holidays. The frequency ranged between 2 and 3 hours, and service on Saturday nights ended at 7:00 p.m. in Providence.

By almost any measure, the pre-1994 RIPTA service was neither timely nor convenient.

Expanded Bus Service Since 1994

In the spring of 1993, RIDOT conducted a survey of URI students and employees to determine the demand and potential for increased bus service (RIDOT 1993c: v). Results of the survey indicated that, if given improved transit service, many members of the URI community were likely to utilize it. Further, it was made clear that the scheduling of transit arrivals at and departures from the University at convenient times was of utmost importance to the success of a program for improved transit.

In response, RIDOT and RIPTA proposed improving the three existing routes serving URI, and adding four new routes. Improved service between Providence and URI, and between Kingston and the Bay Campus was instituted in January, 1994. The new routes were added in September, 1994. Descriptions of the new and/or improved routes follow.

Newport/URI

Running time on this route was reduced by eliminating stops at Kingston Station, Bonnet Shores, Narragansett Pier and the Wakefield Mall. However, a stop at the URI Bay Campus was added to this route, with the intention that the route also function as "shuttle service" between the two URI locations, adding 5 minutes to the route for a total travel time of approximately 47 minutes.

Frequency of service on weekdays was increased to 20 round trips per weekday, beginning at 6:30 a.m. and running until 9:30 p.m. with service every one-half hour

during peak hours and a late night trip from URI to Newport at 10:05 p.m. Service was increased to 16 round trips on Saturdays, and to 14 round trips on Sundays and holidays.

Galilee/Wakefield/URI

Frequency on this route was increased from 4 to 19 round trips per weekday, stopping at Stop & Shop, downtown Wakefield, the Wakefield Mall, URI, and Kingston Station. Service runs every one-half hour between 5:55 and 8:55 a.m. and 3:55 and 5:55 p.m.; and every hour throughout the day until 10:00 p.m. There are 15 round trips on Saturdays, and 9 on Sundays and holidays. On board travel time is 55 minutes.

Providence/URI

Stops in Warwick, at the Rhode Island Mall, and East Greenwich, at the Showcase Cinemas, were added to various trips along this route; stops in Wakefield and Peace Dale were eliminated from 8 of the daily round trips. Running time varies between 65 and 75 minutes, depending on the combination of stops on the trip. Frequency was increased from 5 to 20 round trips on weekdays. There are 18 round trips on Saturdays, and 13 on Sundays and holidays.

Airport Park and Ride/URI

This route begins in Warwick at the Airport Park and Ride lot, and makes stops at the Rhode Island Mall, at the A & P in East Greenwich, at the Frenchtown Road

parking lot, at Routes 2 and 102, and at Routes 2 and 138. Running time is approximately 55 minutes; and there are 6 round trips per weekday.

Westerly/URI

This route functions as a western extension of the Airport Park and Ride route. There are four round trips on this route per weekday. Originating at the Westerly Railroad Station, stops are made at the Route 3 Park and Ride lot, the Hope Valley A & P, Routes 2 and 138, and Kingston Station. Running time is 47 minutes.

East Greenwich & North Kingstown/URI

Hourly service is provided on this route between 6:00 and 9:00 a.m. and 1:30 and 5:30 p.m., for a total of 8 round trips per day. There are two stops in East Greenwich, including the Stop & Shop at Frenchtown Road, and four in North Kingstown, including Quonset Point, Wickford, and Routes 1 and 138. Running time is 45 minutes.

Bonnet Shores/URI

This route begins at the URI Bay Campus, and stops at Bonnet Shores, South Pier and Ocean Roads in Narragansett, the Wakefield Mall, and downtown Wakefield. Running time is 54 minutes. There are 20 round trips per weekday, 10 on Saturdays, and 9 on Sundays.

Bus Ridership Analysis

The expanded RIPTA bus program is funded by the U.S. Department of Transportation through RIDOT, using CMAQ monies. As such, a study was performed by RIDOT, with input from the Rhode Island Department of Environmental Management, estimating the reductions in automobile emissions that could be realized upon successful program implementation.

Assumptions were made about the ability of each route to result in increased ridership and reduced SOV utilization. Each line was then analyzed in terms of how that assumed number of reduced SOV trips would translate into reduced automobile emissions, factoring for increased bus emissions. (Complete depiction of RIDOT analysis by route is shown in Appendix C.) Table 4.1 shows the assumptions that were made about potential new riders by route, and the reductions that would be attained as a result.

Estimated ridership was provided by RIPTA for the Providence/URI route, January through August, 1994, and for all seven routes, September through December, 1994, and appears in Table 4.2. No other information regarding ridership was available.

It is, therefore, difficult to assess the impact that increased bus service has had on ridership. It is apparent that use of the expanded service peaked in October, 1994. Even in that month, however, ridership on 3 of the 4 new routes fell dramatically short of what had been predicted, calling into question their efficacy in the net reduction of automobile emissions.

Table 4.1: Results of RIDOT Analysis Regarding Anticipated Bus Ridership and Automobile Reductions (annual).

Route	New URI Weekday Riders	Reduced VMT's	Emission Reductions (in tons)		
			HC	CO	NOX
Providence	160	488,000	-0.59	-5.00	1.58
Newport	215	402,000	-0.73	-5.67	0.30
N. Kingstown	125	152,000	-0.16	-1.64	0.85
Bonnet Shores	360	477,000	-0.98	-7.69	0.13
Galilee	320	447,000	-0.89	-7.18	0.47
Airport P&R	200	384,000	-0.68	-5.07	-0.08
Westerly	130	142,000	-0.28	-2.27	0.12
Total	1510	2,492,000	-4.31	-34.52	3.37

Source: RIDOT, 1993a.

Table 4.2: Estimated RIPTA Ridership

ESTIMATED RIPTA RIDERSHIP

September, 1994 - December, 1994

Routes	9/94	Average Per Month 10/94	11/94	12/94	Total
#64 Newport	6,213	7,780	6,520	6,342	26,855
#65 Galilee	5,092	6,480	5,740	6,111	23,423
#66 Providence	10,013	11,160	9,020	8,988	39,181
#67 Airport/ Hope Valley	171	180	140	147	638
#68 N. Kingstown	532	480	500	441	1,953
#69 Bonnet Shores Narragansett	5,244	6,820	6,120	6,006	24,190
	27,265	32,900	28,040	28,035	116,240
Projected Ridership	36,670	38,600	38,600	40,530	154,400
Saturday					
#64 Newport	539	806	771	618	2,734
#65 Galilee	803	1,333	841	747	3,724
#66 Providence	1,855	2,841	1,611	1,230	7,537
#69 Bonnet Shores Narragansett	538	847	614	565	2,564
	3,735	5,827	3,837	3,160	16,559
Projected Ridership	5,344	6,680	5,344	6,680	24,048
Sunday					
#64 Newport	523	814	717	529	2,583
#65 Galilee	415	641	408	438	1,902
#66 Providence	1,060	1,805	958	501	4,324
#69 Bonnet Shores Narragansett	402	784	269	221	1,676
	2,400	4,044	2,352	1,689	10,485
Projected Ridership	2,960	3,700	2,960	2,200	11,840
TOTALS	33,400	42,771	34,229	32,884	143,284
Projections	44,974	48,980	46,904	49,430	190,288
% of Projection	74.3%	87.3%	69.9%	66.5%	75.3%

Source: RIDOT.

Table 4.2: Estimated RIPTA Ridership (continued)

ESTIMATED RIPTA RIDERSHIP

January, 1994 - August, 1994

Weekday	Service Days	Avg./Day	Total
#66 Providence	168	346	58,128
Projection	168	285	47,880
Saturdays			
#66 Providence	34	231	7,854
Projection	34	176	5,984
Sundays			
#66 Providence	35	142	4,970
Projection	35	140	4,900
Total Ridership			70,952
Total Projection			58,764
Ridership as a % of Projection			120.7%

Source: RIDOT.

The Newport, Providence, and Galilee Routes

These routes were existing, but because no baseline ridership estimates from 1993 could be obtained, one can only guess as to whether they have realized their predicted ridership. Regarding the Providence route, the 160 predicted new URI week day rider trips, multiplied by the 21 weekdays there were in October, 1994, would have translated to 3,360 new rider trips that month. The estimated weekday ridership for October, 1994 was 11,160; so it was at least possible that in October, 1994, the predicted ridership was realized. However, by December, 1994, weekday ridership on the Providence route had fallen off to just 8,988, decreasing the chances that full realization of the predicted ridership had been attained.

Likewise, regarding the Newport route, the 215 new rider trips that were predicted for that route multiplied by the 21 weekdays in October, 1994 would have translated into 4,515 new rider trips that month. The estimated weekday ridership for October, 1994 was 7,780: again,making it possible that predicted figures were realized, but not likely. Further, it became less likely that predictions for this line were realized when, by December, 1994, ridership had fallen off to just 6,342.

On the Galilee route, it was predicted that 6,720 new URI rider trips would join the existing number of trips. However, since ridership in October, 1994 was estimated to be only 6,480, it is impossible for any of the predictions for this route to have been realized. In fact, as much as 1181.89 grams (or approximately 0.23 tons) of HC emissions, 5602.42 grams (or approximately 1.11 tons) of CO emissions, and 6,555.02 grams (or approximately 1.30 tons) of NOX emissions (RIDOT 1993a) may have been

added to the automobile emissions along this route as a result of the expanded service.

The New Routes

Of the new routes, only the Bonnet Shores route came close to realizing its predicted ridership. A total of 7,560 weekday trips had been predicted for that route, as opposed to the 6,820 estimated riders actually realized in October, 1994. By December, 1994, ridership on this route had fallen off to 6,006. The author estimates that in October, 1994, HC reductions were approximately -0.86 tons, CO reductions were approximately -6.82 tons, and NOX emissions were up approximately 0.22 tons.

Ridership on the Airport, Westerly, and East Greenwich & North Kingstown routes is so low that these routes run as contributors to air pollution. The author estimates that when the estimated ridership on the Airport and Westerly routes is calculated as a percentage of the ridership predicted for those routes, and then is applied to the automobile emissions reductions predicted for that route, the resulting values, added to the emissions being produced by the buses, indicate that 711.41 grams (or approximately 0.14 tons) more HC emissions, 3,077.29 grams (or approximately 0.74 tons) more CO emissions, and 5,380.74 grams (or approximately 0.92 tons) more NOX emissions are being released into the air as a result of those two new routes.

The East Greenwich & North Kingstown route performs only slightly better. Using the same method of calculation, the author estimates that 642.69 grams (or approximately 0.13 tons) more HC emissions, 2,184.06 grams (or approximately 0.43 tons) more CO emissions, and 5,628.98 grams (or approximately 0.95 tons) more NOX

emissions are being released into the air as a result of those two new routes.

Problems with the Expanded Bus Service

A number of problems, possibly contributing to the lower-than-expected ridership, have been identified. These are discussed below.

Travel time

On-board travel time continues to be a discouraging factor for many commuters. The only route with a running time comparable to the commute by private automobile is the Westerly route, with on-board travel time at approximately 118 percent (or 7 minutes) over 40 minutes driving time. Table 4.2 shows on-board travel times compared to driving times for all other routes.

Geographical Distribution of Service

There are some areas of the state that are serviced by more than one route, and others that are not covered at all. The stops at the Showcase Cinemas, Rhode Island Mall, and T.F. Green Airport in Warwick along the Providence URI route, and the stops at Rhode Island Mall, (T.F. Green) Airport Park and Ride in Warwick along the Airport route are so similar in arrival and departure times and populations served as to be called duplications of each other. The same is true for the Stop & Shop stop on the East Greenwich and North Kingstown route and the Frenchtown Road stop on the Airport route; as well as for the A & P, the Frenchtown Road, and the Routes 2 and 102 stops

Table 4.3: Comparison between On-board and Driving Travel Times

Route	Minutes On-board	Minutes Driving	Difference in minutes	Difference as %
Newport/URI	47	30	17	157%
Gal./Wake./URI	55	30	25	183%
Providence/URI	65-75	45	20-30	144-166%
Airport P&R/URI	55	35	20	157%
Westerly/URI	47	40	7	117%
E. Greenwich & N. Kingstown/URI	45	25	20	180%
Bonnet Shores/URI	54	30	24	180%

Note: "Minutes On-Board" are derived from RIPTA schedules; "Minutes Driving" are as experienced by author.

along the Airport route unto each other. Meanwhile, the most commonly-expressed suggestion for improved transit service was to provide bus service to areas not now served. (See Chapter 3.)

Advertising

Some members of the URI community are still not aware that the expanded bus service exists. RIPTA advertises its service in the student newspaper on campus, but not everyone reads the student newspaper. Some of the survey respondents that indicated that bus service did not exist in their area are simply unaware that it does. For example, 3 (of the 6) respondents from Westerly attachednotes to their completed survey forms indicating they would take the bus, but that there was no service in Westerly. All 3 were staff.

Inability to Meet the Needs of the URI Community

Scheduling and routing still present problems to many members of the URI community whose lives are more complex than an out-and-back commute. For example, employees with childcare issues and students who work - sometimes between classes - off campus may continue to find the frequency of service and selection of routes so onerous as to be prohibitive.

Conclusions

Further refinement of the RIPTA bus service to URI is required. What presently

exists is a level of service typical of many small urban areas imposed upon a rural/suburban setting. The result reflects both overkill, as can be witnessed in the abundance of empty buses, and neglect, in that RIPTA continues to fail in providing reasonable on-board travel times.

CHAPTER 5 - TRANSPORTATION ALTERNATIVES

A recent study determined that currently nearly 17,000 trips are generated to and from the Kingston Campus daily (RIDOT 1993c: 2). The peak hour for traffic entering the campus is between 8:00 and 9:00 a.m.; the peak hour for traffic exiting the campus is between 4:00 and 5:00 p.m. Delays in traffic during these hours can be as long as 90 seconds, warranting a Level of Service rating of "F" (Gordon Archibald Associates 1994: 32).

It is, however, difficult to say that Kingston currently experiences congestion at a level that is truly problematic because congestion is relative (Hyman 1993: 155; Cervero 1991: 121). It is perceived differently in Kingston than Boston. It is also perceived differently depending upon the overall length of the commute.

Likewise, it is difficult to state categorically that there is insufficient parking available at URI. It has been stated that because vehicles arriving on campus are occupied by a single person, 8,500 vehicles are arriving daily on a campus with only 5,800 parking spaces (RIDOT 1993c: 2). The calculation is based on the assumption that the half of the 17,000 trips generated daily that reflect "arrivals" at the University happen at once or with enough overlap to suggest that 8,500 automobiles are present on campus at peak hours of the day. The resulting deficit would be 2,700 parking spaces per day, and such is simply not the case. What was not accounted for includes the wide variety of schedules kept by members of the URI community, and those that

enter and exit the campus more than once per day.[1]

There are areas on and around campus in which finding an available parking space at mid-day can be challenging. Illegally parked cars and drivers circling the lot in search of the elusive parking space are commonly witnessed in these areas, which include the parking lots at Christ the King Church and behind the Fine Arts Building, and along Chapel, East Alumni and Flagg Roads. It has also been observed, however, that the parking lot adjacent to Keaney Gym, a major parking facility on campus, is rarely, if ever, full (Waldo & Lombardi 1995: 8; Shaw 1995; Gordon Archibald Associates 1994: 35; and observations by the author). The "parking problem" that exists at URI may well be more a case of inconvenient parking rather than insufficient parking.

Despite the debatability of these two issues, the facts remain that 1) URI is a major trip-generator in Washington County, 2) too many people are driving alone to URI, and 3) once on campus people are continuing to use their vehicles in frivolous and inefficient ways. The objectives of this study are to identify the transportation strategies most likely to result in reducing the use of single occupant vehicles.

Transportation Management

Traffic flow can be improved using traffic supply management and traffic

[1]A study conducted in 1993 indicated that 14.5 percent of the student population goes to URI, goes home and returns to URI later that same day at least once per week (Mignault & Moreira 1993: 87). Another 22.6 percent of the student population commute to URI more than once a day twice per week; and still another 14.5 percent "double commute" between 3 and 8 times per week.

engineering measures. The former includes the construction of new roads or the widening of existing roads. The later attempts to optimize the use of existing roads through such measures as traffic signal improvements and coordination, intersection widening and improvements, turn restrictions and one-way street flow, and on street parking management, among others (Atash, et al 1995: 17). A third method for improving traffic flow is via transportation demand management (TDM), which seeks to eliminate trips through work-at-home programs and telecommuting. Finally, traffic reduction techniques address modal choice.

Traffic Reduction Techniques

Traffic reduction techniques (TRT) aim at decreasing the volume of traffic and vehicle miles of travel by influencing the manner in which people travel to their destination (Orski 1990: 485). They seek to maintain a favorable volume-to-capacity ratio by reducing traffic volume, and avoid the more costly expansion of road capacities (Downs 1993: 42; Ferguson 1993: 442).

TRT's include strategies that can be either market-based, regulatory, or a combination of the two (Downs 1993: 43; Schonfeld & Chadda 1985: 393-4). Market-based strategies put various monetary prices on different types of behavior and permit each individual to choose what he is willing to pay for. Thus market-based strategies are also considered to be "voluntary". Examples of market-based strategies include ridesharing, increased use of public transportation, and increased use of fringe parking lots and feeder transit service. Market-based strategies have the advantage of

maximizing individual choice, but the disadvantage of favoring higher-income persons over poorer ones.

Regulatory strategies mandate certain types of behavior and forbid others, without regard to individual preferences. Examples of regulatory strategies include the elimination of free parking, the restriction of parking under certain circumstances, and the reduction of parking supply or accessibility, all by regulation or ordinance.

Combinations of market-based and regulatory strategies include the establishment of incentives for certain types of behavior and disincentives for others. Examples include the payment of incentives to the users of transit, and the establishment of parking fees for those preferring to drive alone.

An effective traffic reduction effort includes strategies that: 1) offer a wide choice of travel alternatives, allowing commuters to choose the option that best meets their needs; and 2) provide incentives for the usage of alternative modes of transportation (Orski 1990: 486). What follows is a discussion of the TRT's that warrant further consideration by URI, RIDOT, RIPTA, and other state governmental agencies charged with providing effective transportation alternatives.

Ridesharing

The goal of a ridesharing program is to influence and assist commuters in locating other commuters willing to share a ride to a particular destination on a regular basis. Carpooling and vanpooling are forms of ridesharing.

The establishment of a ridesharing program is a difficult undertaking. It requires

both the commitment of resources by a sponsoring organization, and the daily reaffirmation of each participant of commitment to the program itself (Ferguson 1991: 140; Stevens 1990: 563). Ridesharing is, however, the most frequently considered travel reduction option (Schonfeld & Chadda 1985: 398).

Characteristics of commuters that have been identified as contributing to the success of ridesharing programs include:

· Affiliation with larger firms, companies or institutions;

· Having a longer commute than 10 miles; and

· Having a fixed schedule (Ferguson 1991: 132; Stevens 1990: 564-5).

Larger organizations, because of their size, have both formal and informal advantages over smaller organizations in their ability to establish and maintain successful ridesharing programs (Ferguson 1991: 132). First, they may be able to provide more accurate ridesharing information through existing data banks and staff. Second, affiliates of larger organizations have a higher probability of finding at least one other person within the organization who lives nearby and commutes to the same place at approximately the same hours. Larger organizations can also establish explicit policies that influence affiliate behavior regarding ridesharing.

Ridesharing is cheaper for the commuter than driving alone from any distance (Schonfeld & Chadda 1985: 400). Front-door-service vanpools are even less costly than carpools, and can reduce commuter vehicle miles travelled (VMT) up to 50 percent (Pratsch 1986: 593). Carpools are slightly less effective at reducing VMT's (Table 5.1), but are equally effective at reducing the number of SOV's (Orski 1990: 490) and are

Table 5.1: Assessment of Travel Reduction Options *

Options:	*Effectiveness in Reducing: Vehicle miles*	*Energy consumption*	*Environmental impacts*	*Implementation problems and requirements*
Carpooling	M	M	L	Promotion and matching program desirable.
Vanpooling	H	H	M	Governmental/em-ployer assistance and incentives.
Bus transit	H	H	M	Adequate service requires subsidization.
Parking Controls				
Parking fees	M	M	L	Political difficulties.
Restrict supply	M	M	L	Political difficulties.
Park & Ride lots	M	M	L	Requires funding for construction and maintenance; shifts parking requirements to outlying areas.
Auto-free zones	M	M	H	Limited experience.

H = high; M = medium; L = low.

* Partial listing of options and variables.

Source: Schonfeld & Chadda, 1985, pp395-7.

far more workable than vanpools for trips longer than 30 miles (Schonfeld & Chadda 1985: 395-400). Both ridesharing modes offer increased flexibility over public transit, and are comparable in comfort to the private automobile (Atash, et al 1995: 35).

Current relaxation of concern about energy usage and consumption works against the success of ridesharing programs. As such, the promotion of ridesharing programs may need to emphasize those rewards and incentives for participation that are not energy-related (Stevens 1990: 564-73). Factors having a positive affect on the decision to rideshare include saving money on gasoline, reducing wear and tear on the car, altruism (e.g. improving the environment), and having someone to talk to. Additionally, one of the most significant factors correlated with successful ridesharing programs has been the presence of advertising and signage at the commuter destination.

The potential for a successful carpooling program exists at URI. As was discussed in Chapter 3, 22.6 percent of total survey respondents indicated that carpooling was their first choice of transportation alternatives; and another 18.3 percent indicated carpooling was their second choice. Further, the characteristics of URI commuters, including having an affiliation with a large institution, as URI is, and commutes of longer than 10 miles, are consistent with those attributed to other successful ridesharing programs.

The Commuter Center at URI has maintained a carpooling program for a number of years. The program is open to all members of the URI community. Input from commuters regarding the location from which they are commuting and the schedules they need to keep is solicited each semester through "The Commuter Corner", a column

that appears regularly in the campus newspaper. File cards are kept on each of the respondents; and respondent information is made available to others attempting to form carpools through the Commuter Center in person or via E-mail.

For a brief period, the URI Students for Social Change (URISSC) adopted a more active approach for the URI-based carpooling program. URISSC also solicited input from members of the URI community regarding their commutes, and then entered the data into a bank on computer and sought out potential carpool "matches". Unfortunately, the approach was only as good as its initiators and, subsequent to their attrition from URI, the program reverted back to the domain of the Commuter Center.

There are several reasons why carpooling has not been more successful at URI. Among students, the biggest obstacle to carpooling is the variability of their schedules. The lack of fixed and regular schedules is a significant factor that negatively impacts the ability of groups to form successful carpools (Stevens 1990). Among faculty and staff, the tendency to live closer to URI offsets the advantage of generally working regular business hours.

A major shortcoming of the URI carpooling programs to date has been the lack of committed resources and advertising. Staff and computer resources should be allocated to the establishment of a carpool matching program. In addition, a campus-wide advertising campaign should be initiated and maintained on an on-going basis throughout the school year encouraging carpooling and promoting the services of the carpooling program. The target population should include all members of the URI community.

Among the other large-sized state universities in New England, the University of Vermont (UVM) has an active carpooling program, which includes the promotion of the program and a reduction in the rates of parking fees assessed to program participants (Vandall 1993: 2).

Bus Transit

Bus transit has been rated high for its effectiveness in reducing commuter VMT's (Schonfeld & Chadda 1985: 395) and the numbers of SOV's. Benefits to its users include lower automobile insurance rates, safer travel, and relief from driving stress (RIDOT 1992: 6.2). Further, the availability of bus transit can be critical to those without ownership of or access to a private automobile.

Conventional fixed route bus services are highly competitive with the private automobile in high-density urban areas, but are less so in lower-density suburban settings (Cervero 1986: 401). In such settings, the lack of frequency and directness of bus transit result in increases in wait and travel time, and impact negatively upon the commuter's decision to take the bus. Greater frequency of service can substantially diminish wait time and schedule rigidity, another major weakness of transit service (Hsu & McDermott 1977: 43), but is often not an option in areas of lower-density.

The utilization of bus transit as a traffic reduction technique has received mixed reviews, especially in more suburban areas. Beyond the questionable adequacy of route densities, issues that remain a concern include the extent to which the frequency of service required in order to deliver adequate service requires subsidization (Schonfeld

& Chadda 1985: 395), and the extent to which bus transit can deliver on the promise of reduced congestion, energy consumption, and air pollution (Bae 1993: 65-74; Love 1992: 42-47). Buses that run at capacities as low as 20 percent are heavier polluters per passenger than the passenger-equivalent number of automobiles, consume more energy per passenger mile than private automobiles (and far exceed the energy consumption of carpools and vanpools), and have only a minimal effect on traffic congestion mitigation.

RIPTA has long provided bus transit service to URI from points within the state, and has recently expanded service so as to better meet the needs of the URI community. (See Chapter 4 for a full discussion of the expanded service.) Presently, the expanded service is being funded by monies obtained through the CMAQ Program. Other universities in New England receive funding for bus transit service through student fees for transportation and/or parking, parking fees assessed to students, faculty and staff, and parking fine revenue, among other sources (Vandall 1993: 1-3).

This study's survey results show that more than 41 percent of the survey respondents prefer taking the bus over all other transportation alternatives (See Chapter 3). However, as discussed in Chapter 4, estimated RIPTA ridership numbers indicate a number of routes so poorly utilized as to run as polluters. Ridership in October, 1994 - the month in which program ridership peaked - resulted in an average of 8.42 persons per bus per route. Assuming a capacity of 60 persons per bus, this reflects a system running at 14 percent of its total capacity. RIPTA use of smaller jitney buses during off-peak hours and on the routes less travelled increases the efficiency of the URI

service overall; but routes with very low ridership, such as the Airport/Westerly/URI and East Greenwich & North Kingstown/URI routes, lessen the impact of higher capacities attained on other routes, and call into question their ability to address the issues of traffic congestion, and the reduction of air pollution and energy consumption to the extent that other routes may be able.

Ridership along the Providence/URI, Newport/URI, Galilee/ Wakefield/URI, and Bonnet Shores/URI routes has proven that the RIPTA bus service is meeting the needs of many members of the URI community. The combined total of 32,240 estimated rider trips on these routes in October, 1994, reflect a reduction of more than 8 percent in the number of vehicular trips generated daily by the University. Further, the provision of bus service along these routes may be the only way that some students may have of getting to URI; and it allows for others to live in more affordable locations while contending with the costs of a college education.

Park and Ride Lots

Park & Ride lots, otherwise known as "fringe parking", are designed as points at which individuals may transfer from an SOV to another vehicle containing at least one other person (RIDOT 1992: 34). Such lots may serve carpools, vanpools and bus transit.

The success rate of a Park & Ride lot can be attributed in part to the quality of its design. Parking lot placement and layout should accommodate and encourage intermodal connectivity between transit and automobiles (Atash, et al 1995: 33).

Further, they should have adequate lighting and landscaping, and bus shelters and benches should be provided where appropriate.

The effectiveness of Park & Ride lots in reducing VMT's is modest (Schonfeld & Chadda 1985: 396), since most commuters drive to the lots alone. A reduction in the number of SOV's is realized only between the lot and the commuter's ultimate destination, as is the resulting congestion mitigation as well. Park & Rides are effective to the extent that they shift parking requirements to outlying areas, but commitment is required nonetheless to their construction and maintenance as parking facilities.

RIDOT maintains 21 Park & Rides throughout Rhode Island; RIPTA maintains another 6. Six of these lots are serviced by bus transit to and from URI including the lots at Routes 2 and 4, Routes 1 and 138, the airport in Warwick, the railroad station in Westerly, the A & P in Hope Valley, and the Gateway Center in Newport. No information is available regarding the utilization of these lots by members of the URI community.

Incentives

Conventional wisdom would have us believe that people have an irrational love affair with their cars so strong that it makes them ignore alternative transportation strategies (Orski 1990: 487). Recent research suggests, however, that commuters are only exercising good common sense when they choose to drive. Surveys of suburban workers indicate that a key reason why people drive to work is because they need their cars before, during, and after work (Cervero 1991: 124). Close to 60 percent of

suburban office workers surveyed use their cars regularly to make stops on their way to or from work, and nearly 80 percent use them regularly at lunchtime.

In urban areas, office workers can walk or use transit and have easy access to a wide variety of services and activities. For suburban workers, such is usually not the case; and in gaining access to the services they need everyday, cars save time. Thus, it is not enough to simply provide alternatives to the SOV: it is equally important to provide amenities and incentives to compensate for giving up their car.

One such amenity is the guarantee of a ride home in the event the commuter must either unexpectedly stay late or leave early (Atash et al 1995: 27; Ferguson 1990: 449; Orski 1990: 488). Similarly, the provision of company cars or idle ridesharing vans at lunchtime for use by program participants (Cervero 1986: 401), or of mid-day transportation such as shuttle buses to nearby activity centers (Atash et al 1995: 27) has allayed some commuters' fears of being without a car.

Incentives are also needed to help overcome the commuters' obvious preference for driving alone. Approximately 40 percent of all U.S. office parks offer some form of preferential parking as an inducement for ridesharing (Cervero 1986: 391). Financial incentives also help and can be offered as reductions in fees, subsidization, or outright monetary rewards for program participation.

It has been recommended that selected interior lots on campus be redesignated as carpool lots, in an effort to further promote carpooling (University Security and Parking Advisory Committee 1994: 10; RIDOA 1982: 67-9). Spaces in these lots would be made available to all commuting students, faculty and staff, permitting drivers

with passengers to park in the preferred locations at reduced rates or for free. The recommendation remains under consideration at URI: stymied, however, by the lack of staffing and capital funding for expenses associated with the operation of carpool-only lots.

The establishment of interior carpools lots on the Kingston campus has as much, if not more, potential as an incentive for curbing the use of SOV's as does the establishment of parking fees. While some members of the URI community may begrudgingly accept the institution of parking fees and continue to drive nonetheless, everyone wants a more convenient parking space. Most of the illegal parking on campus occurs not because there is no other place to park - a point that is supported by the vacancy rate in the Keaney parking lot: it occurs because people want to park as close as they possibly can to their destination. Interior carpool lots could supply the reward of a convenient parking space for the commitment to carpooling.

Disincentives and Restrictions

The most effective form of disincentive is the elimination of free parking (Orski 1990: 489). The provision of free parking is a significant obstacle to usage of alternative modes of transportation (Pratsch 1986: 594). The availability of free parking stimulates individual automobile driving and deters energy conservation (Schonfeld & Chadda 1985: 400). Studies have estimated that at least 20 percent fewer commuters drive alone when they have to pay for parking, as opposed to having parking provided to them at no charge (USDOT 1980). The elimination of free parking has been found

to have the largest and most consistent impacts among traffic reduction strategies (Ferguson 1990: 452).

Recently it was recommended that, beginning in the Fall of 1995, a fee of $50.00 per semester for student commuters and $104.00 per semester for staff and faculty commuters be charged for parking on campus at URI. It is proposed that the revenue from parking fees go toward the maintenance and operating expenses associated with the roads and parking lots on campus, improved enforcement and security in the parking lots, the installation of additional bicycle racks around campus, support for a carpooling program, and improved campus shuttle service (University Security and Parking Advisory Committee 1994: 9-10). The establishment of such a fee is found to be consistent with those existing at other large New England state universities, including the Universities of Vermont, New Hampshire and Massachusetts at Amherst.

It is expected by some that the institution of such a fee for parking at URI will do much to promote the use of alternative modes of transportation. It will also, unfortunately, effect those that can least afford to pay the fee, while wealthier members of the URI community may continue to opt for driving alone to campus - as many believe will be the case.

It has also been suggested that restrictions be placed on the access roads running throughout campus, increasing control of these "service-only" roadways in an effort to create a more pedestrian-friendly auto-free zone (University Security and Parking Advisory Committee 1994: 10). Reducing the ease with which the automobile is used on campus may serve to reduce the extent to which the automobile is used on campus.

However, substantial budgetary commitment is required for implementation of the suggestion, resulting in its deferment.

Combining Strategies

The cumulative effects of combining several strategies are not simply additive (Schonfeld & Chadda 1985: 404). Some options may be mutually compatible, some may actually enhance each other, and some may be inseparable. Collectively, the provision of alternatives modes of transportation combined with a comprehensive program of incentives reflects a program that is greater than the sum of its parts (Pratsch 1986: 593).

Such is expected to be the case at URI, once parking fees are in place. It has not been enough to provide expanded bus service to URI without providing reasons to take the bus, as can be witnessed by the volume of empty buses. The provision of expanded bus service to URI with parking fees in place would have been a more true test of the system's capabilities of reducing the use of SOV's.

But buses should not be considered the only alternative to the SOV, especially in a state with densities that vary as significantly as they do in Rhode Island. As interesting to see will be the use of carpools in conjunction with the parking fee. An active carpooling program, including matching services and advertising, should be established along with the parking fee to provide a choice of alternative modes of transportation to the URI commuter. State agencies have been reluctant to support the provision of carpooling as an alternative to bus transit services, fearing that the success

of carpooling could reduce the efficiency of services provided (RIDOA 1992: 6.9); but the provision of choice may best meet the needs of the members of the URI community, and ultimately translate to fewer people using SOV's.

Additionally, an ingredient key to the success of any program, and especially pertinent to conditions at URI, is the enforcement of traffic reduction strategies and policies. At present, illegal parking is rampant on campus, obvious violations going unticketed due to a lack of enforcement officers brought about by budgetary constraints. Successful traffic reduction programs possess both "carrot" and "stick" attributes (Cervero 1986: 401).

CHAPTER 6 - CONCLUSIONS AND RECOMMENDATIONS

The University of Rhode Island began as an agricultural school in an agricultural setting. Today, it is a large-sized university in a rural environment. It is the state's primary institute for secondary education, and a major employer. As such, URI is a major trip generator: the current vehicle of choice is the SOV.

When asked about the possibility of utilizing alternative modes of transportation, more than 41 percent of this study's survey respondents expressed a preference for taking the bus, if adequate service were provided. Another 24.7 percent of the survey respondents indicated that driving as far as a Park and Ride lot, and then transferring to either a bus or carpool, was their first choice of alternative modes of transportation; and still 22.6 percent more ranked carpooling as their first preference.

The sheer size of the populations at URI - both faculty/staff and student - indicates the potential for viable programs supporting alternative modes of transportation, especially when combined with a willingness to utilize other modes of transportation, if provided. Yet, because of the complexities that exist, no program to date can be declared a success.

Getting people to change their commuting habits is a difficult task. To alter personal travel behavior, it often requires the introduction of a new and/or significant factor, such as the gasoline crisis in the 1970's, an earthquake disaster, or hosting the Olympic games. Short of such an occurrence, the most effective way of implementing change is the simultaneous introduction of many different traffic reduction strategies (Downs 1993: 43). At URI, this makes all the more sense, given the diversity or

persons, needs, and schedules that must be met.

URI Program Components

Key components of a successful program aimed at reducing the number of SOV's generated by URI include the use of incentives, such as:

- the refinement and subsequent continuation of expanded bus service;
- the promotion of Park and Ride lots as alternatives to driving all the way in to campus;
- the establishment of an active carpooling program, including matching services and advertising; and
- the establishment of preferred parking lots for carpool program participants.

They also include the use of disincentives, such as:

- the establishment of a fee for parking at URI;
- the institution of a restriction against freshmen bringing cars with them to campus;
- the redesign of the Kingston campus to become more pedestrian-friendly and restrict the use of vehicles;
- the exclusion of vehicles from the interior core of the campus; and
- improved enforcement of all traffic reduction and parking regulations and policies.

The combination of these strategies provides both "the carrot" and "the stick", as well as options for members of the URI community.

Realistic Expectations

Implementation of traffic reduction techniques at URI should be considered as part of a larger program that addresses transportation throughout the area. The regional impact of isolated traffic reduction programs have tended to be slight or negligible (Ferguson 1990: 452), as the traffic reductions achieved from an isolated program tend to get lost in the volumes of non-participatory traffic (Orski 1990: 491), and are ultimately offset within a few years by the arrival of more people, jobs, and vehicles (Downs 1993: 43). Thus, it is imperative to regionalize traffic reduction techniques if the program at URI is to have real meaning.

Program Evaluation

Evaluation of other traffic reduction programs has found a relationship between the level of effort expended on a program and the level of success it attained (Ferguson 1990: 452). Level of effort is usually identified in terms of policies, programs, and other actions to be implemented over a certain time. It can also be measured in terms of level of financial commitment made to a given program. The level of success attained by a traffic reduction program may be gauged in terms of measured changes in modal choice.

At URI, the level of success regarding program implementation would be reflected in changes in SOV utilization, carpooling, and bus ridership. However, lacking significant levels of effort, the likelihood of success is not good.

How to Proceed

Reductions in the use of SOV's benefit all the residents of and visitors to the area in which the reductions are being attained. It is a goal worth pursuing. The steps which are necessary to successful program implementation include the following:

- Identify the agencies and population sectors effected or involved;
- Establish a clear understanding/agreement among the parties involved regarding the policy issues to be addressed (ie: traffic congestion, on-campus parking, air quality, fuel consumption, etc.);
- Define and/or quantify the problem;
- Delineate alternative strategies;
- Evaluate the costs and benefits, and positives and negatives of each of the strategies; and
- Analyze the proposed program and obtain commitment from parties involved.

Once the program is instituted, its effectiveness should be monitored; and all parties should be prepared to modify the program, as needed.

Clearly, the present provision of bus service to the University does not fully constitute a traffic reduction program, though it should be a part of a traffic reduction program in the future. What is needed now is a committed, concerted, and highly coordinated effort toward reducing the use of the SOV as the vehicle of choice at URI, and the cooperation of everyone involved.

Appendix A

CAMPUS TRANSIT EVALUATION

Dear Member of the URI Community: _____

I am conducting a project to develop transportation policy for URI and to evaluate RIPTA service to the University. The results will be shared with URI, RIPTA and the State. Please take a few moments to complete this survey regarding your commute. The completed survey can be returned to me by campus mail, or dropped in one of the 3 collection boxes at the Student Union: (1) at the entrance to the Ram's Den; 2) near the travel agency on the ground floor; and (3) opposite Del's at Union Square. Look for the **jungle green** boxes. Thank you for your assistance.

Cynthia Sturges
204 Rodman Hall

1. What is your current status at URI? Please check one:
   Faculty __ Staff __ Student __

2. Where do you live? On Campus __ Off Campus __

3. If commuting from off-campus, where are you commuting from?
   Town: _____ Intersection of: _____

4. Do you currently use RIPTA service? __ Yes __ No, If Yes, what is the route number? ____

5. At what time(s) do you need to arrive at URI? Need to leave URI?

	Before 7 AM	7-8 AM	8-9 AM	9-10 AM	10-12 Noon	After Noon	12-3 PM	3-4 PM	4-5 PM	5-6 PM	6-9 PM	After 9 PM
Monday	____	____	____	____	_____	_____	____	____	____	____	____	____
Tuesday	____	____	____	____	_____	_____	____	____	____	____	____	____
Wednesday	____	____	____	____	_____	_____	____	____	____	____	____	____
Thursday	____	____	____	____	_____	_____	____	____	____	____	____	____
Friday	____	____	____	____	_____	_____	____	____	____	____	____	____
Sat/Sun	____	____	____	____	_____	_____	____	____	____	____	____	____

6. How much do you spend on gas/maintenance for your car per month? _____

7. If the cost of driving to campus alone was to become prohibitive, and all of the following options were made available and convenient to you, what would be your preferred way of commuting to campus? Please rank. (1= first choice, 2=second choice, etc.)

   __ a. Biking
   __ b. Taking the bus
   __ c. Carpooling
   __ d. Driving as far as a shuttle bus stop/park & ride lot
   __ e. Vanpooling
   __ f. Walking

8. What level of importance would you assign the following transportation programs? (1=most important, 2= second most important, etc.)
   __ a. Provide bus routes to areas not now served
   __ b. Establish bikeways and bicycle facilities
   __ c. Increase the number of buses per route (reduce waiting time)
   __ d. Establish more "park & ride" commuter lots
   __ e. Set up bus shelters and informational signs around campus
   __ f. Promote carpools and vanpools
   __ g. Provide more express bus routes
   __ h. Establish free shuttle service from points in South Kingstown

9. Please rank the factors that most influence your decision regarding mode of travel. (1=most influential, 2=second most influential, etc.)
   a. __ Time b. __ Safety c. __ Cost d. __ Freedom

Appendix B

Table B.1: Frequency of Question 7 Responses for Total Commuter Population (in Percentage)

Alternative/Ranked as:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	6.4%	3.8%	7.0%	8.1%	18.8%	3.2%	52.7%
b. Taking the bus	41.4%	22.6%	12.4%	8.6%	.5%	.5%	14.0%
c. Carpooling	22.6%	18.3%	15.1%	6.4%	3.2%	2.1%	32.3%
d. Driving to a stop/lot	24.7%	19.3%	13.4%	8.1%	3.8%	2.7%	28.0%
e. Vanpooling	3.8%	10.2%	16.1%	15.6%	4.3%	2.2%	47.8%
f. Walking	1.6%	5.4%	1.6%	3.2%	6.4%	23.7%	58.1%

Table B.2: Frequency of Question 7 Responses for Faculty/Staff Commuter Population (in Percentage)

Alternative/Ranked As:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	7.4%	3.3%	4.9%	6.6%	15.6%	2.4%	59.8%
b. Taking the bus	45.9%	23.8%	12.3%	4.9%	0.0%	0.0%	13.1%
c. Carpooling	19.7%	16.4%	16.4%	6.5%	3.3%	2.5%	35.2%
d. Driving to a stop/lot	22.9%	18.9%	13.1%	9.0%	2.5%	2.5%	31.1%
e. Vanpooling	4.9%	9.0%	14.7%	14.7%	2.5%	2.5%	51.7%
f. Walking	.8%	5.7%	1.7%	2.5%	5.7%	18.0%	65.6%

Table B.3: Frequency of Question 7 Responses for Student Commuter Population (in Percentage)

Alternative/Ranked As:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	4.7%	4.7%	10.9%	10.9%	25.0%	4.7%	39.1%
b. Taking the bus	32.9%	20.4%	12.6%	15.7%	1.6%	1.6%	15.7%
c. Carpooling	28.1%	21.9%	12.5%	6.2%	3.1%	1.6%	26.6%
d. Driving to a stop/lot	28.1%	20.3%	14.1%	6.3%	6.2%	3.1%	21.9%
e. Vanpooling	1.6%	12.5%	18.7%	17.2%	7.8%	1.6%	40.6%
f. Walking	3.1%	4.7%	1.6%	4.7%	7.8%	34.4%	43.7%

Table B.4: Frequency of Question 7 Responses for Kent County Commuter Population (in Percentage)

Alternative/Ranked As:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	0.0%	0.0%	0.0%	0.0%	21.1%	10.5%	68.4%
b. Taking the bus	52.6%	15.8%	5.3%	0.0%	0.0%	0.0%	15.8%
c. Carpooling	26.3%	10.5%	21.1%	5.3%	0.0%	0.0%	36.8%
d. Driving to a stop/lot	21.1%	36.8%	15.8%	10.5%	0.0%	0.0%	15.8%
e. Vanpooling	10.5%	10.5%	15.8%	15.8%	0.0%	0.0%	47.4%
f. Walking	0.0%	0.0%	0.0%	0.0%	10.5%	15.8%	73.7%

Table B.5: Frequency of Question 7 Responses for Town of Narragansett Commuter Population (in Percentage)

Alternative/Ranked As:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	7.4%	3.7%	18.5%	11.1%	14.8%	0.0%	44.5%
b. Taking the bus	29.6%	44.5%	11.1%	3.7%	0.0%	0.0%	11.1%
c. Carpooling	29.7%	25.9%	7.4%	3.7%	0.0%	0.0%	33.3%
d. Driving to a stop/lot	25.9%	7.4%	14.9%	11.1%	11.1%	3.7%	25.9%
e. Vanpooling	0.0%	0.0%	14.8%	14.8%	7.4%	3.7%	59.3%
f. Walking	0.0%	0.0%	0.0%	7.4%	3.7%	29.6%	59.3%

Table B.6: Frequency of Question 7 Responses for Newport County Commuter Population (in Percentage)

Alternative/Ranked As:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	0.0%	0.0%	0.0%	6.7%	26.7%	6.7%	60.0%
b. Taking the bus	33.3%	13.3%	13.3%	26.7%	6.7%	0.0%	6.7%
c. Carpooling	26.7%	20.0%	13.3%	0.0%	0.0%	0.0%	40.0%
d. Driving to a stop/lot	40.0%	26.7%	13.3%	0.0%	0.0%	6.7%	40.0%
e. Vanpooling	0.0%	20.0%	20.0%	20.0%	0.0%	0.0%	40.0%
f. Walking	0.0%	0.0%	13.3%	0.0%	6.7%	26.7%	53.3%

Table B.7: Frequency of Question 7 Responses for Town of North Kingstown Commuter Population (in Percentage)

Alternative/Ranked As:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	0.0%	0.0%	4.8%	9.5%	23.8%	4.8%	57.1%
b. Taking the bus	28.5%	33.3%	4.8%	4.8%	0.0%	4.8%	23.8%
c. Carpooling	19.0%	4.8%	28.5%	4.8%	4.8%	0.0%	38.1%
d. Driving to a stop/lot	33.3%	14.3%	4.8%	9.5%	9.5%	0.0%	28.6%
e. Vanpooling	4.8%	14.2%	14.3%	14.3%	0.0%	0.0%	52.4%
f. Walking	0.0%	0.0%	0.0%	4.8%	4.8%	33.3%	57.1%

Table B.8: Frequency of Question 7 Responses for Providence County Commuter Population (in Percentage)

Alternative/Ranked As:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	4.2%	0.0%	4.2%	0.0%	20.8%	4.2%	66.6%
b. Taking the bus	29.2%	12.5%	25.0%	8.3%	0.0%	0.0%	25.0%
c. Carpooling	25.0%	12.5%	4.2%	8.3%	4.2%	0.0%	45.8%
d. Driving to a stop/lot	37.5%	20.8%	4.2%	8.3%	0.0%	0.0%	29.2%
e. Vanpooling	4.2%	16.6%	12.5%	12.5%	0.0%	4.2%	50.0%
f. Walking	4.2%	4.2%	0.0%	0.0%	4.2%	20.8%	66.6%

Table B.9: Frequency of Question 7 Responses for Town of South Kingstown Commuter Population (in Percentage)

Alternative/Ranked As:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	17.8%	11.1%	11.1%	13.4%	11.1%	2.2%	33.3%
b. Taking the bus	51.1%	17.8%	13.3%	4.5%	0.0%	0.0%	13.3%
c. Carpooling	15.5%	20.0%	17.8%	8.9%	6.7%	6.7%	24.4%
d. Driving to a stop/lot	8.9%	15.5%	15.5%	8.9%	2.2%	6.7%	42.3%
e. Vanpooling	6.7%	8.9%	11.1%	8.9%	11.1%	4.4%	48.9%
f. Walking	4.4%	15.6%	2.2%	6.7%	8.9%	15.6%	46.6%

Table B.10: Frequency of Question 7 Responses for Washington County Commuter Population (in Percentage)

Alternative/Ranked As:	1st	2nd	3rd	4th	5th	6th	No ans.
a. Biking	2.9%	2.9%	2.9%	8.5%	22.8%	0.0%	60.0%
b. Taking the bus	51.5%	20.0%	11.4%	11.4%	0.0%	0.0%	5.7%
c. Carpooling	22.9%	25.7%	14.3%	8.6%	2.8%	2.8%	22.9%
d. Driving to a stop/lot	25.7%	22.9%	20.0%	5.7%	2.8%	0.0%	22.9%
e. Vanpooling	0.0%	8.6%	25.7%	25.7%	2.9%	0.0%	37.1%
f. Walking	0.0%	5.7%	0.0%	0.0%	5.7%	28.6%	60.0%

Appendix C

Table C.1: Frequency of Question 8 Responses for Total Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	22.6%	17.2%	9.1%	7.5%	7.0%	5.4%	4.3%	2.7%	24.2%
b. Establish bikeways and facilities	8.6%	8.1%	3.8%	3.8%	5.4%	4.8%	8.6%	20.4%	36.5%
c. Increase # of buses per route	18.8%	14.0%	11.3%	8.6%	10.2%	3.8%	4.3%	2.7%	26.3
d. Increase # of Park and Ride lots	17.2%	15.6%	8.6%	7.5%	6.4%	5.9%	7.0%	2.1%	29.7
e. Build bus shelters & signs on campus	7.0%	7.0%	10.7%	11.3%	8.6%	9.7%	7.0%	2.1%	36.6
f. Promote carpools and vanpools	9.7%	9.7%	11.3%	7.0%	9.7%	5.9%	5.9%	8.0%	32.8
g. Increase # of express bus routes	15.6%	16.1%	12.9%	10.8%	5.9%	7.0%	1.1%	1.6%	29.0
h. Provide free shuttle in South Kingstown	17.7%	9.7%	5.9%	7.0%	4.3%	7.5%	9.7%	7.5%	30.7

Table C.2: Frequency of Question 8 Responses for Faculty/Staff Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	23.8%	17.2%	6.6%	8.2%	5.7%	3.3%	3.3%	3.3%	28.6%
b. Establish bikeways and facilities	10.6%	6.6%	4.1%	4.1%	4.1%	4.1%	8.2%	16.4%	41.8%
c. Increase # of buses per route	18.8%	10.7%	11.5%	8.2%	9.0%	3.3%	4.9%	1.6%	32.0%
d. Increase # of Park and Ride lots	14.8%	18.9%	5.74%	8.2%	6.6%	5.7%	4.1%	0.0%	36.0%
e. Build bus shelters & signs on campus	7.4%	7.4%	7.4%	9.0%	7.4%	9.8%	7.4%	.8%	43.4%
f. Promote carpools and vanpools	10.7%	7.4%	12.3%	4.9%	8.2%	6.5%	4.1%	8.2%	37.7%
g. Increase # of express bus routes	13.9%	15.6%	13.1%	10.7%	4.9%	5.8%	0.0%	1.6%	34.4%
h. Provide free shuttle in South Kingstown	17.2%	12.3%	4.9%	5.7%	4.9%	4.9%	7.4%	7.4%	35.3%

Table C.3: Frequency of Question 8 Responses for Student Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	20.3%	17.2%	14.1%	6.2%	9.4%	9.4%	6.2%	1.6%	15.6%
b. Establish bikeways and facilities	4.7%	10.9%	3.1%	3.1%	7.8%	6.3%	9.4%	28.1%	26.6%
c. Increase # of buses per route	18.8%	20.3%	10.9%	9.4%	12.5%	4.7%	3.1%	4.7%	15.6%
d. Increase # of Park and Ride lots	21.9%	9.4%	14.1%	6.2%	6.2%	6.2%	12.6%	6.2%	17.2%
e. Build bus shelters & signs on campus	6.2%	6.2%	17.2%	15.6%	11.0%	9.4%	6.2%	4.7%	23.5%
f. Promote carpools and vanpools	7.8%	14.1%	9.4%	11.0%	12.5%	4.7%	9.4%	7.8%	23.5%
g. Increase # of express bus routes	18.8%	17.1%	12.5%	10.9%	7.8%	9.4%	3.1%	1.6%	18.8%
h. Provide free shuttle in South Kingstown	18.7%	4.7%	7.8%	9.4%	3.1%	12.5%	14.1%	7.8%	21.9%

Table C.4: Frequency of Question 8 Responses for Kent County Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	10.5%	36.8%	10.5%	5.3%	5.3%	5.3%	0.0%	0.0%	26.3%
b. Establish bikeways and facilities	5.3%	5.3%	0.0%	0.0%	0.0%	10.5%	10.5%	21.0%	47.4%
c. Increase # of buses per route	31.6%	5.3%	21.0%	5.3%	5.3%	10.5%	0.0%	0.0%	21.0%
d. Increase # of Park and Ride lots	26.3%	10.5%	5.3%	5.3%	10.5%	5.3%	0.0%	0.0%	36.8%
e. Build bus shelters & signs on campus	5.3%	10.5%	5.3%	10.5%	10.5%	5.3%	15.8%	0.0%	36.8%
f. Promote carpools and vanpools	15.8%	5.3%	5.3%	15.8%	15.8%	0.0%	0.0%	10.5%	31.5%
g. Increase # of express bus routes	15.8%	15.8%	21.0%	15.8%	5.3%	5.3%	0.0%	0.0%	21.0%
h. Provide free shuttle in South Kingstown	0.0%	10.5%	0.0%	5.3%	0.0%	5.3%	21.0%	15.8%	42.1%

Table C.5: Frequency of Question 8 Responses for Town of Narragansett Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	25.9%	11.1%	11.1%	3.7%	14.8%	7.4%	3.7%	0.0%	22.2%
b. Establish bikeways and facilities	0.0%	18.5%	3.7%	11.1%	3.7%	7.4%	3.7%	29.6%	22.2%
c. Increase # of buses per route	14.8%	18.5%	7.4%	0.0%	18.5%	0.0%	14.8%	0.0%	25.9%
d. Increase # of Park and Ride lots	14.8%	18.5%	11.1%	3.7%	0.0%	11.1%	14.8%	7.4%	18.5%
e. Build bus shelters & signs on campus	14.8%	7.4%	22.2%	7.4%	11.1%	11.1%	3.7%	0.0%	22.2%
f. Promote carpools and vanpools	0.0%	11.1%	11.1%	7.4%	7.4%	11.1%	11.1%	18.5%	22.2%
g. Increase # of express bus routes	25.9%	7.4%	7.4%	14.8%	11.1%	11.1%	0.0%	3.7%	18.5%
h. Provide free shuttle in South Kingstown	18.5%	14.8%	3.7%	11.1%	0.0%	7.4%	14.8%	7.4%	22.2%

Table C.6: Frequency of Question 8 Responses for Newport County Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	6.7%	6.7%	6.7%	6.7%	6.7%	0.0%	20.0%	0.0%	46.5%
b. Establish bikeways and facilities	0.0%	13.3%	0.0%	0.0%	0.0%	0.0%	13.3%	26.7%	46.7%
c. Increase # of buses per route	13.3%	13.3%	20.0%	13.3%	0.0%	6.7%	0.0%	26.7%	46.7%
d. Increase # of Park and Ride lots	20.0%	13.3%	6.7%	0.0%	20.0%	0.0%	0.0%	0.0%	40.0%
e. Build bus shelters & signs on campus	0.0%	0.0%	6.7%	6.7%	20.0%	20.0%	0.0%	0.0%	46.6%
f. Promote carpools and vanpools	6.7%	6.7%	13.3%	6.7%	0.0%	0.0%	6.7%	6.7%	53.3%
g. Increase # of express bus routes	26.7%	20.0%	13.3%	6.7%	0.0%	6.7%	0.0%	0.0%	26.6%
h. Provide free shuttle in South Kingstown	6.7%	6.7%	0.0%	0.0%	6.7%	13.3%	6.7%	6.7%	53.3%

Table C.7: Frequency of Question 8 Responses for Town of North Kingstown Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	14.3%	14.3%	9.5%	23.8%	0.0%	9.5%	9.5%	0.0%	19.1%
b. Establish bikeways and facilities	0.0%	9.5%	4.7%	0.0%	4.7%	0.0%	14.3%	23.8%	43.0%
c. Increase # of buses per route	23.8%	23.8%	0.0%	4.7%	14.3%	4.7%	0.0%	4.7%	24.0%
d. Increase # of Park and Ride lots	19.0%	9.5%	0.0%	4.7%	4.7%	9.5%	14.3%	4.7%	33.6%
e. Build bus shelters & signs on campus	9.5%	4.7%	19.0%	14.3%	0.0%	14.3%	4.7%	0.0%	33.5%
f. Promote carpools and vanpools	9.5%	0.0%	19.0%	4.7%	23.8%	0.0%	0.0%	4.7%	38.3%
g. Increase # of express bus routes	23.8%	0.0%	0.0%	9.8%	13.3%	4.7%	0.0%	9.5%	38.1%
h. Provide free shuttle in South Kingstown	23.8%	0.0%	0.0%	9.5%	13.3%	4.7%	0.0%	9.5%	38.1%

Table C.8: Frequency of Question 8 Responses for Providence County Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	25.0%	20.8%	8.3%	4.2	12.5	4.2%	0.0%	4.2%	20.8%
b. Establish bikeways and facilities	16.7%	4.2%	0.0%	4.2%	8.3%	4.2%	12.5%	20.8%	29.1%
c. Increase # of buses per route	12.5%	16.7%	12.5%	16.7%	8.3%	4.2%	0.0%	0.0%	29.1%
d. Increase # of Park and Ride lots	33.3%	12.5%	16.7%	12.5%	8.3%	4.2%	0.0%	0.0%	12.5%
e. Build bus shelters & signs on campus	8.3%	4.2%	4.2%	8.3%	16.7%	4.2%	12.5%	12.5%	29.1%
f. Promote carpools and vanpools	4.2%	12.5%	16.7%	12.5%	4.2%	12.5%	4.2%	4.2%	29.1%
g. Increase # of express bus routes	16.7%	25.0%	16.7%	8.3%	4.2%	4.2%	0.0%	4.2%	20.7%
h. Provide free shuttle in South Kingstown	0.0%	0.0%	12.5%	8.3%	0.0%	16.7%	20.8%	4.2%	37.5%

Table C.9: Frequency of Question 8 Responses for South Kingstown Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	15.6%	15.6%	8.9%	8.9%	4.4%	6.7%	4.4%	8.9%	26.6%
b. Establish bikeways and facilities	17.8%	2.2%	4.4%	6.7%	8.9%	4.4%	6.7%	13.3%	35.5%
c. Increase # of buses per route	15.6%	8.9%	11.1%	6.7%	11.1%	4.4%	6.7%	4.4%	31.1%
d. Increase # of Park and Ride lots	8.9%	15.6%	6.7%	8.9%	8.9%	6.7%	6.7%	2.2%	35.5%
e. Build bus shelters & signs on campus	4.4%	11.1%	8.9%	15.6%	2.2%	8.9%	2.2%	2.2%	44.4%
f. Promote carpools and vanpools	13.3%	6.7%	11.1%	2.2%	6.7%	4.4%	11.1%	11.1%	33.3%
g. Increase # of express bus routes	6.7%	22.2%	8.9%	11.1%	6.7%	4.4%	2.2%	0.0%	37.8%
h. Provide free shuttle in South Kingstown	40.0%	17.8%	13.3%	4.4%	6.7%	4.4%	2.2%	0.0%	11.1%

Table C.10: Frequency of Question 8 Responses for Washington County Commuter Population (in Percentage)

Program/Ranked as:	1st	2nd	3rd	4th	5th	6th	7th	8th	No ans.
a. Provide bus routes in new areas	45.7%	17.1%	8.6%	2.9%	5.7%	2.9%	0.0%	0.0%	17.1%
b. Establish bikeways and facilities	8.6%	8.6%	8.6%	0.0%	5.7%	5.7%	5.7%	17.1%	40.0%
c. Increase # of buses per route	22.9%	14.3%	11.4%	14.3%	8.6%	0.0%	2.8%	5.7%	20.0%
d. Increase # of Park and Ride lots	11.4%	22.9%	11.4%	11.4%	0.0%	2.9%	8.6%	0.0%	31.4%
e. Build bus shelters & signs on campus	5.7%	5.7%	8.6%	11.4%	8.6%	8.6%	11.4%	0.0%	40.0%
f. Promote carpools and vanpools	14.3%	8.6%	14.3%	5.7%	8.6%	11.4%	0.0%	2.9%	34.3%
g. Increase # of express bus routes	11.4%	8.6%	2.9%	5.7%	5.7%	5.7%	8.6%	14.3%	37.1%
h. Provide free shuttle in South Kingstown	11.4%	8.6%	2.9%	5.7%	5.7%	5.7%	8.6%	14.3%	37.1%

Appendix D

URI-Air Quality Analysis: Providence - URI

Bus: Providence to URI

Links	Distance (mile)	Bus Trips	Speed	Emission Rate (gm/mile) HC	CO	NOX	Emissions (gms) HC	CO	NOX
Kennedy-6147	8	15	45	1.34	5.78	13.44	160.8	693.6	1612.8
6147-Airport	1.4	15	20	2.59	11.88	14.07	54.39	249.48	295.47
Airport-6147	1.4	15	20	2.59	11.88	14.07	54.39	249.48	295.47
6147-2739	11	15	45	1.34	5.78	13.44	221.1	953.7	2217.6
2739-3406	3.5	15	45	1.34	5.78	13.44	70.35	303.45	705.6
3406-3397	0.8	15	40	1.46	6.09	12.63	17.52	73.08	151.56
3397-3579	2.5	15	40	1.46	6.09	12.63	54.75	228.37	473.62
3579-3577	1.7	15	30	1.86	7.77	12.42	47.43	198.13	316.71
3577-3575	2	15	20	2.59	11.88	14.07	77.7	356.4	422.1
3575-3559	0.3	15	10	3.93	21.8	18.38	17.685	98.1	82.71
3559-3560	0.2	15	10	3.93	21.8	18.38	11.79	65.4	55.14
3560-URI	0.5	15	5	5.01	31.61	22.15	37.575	237.07	166.12
TOTAL	33.3								

Bus: URI to Providence

Links	Distance	Bus Trips	Speed	Emission Rate (gm/mile) HC	CO	NOX	Emissions (gms) HC	CO	NOX
URI-3560	0.5	15	5	5.01	31.61	22.15	37.575	237.07	166.12
3560-3559	0.2	15	10	3.93	21.8	18.38	11.79	65.4	55.14
3559-3575	0.3	15	10	3.93	21.8	18.38	17.685	98.1	82.71
3575-3577	2	15	20	2.59	11.88	14.07	77.7	356.4	422.1
3577-3579	1.7	15	30	1.86	7.77	12.42	47.43	198.13	316.71
3579-3397	2.5	15	40	1.46	6.09	12.63	54.75	228.37	473.62
3397-3406	0.8	15	40	1.46	6.09	12.63	17.52	73.08	151.56
3406-2739	3.5	15	45	1.34	5.78	13.44	70.35	303.45	705.6
2739-6147	11	15	45	1.34	5.78	13.44	221.1	953.7	2217.6
6147-Airport	1.4	15	20	2.59	11.88	14.07	54.39	249.48	295.47
Airport-6147	1.4	15	20	2.59	11.88	14.07	54.39	249.48	295.47
6147-Kennedy	8	15	45	1.34	5.78	13.44	160.8	693.6	1612.8
TOTAL	33.3								

Source: RIDOT, 1993a.

PROVIDENCE

Auto: ~~N.Kingstown~~ to URI

Links	Distance (mile)	Ex-Auto Trips 10.00%	Speed	Emission Rate (gm/mile) HC	CO	NOX	Emissions (gms) HC	CO	NOX
Kennedy-6147	8	39	55	1.51	10.47	2.24	475.76	3298.8	705.76
6147-Airport	1.4	0	30	2.08	14.98	1.69	0	0	0
Airport-6147	1.4	0	30	2.08	14.98	1.69	0	0	0
6147-2739	11	39	55	1.51	10.47	2.24	654.17	4535.8	970.42
2739-3406	3.5	39	55	1.51	10.47	2.24	208.14	1443.2	308.77
3406-3397	0.8	49	50	1.53	10.47	1.9	60.257	412.35	74.830
3397-3579	2.5	51	50	1.53	10.47	1.9	196.37	1343.8	243.86
3579-3577	1.7	60	40	1.73	11.92	1.74	175.81	1211.3	176.82
3477-3575	2	62	30	2.08	14.98	1.69	258.43	1861.2	209.97
3575-3559	0.3	68	20	2.71	21.06	1.62	55.366	430.26	33.097
3559-3560	0.2	71	20	2.71	21.06	1.62	38.740	301.06	23.158
3560-URI	0.5	81	10	4.55	36.28	1.72	185.01	1475.2	69.938
TOTAL	33.3								

Auto: URI to Providence

Links	Distance	Auto Trips	Speed	Emission Rate (gm/mile) HC	CO	NOX	Emissions (gms) HC	CO	NOX
URI-3560	0.5	81	10	4.55	36.28	1.72	185.01	1475.2	69.938
3560-3559	0.2	71	20	2.71	21.06	1.62	38.740	301.06	23.158
3559-3575	0.3	68	20	2.71	21.06	1.62	55.366	430.26	33.097
3575-3577	2	62	30	2.08	14.98	1.69	258.43	1861.2	209.97
3577-3579	1.7	60	40	1.73	11.92	1.74	175.81	1211.3	176.82
3579-3397	2.5	51	50	1.53	10.47	1.9	196.37	1343.8	243.86
3397-3406	0.8	49	50	1.53	10.47	1.9	60.257	412.35	74.830
3406-2739	3.5	39	55	1.51	10.47	2.24	208.14	1443.2	308.77
2739-6147	11	39	55	1.51	10.47	2.24	654.17	4535.8	970.42
6147-Airport	1.4	0	30	2.08	14.98	1.69	0	0	0
Airport-6147	1.4	0	30	2.08	14.98	1.69	0	0	0
6147-Kennedy	8	39	55	1.51	10.47	2.24	475.76	3298.8	705.76
	33.3								

Source: RIDOT, 1993a.

URI-Air Quality Analysis: Newport

Bus: Newport to URI

Links	Distance (mile)	Bus Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
Newport-6460	0.8	9	5	5.01	31.61	22.15	36.072	227.59	159.48
6460-3382	5.6	9	30	1.86	7.77	12.42	93.744	391.60	625.96
3382-3381	2	9	25	2.17	9.39	12.99	39.06	169.02	233.82
3381-3389	2.5	9	35	1.63	6.72	12.3	36.675	151.2	276.75
3389-3432	4.5	9	25	2.17	9.39	12.99	87.885	380.29	526.09
3432-3579	2	9	25	2.17	9.39	12.99	39.06	169.02	233.82
3579-3577	1.7	9	30	1.86	7.77	12.42	28.458	118.88	190.02
3577-3575	2	9	20	2.59	11.88	14.07	46.62	213.84	253.26
3575-3559	0.3	9	10	3.93	21.8	18.38	10.611	58.86	49.626
3559-3560	0.2	9	10	3.93	21.8	18.38	7.074	39.24	33.084
3560-URI	0.5	9	5	5.01	31.61	22.15	22.545	142.24	99.675
TOTAL	22.1								

Bus: URI to Newport

Links	Distance	Bus Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
URI-3560	0.5	9	5	5.01	31.61	22.15	22.545	142.24	99.675
3560-3559	0.2	9	10	3.93	21.8	18.38	7.074	39.24	33.084
3559-3575	0.3	9	10	3.93	21.8	18.38	10.611	58.86	49.626
3575-3577	2	9	20	2.59	11.88	14.07	46.62	213.84	253.26
3577-3579	1.7	9	30	1.86	7.77	12.42	28.458	118.88	190.02
3579-3432	2	9	25	2.17	9.39	12.99	39.06	169.02	233.82
3432-3389	4.5	9	25	2.17	9.39	12.99	87.885	380.29	526.09
3389-3381	2.5	9	35	1.63	6.72	12.3	36.675	151.2	276.75
3381-3382	2	9	25	2.17	9.39	12.99	39.06	169.02	233.82
3382-6460	5.6	9	30	1.86	7.77	12.42	93.744	391.60	625.96
6460-Newport	0.8	9	5	5.01	31.61	22.15	36.072	227.59	159.48

Source: RIDOT, 1993a.

TOTAL	22.1

Auto: Newport to URI

Links	Distance (mile)	Ex-Auto Trips 10.00%	Speed	Emission Rate (gm/mile) HC	CO	NOX	Emissions (gms) HC	CO	NOX
Newport-6460	0.8	13	10	4.55	36.28	1.72	46.079	367.42	17.419
6460-3382	5.6	18	40	1.73	11.92	1.74	177.15	1220.5	178.17
3382-3381	2	35	35	1.89	13.22	1.72	132.92	929.75	120.96
3381-3389	2.5	45	45	1.61	10.94	1.75	181.16	1231.0	196.92
3389-3432	4.5	51	35	1.89	13.22	1.72	430.66	3012.3	391.92
3432-3579	2	79	35	1.89	13.22	1.72	300.40	2101.2	273.38
3579-3577	1.7	88	40	1.73	11.92	1.74	258.54	1781.4	260.04
3577-3575	2	90	30	2.08	14.98	1.69	375.46	2704.0	305.06
3575-3559	0.3	96	20	2.71	21.06	1.62	78.237	608.00	46.769
3559-3560	0.2	100	20	2.71	21.06	1.62	53.988	419.55	32.273
3560-URI	0.5	109	10	4.55	36.28	1.72	249.01	1985.5	94.131
TOTAL	22.1								

Auto: URI to Newport

Links	Distance	Auto Trips	Speed	Emission Rate (gm/mile) HC	CO	NOX	Emissions (gms) HC	CO	NOX
URI-3560	0.5	109	10	4.55	36.28	1.72	249.01	1985.5	94.131
3560-3559	0.2	100	20	2.71	21.06	1.62	53.988	419.55	32.273
3559-3575	0.3	96	20	2.71	21.06	1.62	78.237	608.00	46.769
3575-3577	2	90	30	2.08	14.98	1.69	375.46	2704.0	305.06
3577-3579	1.7	88	40	1.73	11.92	1.74	258.54	1781.4	260.04
3579-3432	2	79	35	1.89	13.22	1.72	300.40	2101.2	273.38
3432-3389	4.5	51	35	1.89	13.22	1.72	430.66	3012.3	391.92
3389-3381	2.5	45	45	1.61	10.94	1.75	181.16	1231.0	196.92
3381-3382	2	35	35	1.89	13.22	1.72	132.92	929.75	120.96
3382-6460	5.6	18	40	1.73	11.92	1.74	177.15	1220.5	178.17
6460-Newport	0.8	13	10	4.55	36.28	1.72	46.079	367.42	17.419
TOTAL	22.1								

Source: RIDOT, 1993a.

URI-Air Quality Analysis

Bus:Bonnett Shores-URI-Kingston Station

Links	Distance (mile)	Bus Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
Bay Campus-3432	1	9	10	3.93	21.8	18.38	35.37	196.2	165.42
3432-3438	0.8	9	20	2.59	11.88	14.07	18.648	85.536	101.30
3438-3454	4.5	9	15	3.16	15.73	15.8	127.98	637.06	639.9
3454-3448	1.1	9	15	3.16	15.73	15.8	31.284	155.72	156.42
3448-3491	0.9	9	20	2.59	11.88	14.07	20.979	96.228	113.96
3491-3498	0.8	9	20	2.59	11.88	14.07	18.648	85.536	101.30
3498-3509	1.1	9	15	3.16	15.73	15.8	31.284	155.72	156.42
3509-3557a	1.7	9	20	2.59	11.88	14.07	39.627	181.76	215.27
3557a-3557	1.7	9	20	2.59	11.88	14.07	39.627	181.76	215.27
2557-3559	1.8	9	20	2.59	11.88	14.07	41.958	192.45	227.93
3559-3560	0.2	9	10	3.93	21.8	18.38	7.074	39.24	33.084
3560-URI	0.5	9	5	5.01	31.61	22.15	22.545	142.24	99.675
URI-3560	0.5	9	5	5.01	31.61	22.15	22.545	142.24	99.675
3560-3562	1.3	9	20	2.59	11.88	14.07	30.303	138.99	164.61
3562-Kingston	0.5	9	20	2.59	11.88	14.07	11.655	53.46	63.315
TOTAL	18.4						499.52	2484.1	2553.5

Bus: Kingston-URI-Bonnett Shores

Links	Distance	Bus Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
Kingston-3562	0.5	9	20	2.59	11.88	14.07	11.655	53.46	63.315
3562-3560	1.3	9	20	2.59	11.88	14.07	30.303	138.99	164.61
3560-URI	0.5	9	5	5.01	31.61	22.15	22.545	142.24	99.675
URI-3560	0.5	9	5	5.01	31.61	22.15	22.545	142.24	99.675

3560-3559	0.2	9	10	3.93	21.8	18.38	7.074	39.24	33.084
3559-3557	1.8	9	20	2.59	11.88	14.07	41.958	192.45	227.93
3557-3557a	1.7	9	20	2.59	11.88	14.07	39.627	181.76	215.27
3557a-3509	1.7	9	20	2.59	11.88	14.07	39.627	181.76	215.27
3509-3498	1.1	9	15	3.16	15.73	15.8	31.284	155.72	156.42
3498-3491	0.8	9	20	2.59	11.88	14.07	18.648	85.536	101.30
3491-3448	0.9	9	20	2.59	11.88	14.07	20.979	96.228	113.96
3448-3454	1.1	9	15	3.16	15.73	15.8	31.284	155.72	156.42
3454-3438	4.5	9	15	3.16	15.73	15.8	127.98	637.06	639.9
3438-3432	0.8	9	20	2.59	11.88	14.07	18.648	85.536	101.30
3432-Bay Campus	1	9	10	3.93	21.8	18.38	35.37	196.2	165.42
TOTAL	18.4						499.52	2484.1	2553.5

Source: RIDOT, 1993a.

Auto:Bonnett Shores-URI-Kingston Station

Links	Distance (mile)	Ex-Auto Trips 10.00%Pier 5.00%Bay	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX	VMT's
Bay Campus-3432	1	0	20	2.71	21.06	1.62	0	0	0	0
3432-3438	0.8	11	30	2.08	14.98	1.69	18.139	130.63	14.738	9
3438-3454	4.5	36	25	2.34	17.44	1.66	381.39	2842.5	270.55	163
3454-3448	1.1	46	25	2.34	17.44	1.66	118.57	883.72	84.115	51
3448-3491	0.9	78	30	2.08	14.98	1.69	146.79	1057.2	119.27	71
3491-3498	0.8	100	30	2.08	14.98	1.69	165.59	1192.5	134.54	80
3498-3509	1.1	108	25	2.34	17.44	1.66	277.87	2071.0	197.12	119
3509-3557a	1.7	123	30	2.08	14.98	1.69	433.95	3125.2	352.58	209
3557a-3557	1.7	130	30	2.08	14.98	1.69	458.82	3304.3	372.79	221
3557-3559	1.8	156	30	2.08	14.98	1.69	585.86	4219.3	476.01	282
3559-3560	0.2	160	20	2.71	21.06	1.62	86.643	673.32	51.793	32
3560-URI	0.5	170	15	3.39	26.15	1.65	288.12	2222.5	140.23	85
URI-3560	0.5	10	15	3.39	26.15	1.65	16.95	130.75	8.25	5
3560-3562	1.3	0	30	2.08	14.98	1.69	0	0	0	0
3562-Kingston	0.5	0	30	2.08	14.98	1.69	0	0	0	0
TOTAL	18.4									1324

Auto: Kingston-URI-Bonnett Shores

Links	Distance	Auto Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX	
Kingston-3562	0.5	0	30	2.08	14.98	1.69	0	0	0	0
3562-3560	1.3	0	30	2.08	14.98	1.69	0	0	0	0
3560-URI	0.5	10	15	3.39	26.15	1.65	16.95	130.75	8.25	5
URI-3560	0.5	170	15	3.39	26.15	1.65	288.12	2222.5	140.23	85
3560-3559	0.2	160	20	2.71	21.06	1.62	86.643	673.32	51.793	32
3559-3557	1.8	156	30	2.08	14.98	1.69	585.86	4219.3	476.01	282

3557-3557a	1.7	130	30	2.08	14.98	1.69	458.82	3304.3	372.79	221
3557a-3509	1.7	123	30	2.08	14.98	1.69	433.95	3125.2	352.58	209
3509-3498	1.1	108	25	2.34	17.44	1.66	277.87	2071.0	197.12	119
3498-3491	0.8	100	30	2.08	14.98	1.69	165.59	1192.5	134.54	80
3491-3448	0.9	78	30	2.08	14.98	1.69	146.79	1057.2	119.27	71
3448-3454	1.1	46	25	2.34	17.44	1.66	118.57	883.72	84.115	51
3454-3438	4.5	36	25	2.34	17.44	1.66	381.39	2842.5	270.55	163
3438-3432	0.8	11	30	2.08	14.98	1.69	18.139	130.63	14.738	9
3432-Bay Campus	1	0	20	2.71	21.06	1.62	0	0	0	0
	18.4									1324

Source: RIDOT, 1993a.

URI-Air Quality Analysis

Bus:Galilee-URI

Links	Distance (mile)	Bus Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
Galilee-3468	1.5	16	25	2.17	9.39	12.99	52.08	225.36	311.76
3468-3475	1.5	16	30	1.86	7.77	12.42	44.64	186.48	298.08
3475-3483	2.5	16	30	1.86	7.77	12.42	74.4	310.8	496.8
3483-3498	1.5	16	25	2.17	9.39	12.99	52.08	225.36	311.76
3498-3503	1	16	15	3.16	15.73	15.8	50.56	251.68	252.8
3503-3509	1.2	16	15	3.16	15.73	15.8	60.672	302.01	303.36
3509-3505	1.2	16	15	3.16	15.73	15.8	60.672	302.01	303.36
3505-3588	1.6	16	20	2.59	11.88	14.07	66.304	304.12	360.19
3588-3575	1.4	16	20	2.59	11.88	14.07	58.016	266.11	315.16
3575-3559	0.3	16	10	3.93	21.8	18.38	18.864	104.64	88.224
3559-3560	0.2	16	10	3.93	21.8	18.38	12.576	69.76	58.816
3560-URI	0.5	16	5	5.01	31.61	22.15	40.08	252.88	177.2
TOTAL	14.4								

Bus: URI-Galilee

Links	Distance	Bus Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
URI-3560	0.5	16	5	5.01	31.61	22.15	40.08	252.88	177.2
3560-3559	0.2	16	10	3.93	21.8	18.38	12.576	69.76	58.816
3559-3575	0.3	16	10	3.93	21.8	18.38	18.864	104.64	88.224
3575-3588	1.4	16	20	2.59	11.88	14.07	58.016	266.11	315.16
3588-3505	1.6	16	20	2.59	11.88	14.07	66.304	304.12	360.19
3505-3509	1.2	16	15	3.16	15.73	15.8	60.672	302.01	303.36

3509-3503	1.2	16	15	3.16	15.73	15.8	60.672	302.01	303.36
3503-3498	1	16	15	3.16	15.73	15.8	50.56	251.68	252.8
3498-3483	1.5	16	25	2.17	9.39	12.99	52.08	225.36	311.76
3483-3475	2.5	16	30	1.86	7.77	12.42	74.4	310.8	496.8
3475-3468	1.5	16	30	1.86	7.77	12.42	44.64	186.48	298.08
3468-Galilee	1.5	16	25	2.17	9.39	12.99	52.08	225.36	311.76
TOTAL	14.4								

Source: RIDOT, 1993a.

Auto:Galilee-URI

Links	Distance (mile)	Ex-Auto Trips 10.00%	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX	VMT's
Galilee-3468	1.5	0	35	1.89	13.22	1.72	0	0	0	0
3468-3475	1.5	20	40	1.73	11.92	1.74	51.101	352.09	51.396	30
3475-3483	2.5	58	40	1.73	11.92	1.74	249.42	1718.5	250.86	144
3483-3498	1.5	91	35	1.89	13.22	1.72	259.19	1813.0	235.88	137
3498-3503	1	99	25	2.34	17.44	1.66	232.04	1729.4	164.61	99
3503-3509	1.2	106	25	2.34	17.44	1.66	298.20	2222.4	211.54	127
3509-3505	1.2	120	25	2.34	17.44	1.66	335.72	2502.1	238.16	143
3505-3588	1.6	129	30	2.08	14.98	1.69	430.66	3101.5	349.91	207
3588-3575	1.4	142	30	2.08	14.98	1.69	413.69	2979.3	336.12	199
3575-3559	0.3	148	20	2.71	21.06	1.62	120.35	935.33	71.948	44
3559-3560	0.2	151	20	2.71	21.06	1.62	82.068	637.77	49.059	30
3560-URI	0.5	160	10	4.55	36.28	1.72	363.67	2899.8	137.47	80
TOTAL	14.4									1241

Auto: URI-Galilee

Links	Distance	Auto Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX	VMT's
URI-3560	0.5	160	10	4.55	36.28	1.72	363.67	2899.8	137.47	80
3560-3559	0.2	151	20	2.71	21.06	1.62	82.068	637.77	49.059	30
3559-3575	0.3	148	20	2.71	21.06	1.62	120.35	935.33	71.948	44
3575-3588	1.4	142	30	2.08	14.98	1.69	413.69	2979.3	336.12	199
3588-3505	1.6	129	30	2.08	14.98	1.69	430.66	3101.5	349.91	207
3505-3509	1.2	120	25	2.34	17.44	1.66	335.72	2502.1	238.16	143

3509-3503	1.2	106	25	2.34	17.44	1.66	298.20	2222.4	211.54	127
3503-3498	1	99	25	2.34	17.44	1.66	232.04	1729.4	164.61	99
3498-3483	1.5	91	35	1.89	13.22	1.72	259.19	1813.0	235.88	137
3483-3475	2.5	58	40	1.73	11.92	1.74	249.42	1718.5	250.86	144
3475-3468	1.5	20	40	1.73	11.92	1.74	51.101	352.09	51.396	30
3468-Galilee	1.5	0	35	1.89	13.22	1.72	0	0	0	0
TOTAL	14.4									1241

Source: RIDOT, 1993a.

URI-Air Quality Analysis

Route: Airport Park-n-Ride

Bus: Airport to URI

Links	Distance (mile)	Bus Trips	Speed	Emission Rate (gm/mile)			Emmissions (gms)		
				HC	CO	NOX	HC	CO	NOX
PnR-6147	3	6	20	2.59	11.88	14.07	46.62	213.84	253.26
6147-6111	1	6	45	1.34	5.78	13.44	8.04	34.68	80.64
6111-6064	1.8	6	45	1.34	5.78	13.44	14.472	62.424	145.15
6064-3027	3.2	6	40	1.46	6.09	12.63	28.032	116.92	242.49
3027-2739	2.5	6	40	1.46	6.09	12.63	21.9	91.35	189.45
2739-3573	7.5	6	40	1.46	6.09	12.63	65.7	274.05	568.35
3573-3565	1	6	20	2.59	11.88	14.07	15.54	71.28	84.42
3565-3562	0.5	6	20	2.59	11.88	14.07	7.77	35.64	42.21
3562-3560	1.3	6	20	2.59	11.88	14.07	20.202	92.664	109.74
3560-URI	0.5	6	5	5.01	31.61	22.15	15.03	94.83	66.45
TOTAL	22.3								

Bus: URI-Airport

Links	Distance	Bus Trips	Speed	Emission Rate (gm/mile)			Emmissions (gms)		
				HC	CO	NOX	HC	CO	NOX
URI-3560	0.5	6	5	5.01	31.61	22.15	15.03	94.83	66.45
3560-3562	1.3	6	20	2.59	11.88	14.07	20.202	92.664	109.74
3562-3565	0.5	6	20	2.59	11.88	14.07	7.77	35.64	42.21
3565-3573	1	6	20	2.59	11.88	14.07	15.54	71.28	84.42
3573-2739	7.5	6	40	1.46	6.09	12.63	65.7	274.05	568.35
2739-3027	2.5	6	40	1.46	6.09	12.63	21.9	91.35	189.45
3027-6064	3.2	6	40	1.46	6.09	12.63	28.032	116.92	242.49
6064-6111	1.8	6	45	1.34	5.78	13.44	14.472	62.424	145.15
6111-6147	1	6	45	1.34	5.78	13.44	8.04	34.68	80.64
6147-PnR	3	6	20	2.59	11.88	14.07	46.62	213.84	253.26
TOTAL	22.3								

Source: RIDOT, 1993a.

Auto: Airport to URI

Links	Distance (mile)	Ex-Auto Trips 10.00%	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
PnR-6147	3	17	30	2.08	14.98	1.69	105.32	758.54	85.576
6147-6111	1	17	55	1.51	10.47	2.24	25.487	176.72	37.808
6111-6064	1.8	21	55	1.51	10.47	2.24	57.346	397.62	85.070
6064-3027	3.2	21	50	1.53	10.47	1.9	103.29	706.89	128.28
3027-2739	2.5	41	50	1.53	10.47	1.9	156.02	1067.7	193.75
2739-3573	7.5	65	50	1.53	10.47	1.9	742.46	5080.7	922.01
3573-3565	1	91	30	2.08	14.98	1.69	190.16	1369.5	154.51
3565-3562	0.5	91	30	2.08	14.98	1.69	95.084	684.79	77.256
3562-3560	1.3	91	30	2.08	14.98	1.69	247.22	1780.4	200.86
3560-URI	0.5	101	10	4.55	36.28	1.72	230.39	1837.1	87.095
TOTAL	22.3								

Auto: URI to Airport

Links	Distance	Auto Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
URI-3560	0.5	101	10	4.55	36.28	1.72	230.39	1837.1	87.095
3560-3562	1.3	91	30	2.08	14.98	1.69	247.22	1780.4	200.86
3562-3565	0.5	91	30	2.08	14.98	1.69	95.084	684.79	77.256
3565-3573	1	91	30	2.08	14.98	1.69	190.16	1369.5	154.51
3573-2739	7.5	65	50	1.53	10.47	1.9	742.46	5080.7	922.01
2739-3027	2.5	41	50	1.53	10.47	1.9	156.02	1067.7	193.75
3027-6064	3.2	21	50	1.53	10.47	1.9	103.29	706.89	128.28
6064-6111	1.8	21	55	1.51	10.47	2.24	57.346	397.62	85.070
6111-6147	1	17	55	1.51	10.47	2.24	25.487	176.72	37.808
6147-PnR	3	17	30	2.08	14.98	1.69	105.32	758.54	85.576

Source: RIDOT, 1993a.

URI-Air Quality Analysis

Route: Hope Valley Park-n-Ride

Bus: Hope-Valley to URI

Links	Distance (mile)	Bus Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
PnR-3628	0.5	6	10	3.93	21.8	18.38	11.79	65.4	55.14
3628-3627	2.3	6	20	2.59	11.88	14.07	35.742	163.94	194.16
3627-3569	3.1	6	20	2.59	11.88	14.07	48.174	220.96	261.70
3569-3573	1.9	6	20	2.59	11.88	14.07	29.526	135.43	160.39
3573-3565	1	6	20	2.59	11.88	14.07	15.54	71.28	84.42
3565-3562	0.5	6	20	2.59	11.88	14.07	7.77	35.64	42.21
3562-3560	1.3	6	20	2.59	11.88	14.07	20.202	92.664	109.74
3560-URI	0.5	6	5	5.01	31.61	22.15	15.03	94.83	66.45
TOTAL	11.1								

Bus: URI-Hope Valley

Links	Distance	Bus Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
URI-3560	0.5	6	5	5.01	31.61	22.15	15.03	94.83	66.45
3560-3562	1.3	6	20	2.59	11.88	14.07	20.202	92.664	109.74
3562-3565	0.5	6	20	2.59	11.88	14.07	7.77	35.64	42.21
3565-3573	1	6	20	2.59	11.88	14.07	15.54	71.28	84.42
3573-3569	1.9	6	20	2.59	11.88	14.07	29.526	135.43	160.39
3569-3627	3.1	6	20	2.59	11.88	14.07	48.174	220.96	261.70
3627-3628	2.3	6	20	2.59	11.88	14.07	35.742	163.94	194.16
3560-PnR	0.5	6	10	3.93	21.8	18.38	11.79	65.4	55.14
TOTAL	11.1								

Source: RIDOT, 1993a.

Auto: Hope-Valley to URI

Links	Distance (mile)	Ex-Auto Trips 10.00%	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
PnR-3628	0.5	15	30	2.08	14.98	1.69	16.091	115.88	13.074
3628-3627	2.3	21	30	2.08	14.98	1.69	100.93	726.93	82.010
3627-3569	3.1	30	30	2.08	14.98	1.69	190.46	1371.6	154.75
3569-3573	1.9	30	30	2.08	14.98	1.69	116.73	840.71	94.847
3573-3565	1	56	30	2.08	14.98	1.69	117.02	842.82	95.084
3565-3562	0.5	56	30	2.08	14.98	1.69	58.513	421.41	47.542
3562-3560	1.3	56	30	2.08	14.98	1.69	152.13	1095.6	123.61
3560-URI	0.5	66	10	4.55	36.28	1.72	150.39	1199.2	56.854

Auto: Hope-Valley to URI

Links	Distance	Ex-Auto Trips	Speed	Emmission Rate (gm/mile) HC	CO	NOX	Emmissions (gms) HC	CO	NOX
URI-3560	0.5	66	10	4.55	36.28	1.72	150.39	1199.2	56.854
3560-3562	1.3	56	30	2.08	14.98	1.69	152.13	1095.6	123.61
3562-3565	0.5	56	30	2.08	14.98	1.69	58.513	421.41	47.542
3565-3573	1	56	30	2.08	14.98	1.69	117.02	842.82	95.084
3573-3569	1.9	30	30	2.08	14.98	1.69	116.73	840.71	94.847
3569-3627	3.1	30	30	2.08	14.98	1.69	190.46	1371.6	154.75
3627-3628	2.3	21	30	2.08	14.98	1.69	100.93	726.93	82.010
3560-PnR	0.5	15	30	2.08	14.98	1.69	16.091	115.88	13.074
	11.1								

Source: RIDOT, 1993a.

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