

*Technical Memorandum:*

**South Portland Bus Service (SPBS)  
Passenger On/Off Survey**



*Prepared by:*  
**Greater Portland Council of Governments**

*In Cooperation with:*  
**South Portland Bus Service (SPBS)**

*Prepared for:*  
**South Portland Bus Service (SPBS)  
Portland Area Comprehensive Transportation Committee (PACTS)  
Maine Department of Transportation (MDOT)**

December, 2003

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*The contents of this document reflects the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the views of the Federal Transit Administration, Federal Highway Administration or the Maine Department of Transportation. This project does not constitute a standard, specification or regulation.*

# **SOUTH PORTLAND BUS SERVICE ON/OFF PASSENGER SURVEY 2003**

## **Table of Contents**

<b>A. INTRODUCTION</b>	<b>1</b>
<b>Overview</b>	<b>1</b>
<b>Purpose</b>	<b>1</b>
<b>Methodology</b>	<b>1</b>
Exhibit I: Sample Completed SPBS On/Off Staff Survey Form	
<b>B. SUMMARY ON/OFF SURVEY RESULTS</b>	<b>3</b>
<b>Boardings/Departures - On/Off System-wide Totals vs. Monthly Farebox Totals</b>	<b>3</b>
Exhibit II: SPBS Ridership Compared to On/Off Ridership	
<b>Boardings/Departures - On/Off Totals by Route and Day</b>	<b>4</b>
Exhibit III: Boardings by Route and Day	
Exhibit IV: Percentage of Weekday Boardings by Route	
Exhibit V: Percentage of Saturday Boardings by Route	
<b>Passenger Boardings by Time of Day</b>	<b>6</b>
Exhibit VI: Passenger Boardings by Time of Day	
<b>Boardings per Hour</b>	<b>7</b>
Exhibit VII: Average Boardings per Hour by Route and Day	
<b>Passenger Mileage</b>	<b>8</b>
Exhibit VIII: Passenger Mileage by Route and Day	
Exhibit IX: Percentage of Weekday Passenger Mileage by Route	
Exhibit X: Percentage of Saturday Passenger Mileage by Route	
<b>Average Trip Distance</b>	<b>10</b>
Exhibit XI: SPBS Average Trip Distance	
Exhibit XII: SPBS Round-Trip Mileage by Route	
<b>Productivity Metrics</b>	<b>11</b>
Exhibit XIII: Daily Trip Miles	
Exhibit XIV: Daily Trips	
Exhibit XV: Daily Trip Hours	
Exhibit XVI: Daily Service Hours	
Exhibit XVII: Boardings per Mile	
Exhibit XVIII: Average Boardings per Trip	

## **LIST OF APPENDICES**

**NOTE: This version of the report does not include Appendices.**

### **APPENDIX A: SPBS ROUTE MAPS**

Route One:	Willard Square
Route Three:	Crosstown
Route Four:	Maine Mall

### **APPENDIX B: SPBS ROUTE SCHEDULE & TIMETABLE**

### **APPENDIX C: SAMPLE SURVEY INSTRUMENT**

### **APPENDIX D: RIDERSHIP COMPARISONS BETWEEN '01 AND '03**

Exhibit I:	SPBS Monthly Ridership for April 2001 compared to April - June 2003
Exhibit II:	Survey Ridership for April 2001 compared to April - June 2003

### **APPENDIX E: PASSENGER BOARDINGS/DEPARTURES BY TIME OF DAY**

Exhibit I:	Route One: Weekdays
Exhibit II:	Route Three: Weekdays
Exhibit III:	Route Four: Weekdays
Exhibit IV:	Combined Weekday Boardings/Departures
Exhibit V:	Route One: Saturday
Exhibit VI:	Route Four: Saturday
Exhibit VII:	Route One/Four: Saturdays
Exhibit VIII:	Weekday Boardings by Time of Day
Exhibit IX:	Saturday Boardings by Time of Day

### **APPENDIX F: 2001 SPBS ON/OFF SURVEY SUMMARY TABLES**

Table 1:	Weekday Boardings by Time of Day
Table 2:	Weekday Boardings by Bus Roundtrip
Table 3:	Weekday Passenger Miles
Table 4:	Weekday Boardings per Hour
Table 5:	Weekday Bus Hours
Table 6:	Saturday Boardings and Passenger Miles
Table 7:	Saturday Boardings by Bus Roundtrip
Table 8:	Saturday Boardings per Hour
Table 9:	Saturday Bus Hours

### **APPENDIX G: ROUTE INFORMATION BY STOP**

Ten Most Highly Used Stop Locations - Outbound and Inbound Trips
Route 1: Weekday
Route 1: Saturday
Route 3: Weekday
Route 4: Weekday
Route 4: Saturday

### **APPENDIX H: PASSENGER ON/OFF SURVEY 2003 - CONDENSED SUMMARY**

## **A. INTRODUCTION**

### **Overview**

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Every two years, the Greater Portland Council of Governments (GPCOG) conducts the On/Off Passenger Survey on behalf of the South Portland Bus Service (SPBS). The On/Off Survey counts the number of persons boarding and alighting a South Portland bus and derives from these counts other useful bus route and stop information. One example is average bus trip length in passenger miles, which is required for reporting to the Federal Transit Administration.

The survey is historically known as the “Brown Sheet Survey”, named after brown-colored spreadsheets displaying the results of the early surveys. The GPCOG Transportation Planning Division conducts the On/Off Survey as part of its role to provide planning assistance to the public transit operators in the region.

### **Purpose**

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The purpose of the survey is twofold:

- 1) to prepare an estimate of system-wide passenger miles for federal reporting requirements, and
- 2) to provide stop-frequency data for planning passenger amenities such as bus shelters, bus stops and information kiosks.

### **Methodology**

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The On/Off Survey is generally conducted in April, which is considered to be a typical month for transit ridership. The survey requires about 74 on-bus personnel hours to cover the entire SPBS system. Staff positions are filled by GPCOG staff as well as temporary personnel. The survey is conducted in conjunction with the METRO On/Off survey to optimize the effort necessary to collect data.

Each run on each route is surveyed once during the course of the survey. Data gathering is scheduled into roughly four-hour blocks allowing surveyors to work up to two “jobs” per day with a break in the middle. Weekday and Saturday routes are treated as independent routes in the survey. Appendix A contains maps for each route of the SPBS system. Appendix B contains a copy of a SPBS route schedule.

Survey staffers ride the SPBS buses and count the persons boarding and departing at each stop for an entire route day. This information is collected and marked on a survey sheet designed specifically for each bus and route. Exhibit I shows a portion of a completed sample survey sheet with an explanation of the sheet design. A copy of an entire blank survey form can be found in Appendix C.

## Exhibit I Sample Completed SPBS On/Off Staff Survey Form

2001 SPBS ON/OFF SURVEY OF ROUTE 1: WILLARD SQUARE			
<b>WEEKDAY SERVICE</b>			
		<b>TRIP SEQUENCE</b>	Out: 7:10 AM
		<b>DIRECTION</b>	In: 7:40 AM
Bus 101	<b>SCHEDULED TIME</b>		
<b>BUS STOPS</b>		<b>ON</b>	<b>OFF</b>
<b>PASSENGERS ALREADY ON</b>			3
HIGH & CONGRESS	HARMON'S FLORIST	I	
536 CONGRESS	OLD 5 & 10		
MONUMENT SQUARE	BUS SHELTER	III	
CASCO BANK	POLE # 557		
TEMPLE & FEDERAL	POLE # 8		II
TEMPLE, FREE, SPRING	POLE #		
CROSS & FORE	POLES #18, 19		II
GLOBE'S RESTAURANT	POLE # 1/2		I
75 YORK STREET	MID-BLOCK		
<b>PASSENGERS REMAINING</b>			1
Next Scheduled Trip			7:54 AM

The SPBS On/Off Survey directly collects two main statistics: boardings (a.k.a. “Ridership, or “Number of Passengers”) and departures (a.k.a. “Offs”). The boarding/departure information is entered into a Microsoft Excel Spreadsheet that automatically calculates passenger mileage and other summary information. Passenger mileage information is calculated exclusively from the On/Off Survey data, and describes total bus ridership in terms of distance or passenger miles (i.e., five people riding a bus for one mile = five passenger miles).

Since 1999, using GPCOG's Geographic Information Systems (GIS) capabilities, the mapping department was able to plot each stop and measure the distance between them to the nearest one hundredth of a mile. These distances are utilized in the spreadsheet calculations and updated whenever there are changes to the routes. It is anticipated that this detailed mapping will have many more uses as SPBS embarks on Intelligent Transportation System (ITS) applications for transit.

Route passenger mileage is the summation of the passenger mileage at the individual stop. It should be noted that “passenger mileage” is an aggregate statistic, and thus does not describe riding characteristics of any individual passenger.

Although the On/Off Survey provides merely a “snapshot” of route characteristics for the day the survey is conducted, there is a strong correlation between the route ridership distributions of the On/Off survey and the actual “fare box” ridership counts for the same time period.

## B. SUMMARY ON/OFF SURVEY RESULTS\*

### Boardings/Departures - On/Off System-wide Totals vs. Monthly Fare-Box Totals

The primary set of system-wide descriptive statistics collected by the On/Off Survey is passenger boardings. Departures are the natural counterpart to passenger boardings, but because departures are roughly equivalent to boardings, reporting both sets of data is redundant in most cases.

The On/Off Survey counted 876 total boardings during the sample period. Exhibit II displays ridership distributions by route comparing it to actual farebox ridership counts for the same period. Overall ridership for the months of April through June increased by 14% over the same period in 2001. The distribution of ridership among routes for the 2003 survey remained within 2% of that for 2001. The actual number of boardings for the months in 2003 increased by 18%, (Route One), 31%, (Route Three) and 10%, (Route Four), compared to 2001.

The number of passengers “captured” by the survey in 2003 was 8.6% higher than in 2001. Tables comparing the surveys of the last several years are in Appendix D.

<b>Exhibit II</b>				
<b>SPBS Actual Boardings Compared to On/Off Boardings</b>				
<b>SPBS Actual Boardings April - June 2003</b>			<b>On/Off Survey Totals</b>	
<b>Route</b>	<b>Actual Ridership</b>	<b>Percentage</b>	<b>Survey Ridership</b>	<b>Percentage</b>
1	12,436	29%	297	34%
3	4,181	10%	27	3%
4	26,137	61%	552	63%
<b>Total</b>	<b>42,754</b>	100%	<b>876</b>	100%

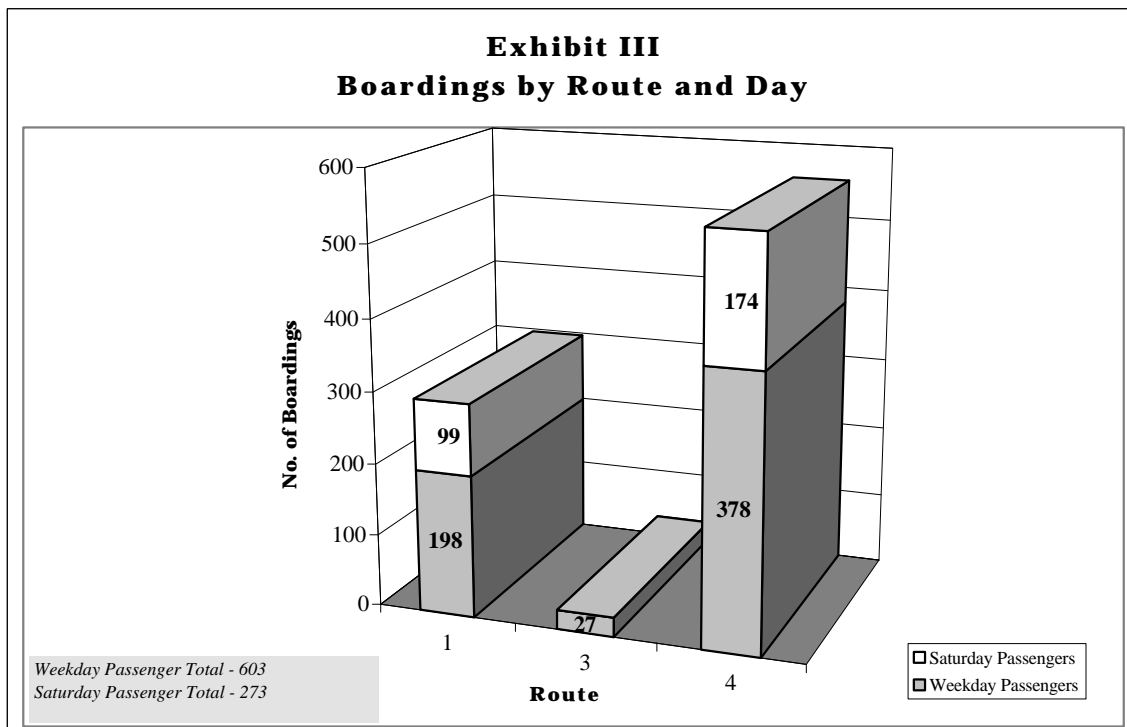
\*Monthly fare-box Ridership information provided by the South Portland Bus Service (SPBS).

The distribution of ridership by route reported in the On/Off Survey is similar to actual monthly ridership distributions, but not as close as in previous surveys. Route Four – *Maine Mall* has the highest ridership in the On/Off survey with 552 boardings (63% of the total ridership of the On/Off Survey), followed by Route One – *Willard Square* with 297 boardings (34%). The farebox totals for the survey period show Route Four as having the highest ridership at 61%, and Route One with the second highest ridership at 29%. Route Three - *Crosstown* has the lowest ridership for both the On/Off Survey (27 boardings or 3%) and the lowest farebox totals at 10%.

\* For summary tables of the SPBS On/Off Survey Results, see Appendix F - Summary Tables

## Boardings/Departures - On/Off Totals by Route and Day

Like the farebox totals collected by SPBS, the On/Off Survey separates weekday, Saturday and Sunday routes to show differences in route characteristics by day. Exhibit IV displays the distribution of boardings by route for the On/Off Survey as in Exhibit III, but goes further to show how the different days of the week contribute to total route ridership.



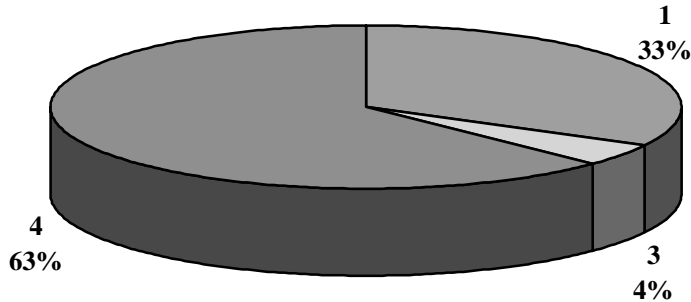
*Reminder: The weekday category describes cumulative data for only one weekday during the week and not the aggregation of all weekdays during the week. This standard applies to daily data in the On/Off survey.*

Exhibit III displays passenger boardings by route in the following descending order: Route Four (552), One (297) and Three (27). While the actual farebox totals vary slightly, this chart plainly shows Routes Four and One hold a much larger proportion of the total system ridership than Route Three.

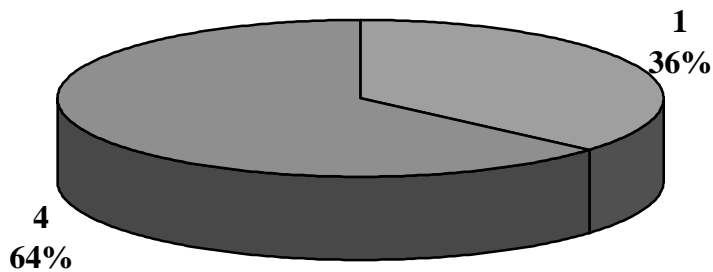
Only Routes One and Four offer Saturday service. Saturday boardings are approximately one half of weekday boardings on both routes. This is roughly corroborated by the fare box counts but the monthly variation over the three months of the survey places the Saturday to weekday ratio as low as 34% and as high as 56% within any given month.

Higher weekday ridership may be partially attributed to commuters, but fewer runs over a shorter operating day on Saturday also account for the lower number of boardings. Route Four services the Maine Mall Area of South Portland (see Appendix A - Route Maps), and higher Saturday ridership on that route is indicative of Saturday shoppers.

**Exhibit IV**  
**Percentage of Weekday Boardings by Route**



**Exhibit V**  
**Percentage of Saturday Boardings by Route**

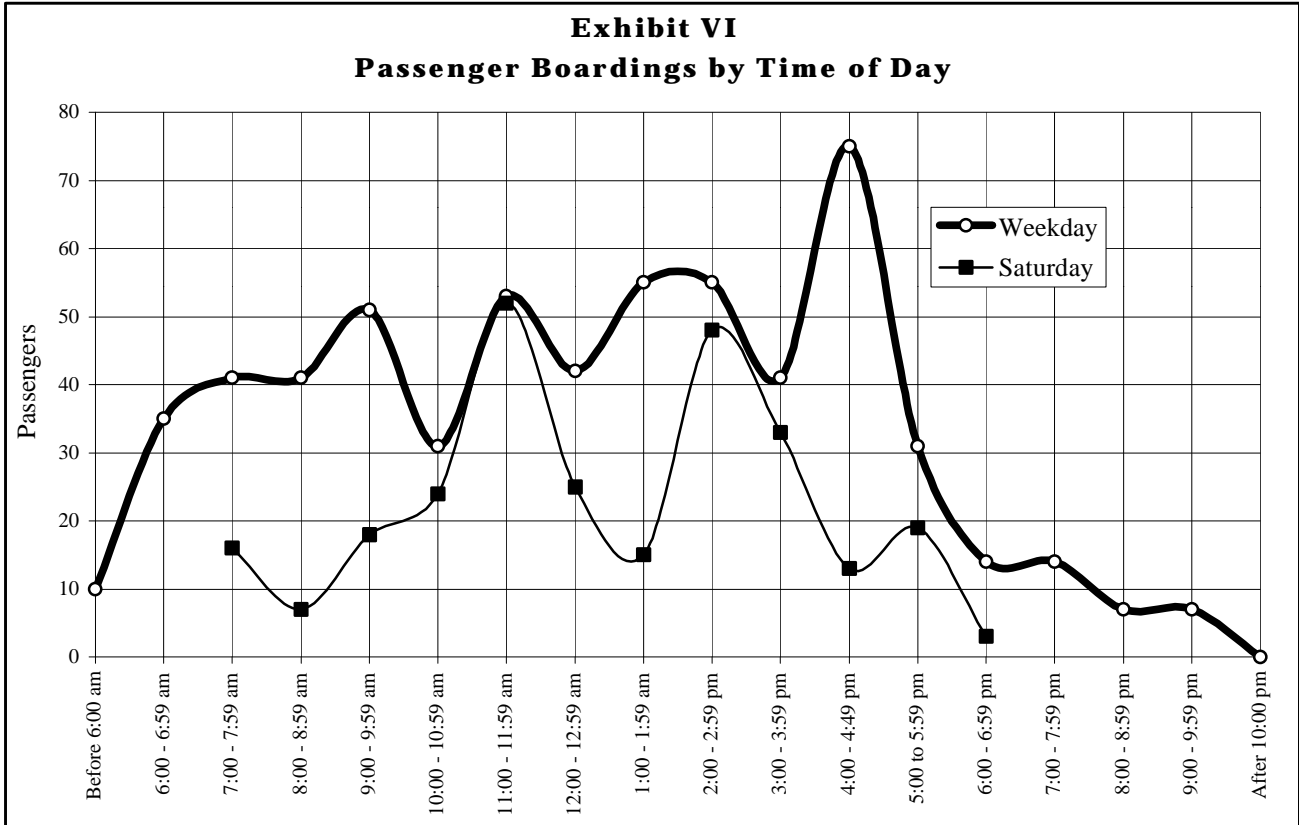


Exhibits IV, and V isolate weekday and Saturday boardings to highlight distribution patterns attributable to weekday /weekend variations.

The boarding distribution of weekday routes (Exhibit IV) and Saturday routes (Exhibit V) are both similar to the total boarding distributions shown in Exhibit II.

**Passenger Boardings by Time of Day**

Exhibit VI displays passenger boardings by time of day. Passenger boardings for the routes of the SPBS transit system are combined and divided into their hourly components to show boarding trends within the daily ridership (for Passenger Boardings/Departures by Time of Day for the Individual Routes, see Appendix E). Boarding times are not actual, but are determined by the starting time of their corresponding outbound or inbound trip.

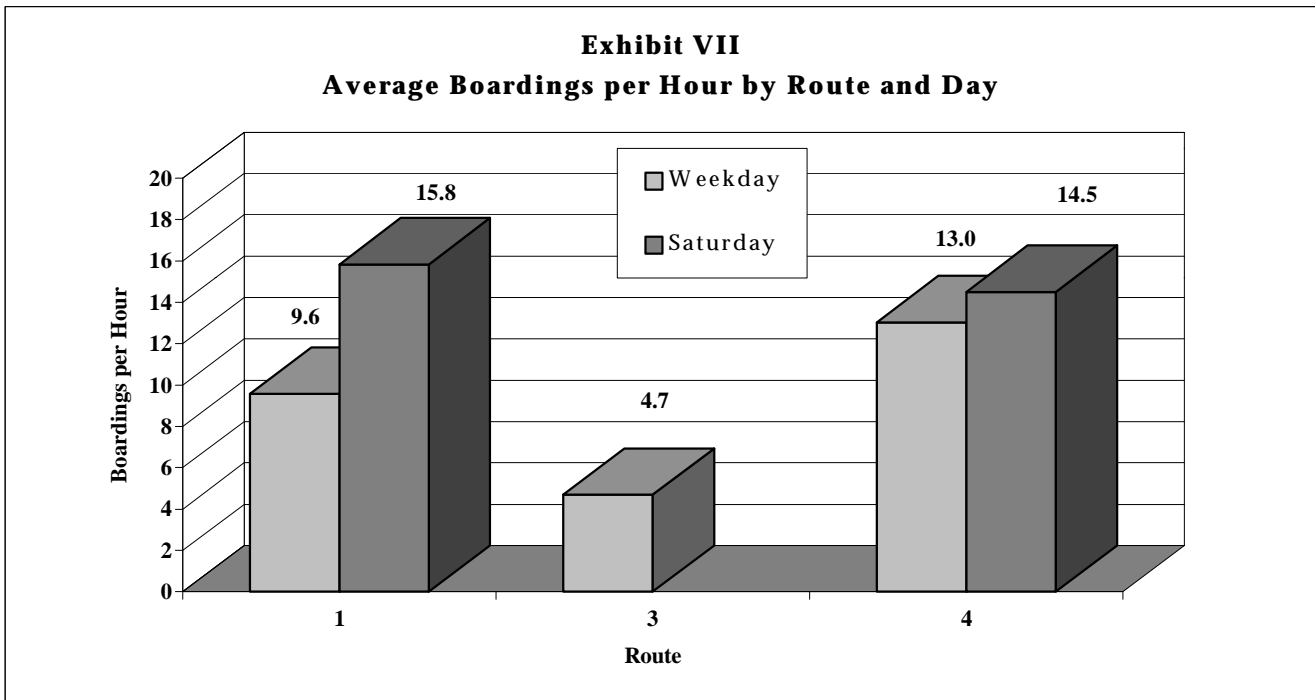


Several properties of Exhibit VI are different from previous years. The weekday morning peak has generally been earlier, more pronounced and of similar magnitude as the afternoon peak. And, the post rush hour drop has tended to flatten out more quickly. The similarity with previous results is that the highest weekday peak has always been later in the afternoon, at 3:00 or 4:00 PM.

The most noticeable difference from previous years is the magnitude of the peaks on Saturday. This is the first time Saturday boardings have been this high, encroaching into the weekday boardings series. Charts showing weekday and Saturday boardings by time of day for each route may be found in Appendix E.

## Boardings per Hour

Another way to examine bus-boarding statistics is to divide the number of persons riding the bus by the total hours of bus service. Some bus routes appear to have more boardings because they have more buses in operation or longer service hours. Calculating boardings per hour is a way to describe the concentration of ridership, holding constant for differences in number of buses and service hours. In other words, 5 bus hours can mean one bus operating five hours or 5 buses operating one hour. If the total number of passengers is 50, the average number of boardings per hour is 10.

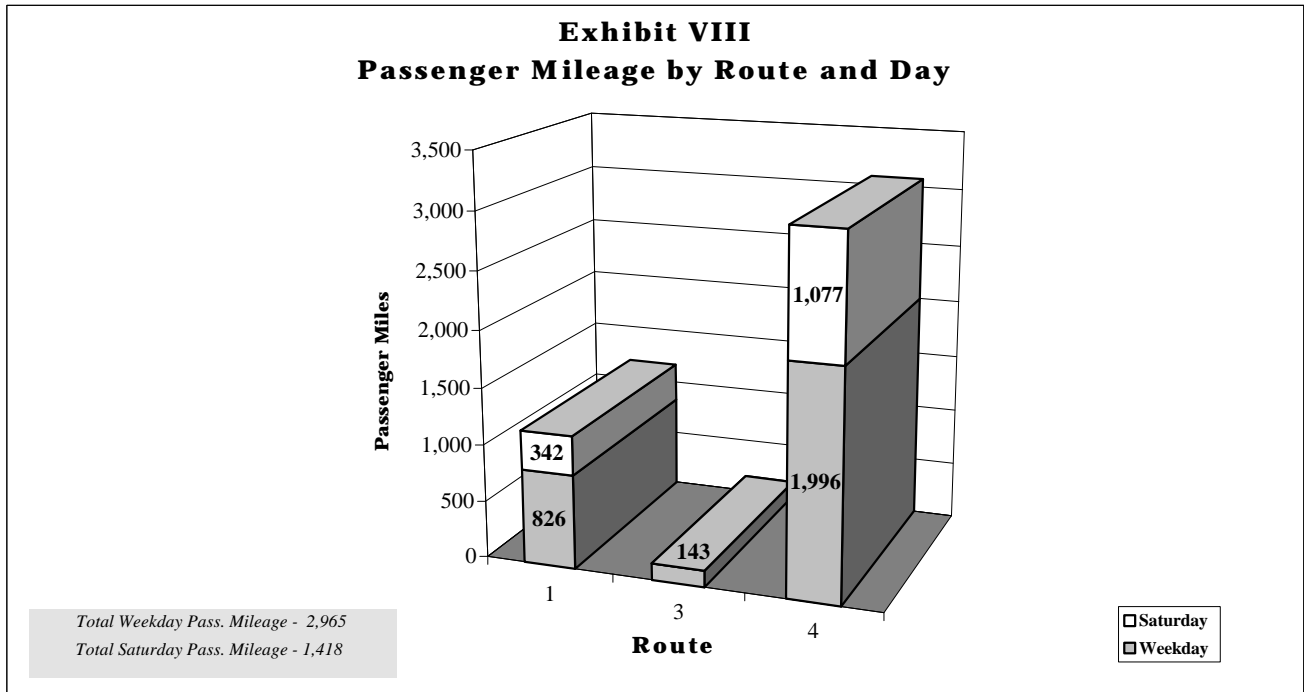


Route Four's high weekday ridership rates (Exhibits II & III) are echoed by its high concentration of passengers (Exhibit VII). Route One weekday has the second highest concentration of passengers at 9.6 passengers per hour. Route Three weekday appears to have a relatively low concentration of riders even with its minimal bus hours.

Saturday boardings per hour are remarkably higher than on weekdays. Recall that Saturday boardings are roughly half that for weekdays, however bus hours are reduced to nearly one-third. In fact, one bus operates both routes on Saturday, switching back and forth. So, the concentration of riders is greater.

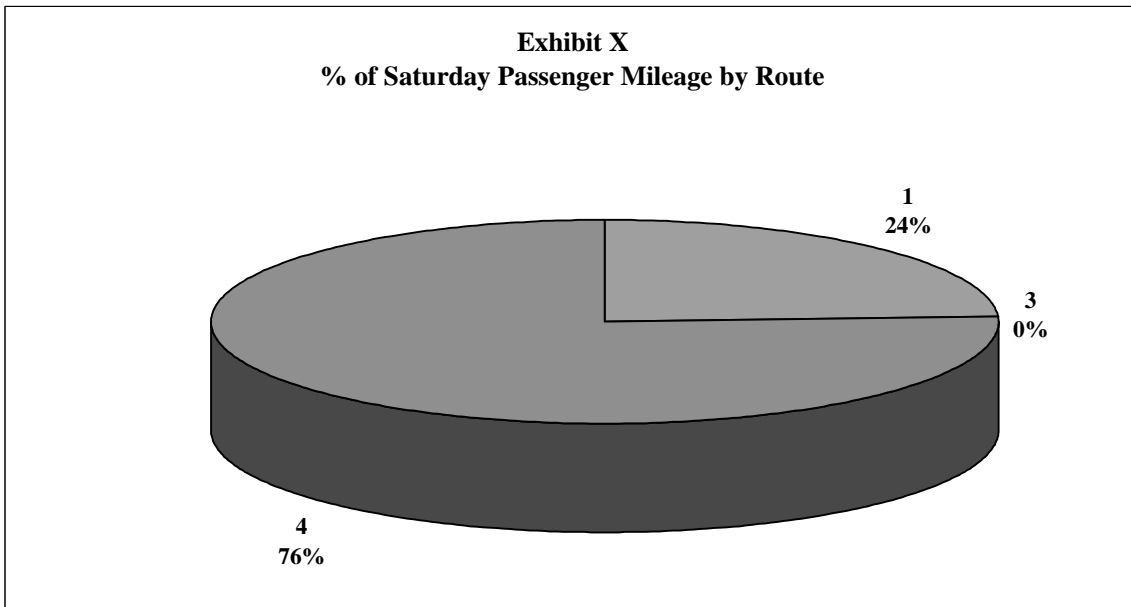
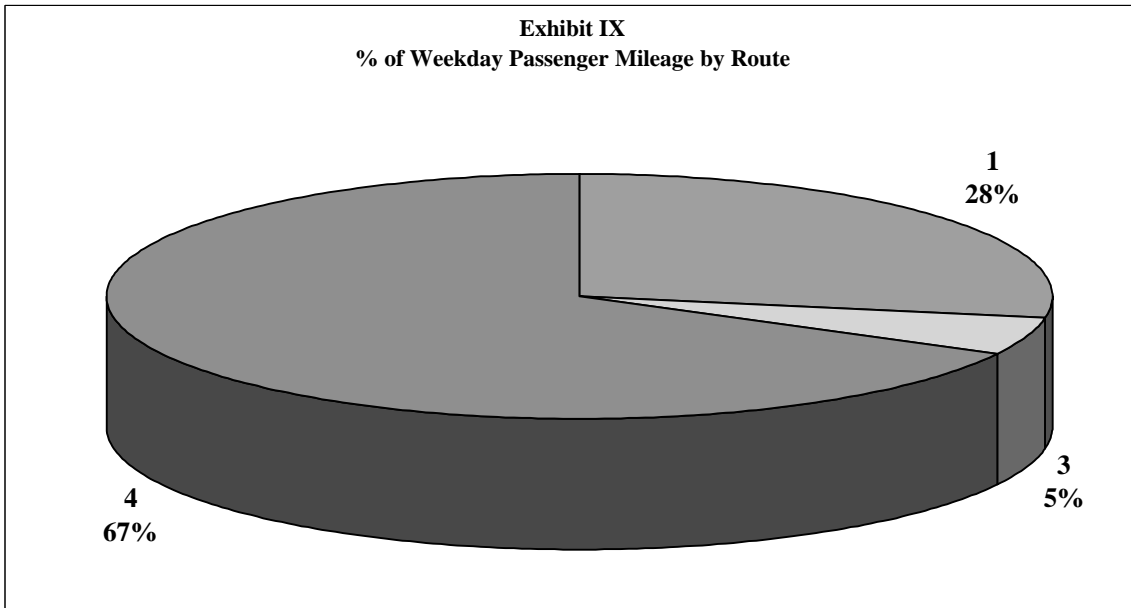
## Passenger Mileage

Passenger miles are the sum total of passengers carried times total miles operated. Exhibit VIII shows passenger mileage by route and day.



The distribution of passenger mileage follows a distribution pattern similar to boardings. Route Four has the highest total passenger mileage (3,073), followed by Route One (1,168), and Route Three (143). Weekdays constitute 68% of all passenger mileage, while Saturdays constitute 32%. Route Four weekday has the greatest passenger mileage of any per day route (1,996), followed by Route Four Saturday (1,077), and Route One weekday (826).

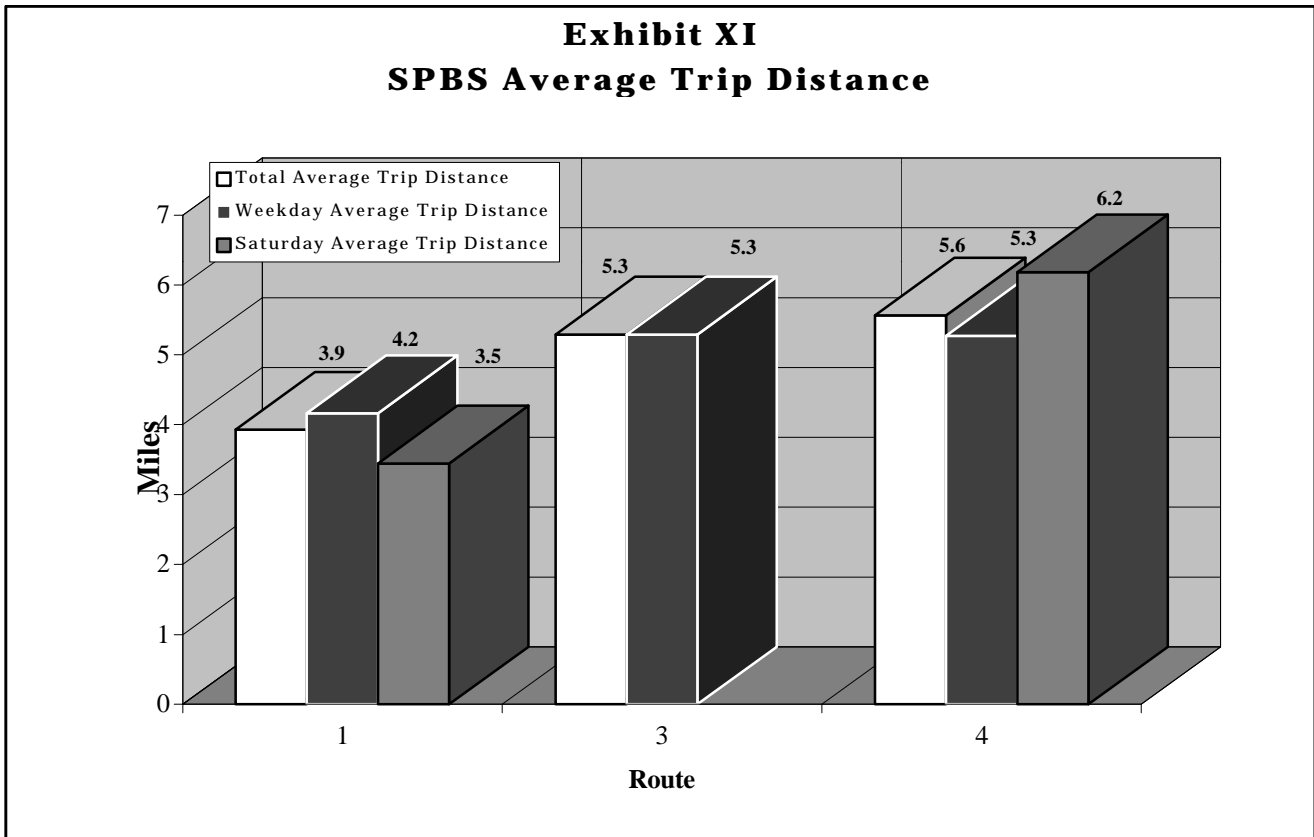
Exhibits IX and X isolate weekday and Saturday passenger mileage to highlight distribution patterns attributable to weekday/weekend variations.



Route Four comprises the largest percentage of both weekday and Saturday passenger miles. Route One's Saturday passenger mileage (24%) is very similar to its weekday mileage (28%).

**Average Trip Distance:**

Average trip distance is obtained by dividing each route’s passenger mileage by the number of passengers (i.e. boardings). The average passenger trip distance describes the distance the average passenger travels on that route.



As shown in Exhibit XI, some routes have longer or shorter average trips, a byproduct of general trip geographical characteristics. Route Four has the longest average passenger trip distance (5.6 miles) for all days combined (total average trip distance). Route Four shares the longest weekday average trip distance (5.3 miles) with Route Three. And, Route Four also has the longest Saturday trip distance (6.2 miles.)

The distinction should more properly be given to the routes with the lowest average trip distances since those are more productive.

**Exhibit XII  
SPBS Maximum Roundtrip  
Mileage by Route**

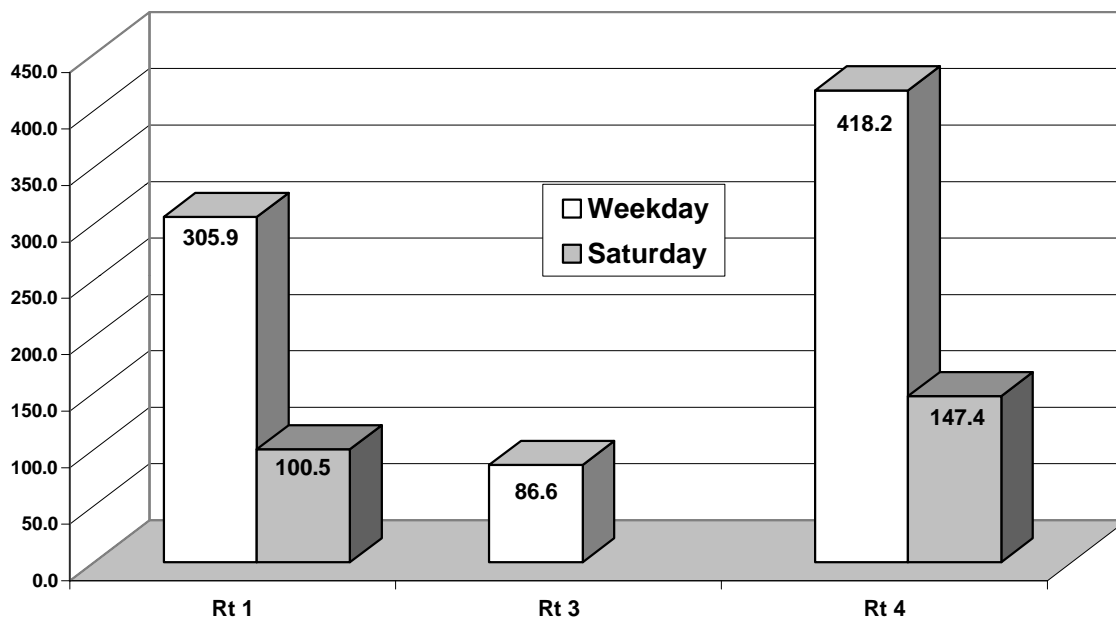
Route	Weekdays	Saturdays
1	15.34	11.23
3	21.64	-
4	28.26	21.72

### Productivity Metrics:

Following are some additional ways of looking at the data that have not previously been considered in the analysis of this survey. Operating data such as equipment movement and intensity and duration of service are plotted to form the basis for calculations that integrate boarding statistics. A peak and base period summary of each route as well as a condensed summary table of these statistics may be found in Appendix H.

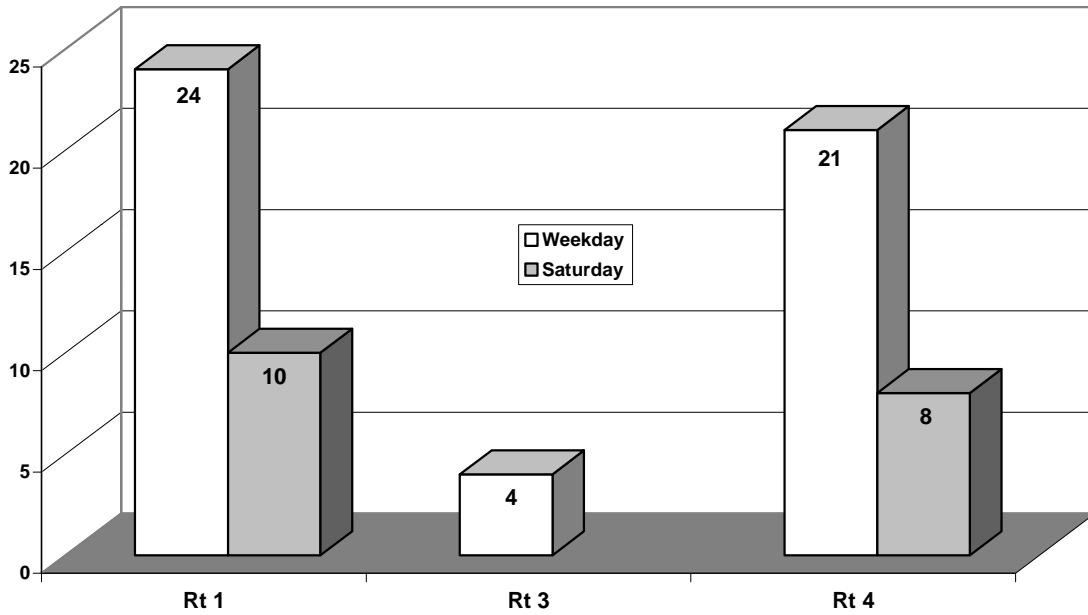
One basic metric is the daily trip miles traveled on each route. Since buses generally travel different deviations of the route throughout the day, there are different trip lengths. The sum total of these route deviations make up the daily trip miles. These numbers will be used to calculate the number of boardings per mile. Weekday and Saturday trip miles appear in Exhibit XIII below.

Exhibit XIII Daily Trip Miles



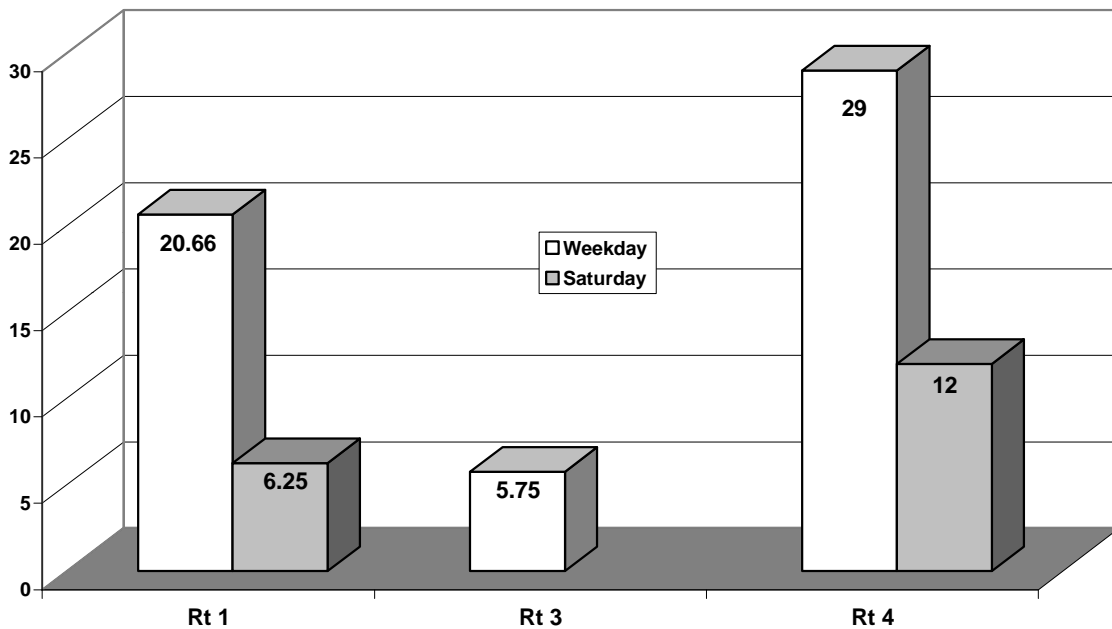
The daily number of bus trips on each route is another operational statistic that is used for deriving the average number of boardings per trip. Exhibit XIV displays the number of daily trips on each route.

**Exhibit XIV Daily Trips**



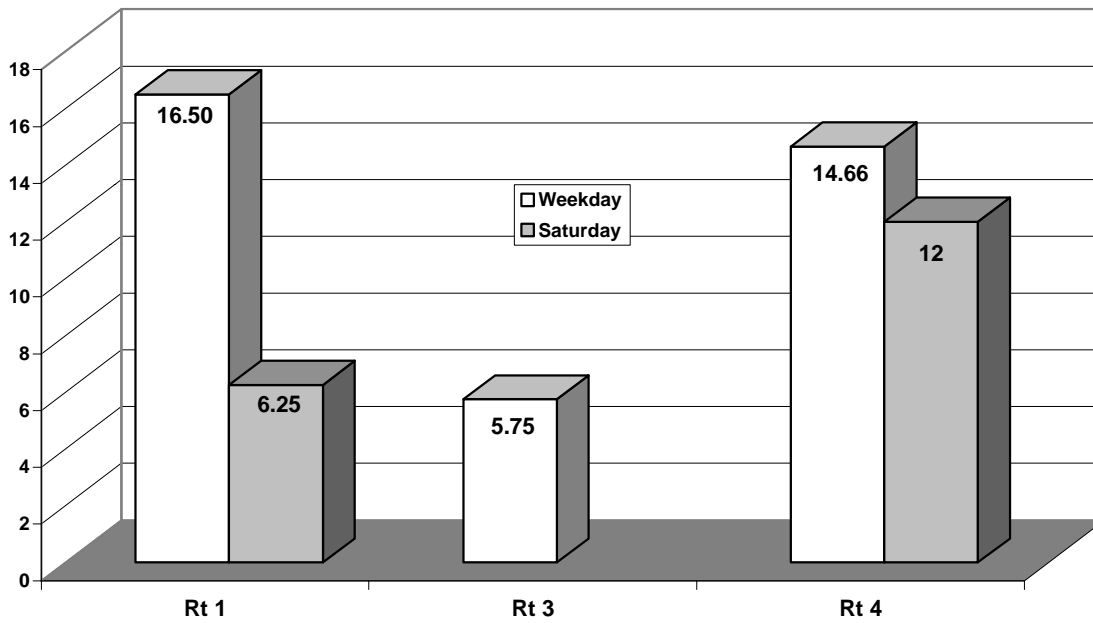
Finally, there are the total daily trip hours (or bus hours) on each route. Since some routes have more than one bus operating at the same time, the revenue operating hours for each bus deployed on the route are combined to produce the Daily Trip Hours - Exhibit XV. Daily trip hours were already used to calculate the average number of boardings per hour in Exhibit VII.

**Exhibit XV Daily Trip Hours**



As a comparison, the Daily Service Hours, the number of hours the route is serviced, is displayed in Exhibit XVI.

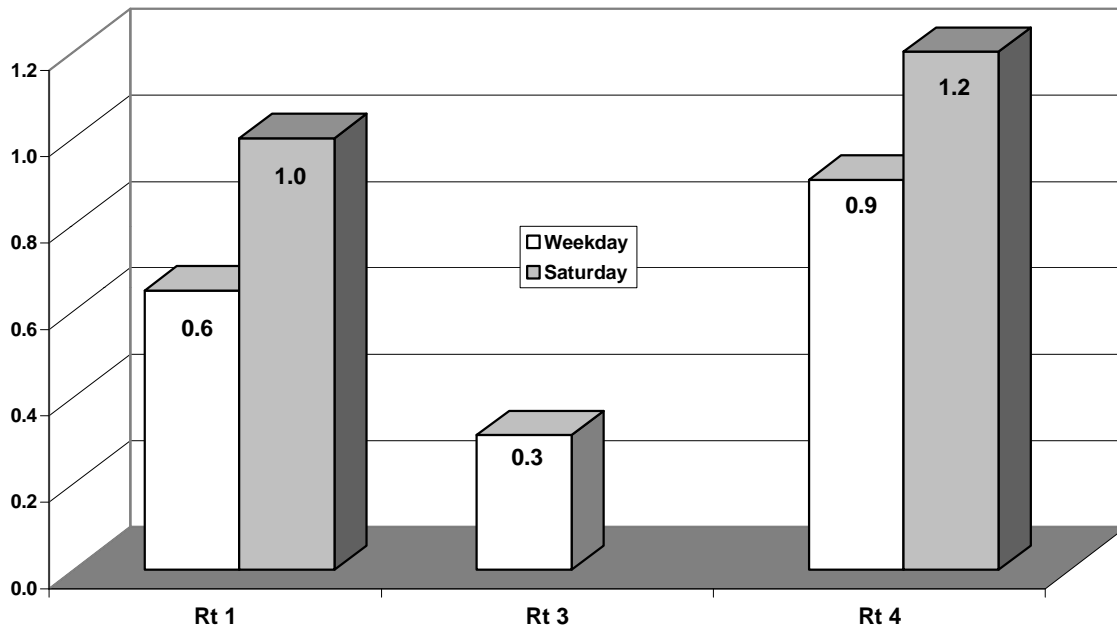
**Exhibit XVI Daily Service Hours**



Using these baseline operational figures, some very simple metrics may be produced which are useful for comparing the productivity of routes compared with one another in the system. It should be noted that these metrics are not intended for comparison with routes in other systems.

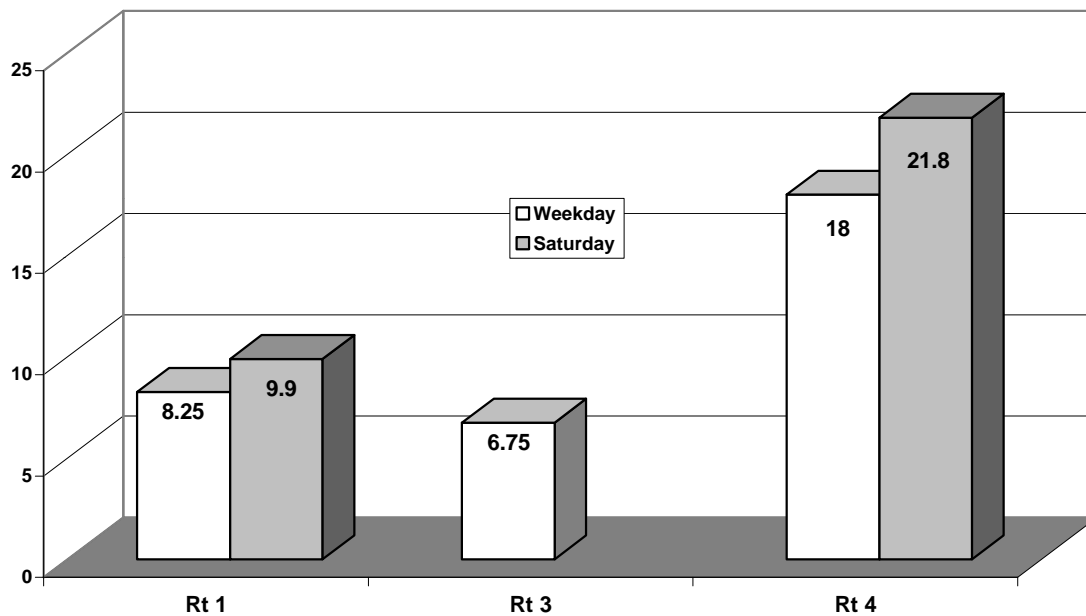
Passengers per mile or boardings per mile are calculated by dividing the total number of boardings for the day by the daily trip miles for each route. The higher the number the more productive the route is. Boardings per mile statistics are in Exhibit XVII.

**Exhibit XVII Boardings per Mile**



Another way to look at the data is to calculate the average daily boardings per trip. Total boardings per route divided by the number of runs on that route per day equals boardings per trip. Exhibit XVIII displays this metric.

**Exhibit XVIII Average Boardings per Trip**



The most obvious conclusion derived from looking at these data and the boardings per hour (Exhibit VII) is that productivity on Saturday is significantly greater than on weekdays. The level of effort on weekdays, whether measured by trips, miles or hours is more than twice the effort on Saturdays for both Routes One and Four. There are only about half as many total boardings on Saturdays but each trip is used more intensively. Note that Route Three does not operate on Saturdays.

Route One Weekday has the highest number of daily trips and the longest service day but in terms of total daily trip hours and miles, Route Four Weekday is the workhorse of the system. That effort is rewarded by capturing the highest numbers of weekday boardings per trip and per mile. On Saturday, Route One makes a couple more trips than Route Four but it travels a third fewer miles over about half as many service hours. Still, Route Four handles slightly more boardings per mile and more than twice as many boardings per trip on Saturdays.

The analysis above is for each entire route for a full day. More detailed weekday information is available for peak and off peak periods in tabular form in Appendix H.