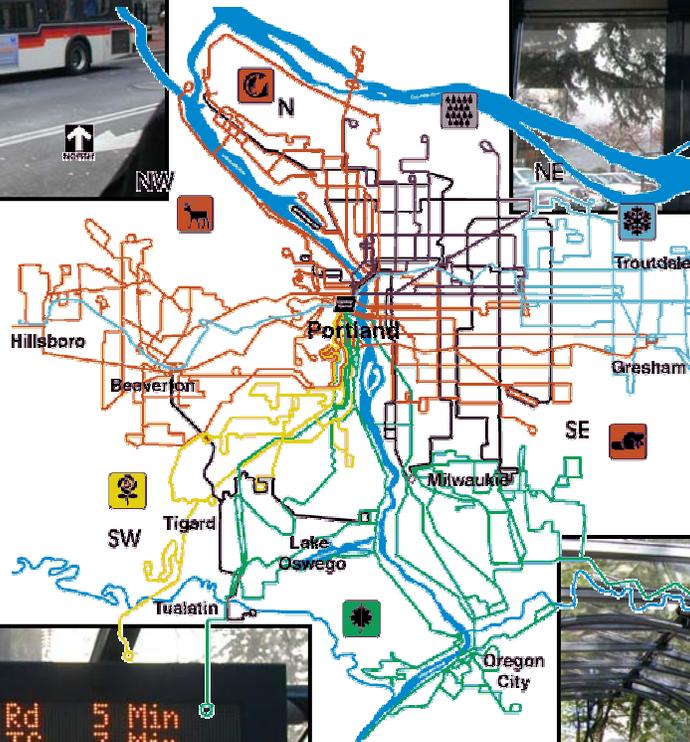# Oregon Regional Intelligent Transportation Systems (ITS) Integration Program

Final Phase III Report:

Transit Tracker Information Displays

Contract Number: DTFH61-96-C-00098   Task Order 9822

Submitted to:

United States Department of Transportation

Submitted by:
Science Applications International Corporation

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NOTICE

Comments on this report are requested to be provided
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ABBREVIATIONS

AVL	Automatic Vehicle Location
COATS	Rural California/Oregon Advanced Transportation System
C-TRAN	Clark County Transit Provider
C-VAN	Clark County's Curb-to-Curb Paratransit Service
GPS	Global Positioning System
ITS	Intelligent Transportation Systems
MAX	Portland Light-Rail System
MOEs	Measures of Effectiveness
ODT	Oregon Department of Transportation
RTC	Regional Transportation Council
SAIC	Science Applications International Corporation
TriMet	Tri-County Metropolitan Transportation District
USDOT	United States Department of Transportation
VMT	Vehicle Miles Traveled

EXECUTIVE SUMMARY

The Portland metropolitan region has a long history of investing in multi-modal transportation solutions to enhance mobility and maintain the region's livability standards and reputation. Since the early 1990s, the Portland region has been actively involved in planning and deploying Intelligent Transportation Systems (ITS) as a complementary means to enhance travel efficiency and safety. Portland's commitment to feasible ITS solutions for transportation problems is evidenced by *TransPort 2000*, a regional ITS plan consisting of 16 integrated and interoperable projects.[1] *Transport 2000* includes significant bi-state, urban-rural, and multi-modal components. This project plan represents the joint planning efforts of a regional committee consistent with statewide and regional planning processes in Oregon and Washington. The *Transport 2000* projects build on the region's significant existing ITS investment and fills current gaps in planning, emergency management, traveler information, and parking subsystems.

Under the direction and funding of the United States Department of Transportation (USDOT), national ITS evaluations are conducted to accelerate the integration and interoperability of ITS in metropolitan and rural areas. As part of an ongoing process to investigate the success of ITS across the country and provide insights into the potential strengths and weaknesses of the overall national integration program, the Oregon Regional ITS Integration Program was selected for independent national evaluation. Specifically, four projects were selected for evaluation:

- Regional Intermodal Transit Traveler Information and Security System – Transit Tracker Information Displays.

- I-5/Barbur Boulevard Parallel Corridor Traffic Management Demonstration Project.

- Rural California/Oregon Advanced Transportation System (COATS), a bi-state rural integration project.

- Transit Buses as Traffic Probes project.

Science Applications International Corporation was selected by USDOT as the Independent Evaluator for these projects. This document presents the evaluation strategies and objectives, the data collection methodologies, and the results of the evaluation of the Transit Tracker information displays. This is the first of four Phase III documents that will be delivered as part of this evaluation.

The Transit Tracker Evaluation

Transit Tracker uses global positioning system (GPS) technology to track how far a bus is along its scheduled route. Every TriMet bus is equipped with a transmitter that allows continuous satellite tracking with an accuracy of approximately 30 feet. This real-time location information is used to calculate real-time bus and train arrival information. The

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[1] *TransPort 2000*, A FY 2000 Federal Transportation Appropriations Bill Project Request, June 15, 2001.

information is then routed to electronic displays in the frequently used bus shelters and to the Transit Tracker Online Website in the form of arrival countdowns.

The Transit Tracker evaluation was structured to collect and analyze data reflecting changes in bus riders' behaviors, perceptions, and satisfaction as a result of the Transit Tracker information displays and Transit Tracker Online. The evaluation was designed to meet the following five objectives:

- Assess bus riders' use of trip planning information.

- Assess bus riders' perceptions of transit system efficiency.

- Assess bus riders' perceptions of personal security.

- Assess bus riders' perceptions of Transit Tracker service.

- Assess bus riders' overall satisfaction with the system.

The approach to the Transit Tracker evaluation was three-fold and involved the following elements:

- Administration of a before-and-after intercept survey of bus riders at bus stops.

- Analysis of ridership data at the bus stops surveyed.

- Administration of an Online survey of Transit Tracker Online users.

In all, surveyors obtained 240 complete "Before" intercept surveys (administered at four bus stops in late January 2002) and 278 complete "After" intercept surveys (administered at four bus stops in early February 2003). During a three-week period in the spring of 2003, 358 Transit Tracker Online users completed the Online survey. The survey and ridership results are summarized below according to each of the evaluation objectives.

Assess Bus Riders' Use of Trip Planning Information

The first objective of the evaluation was to assess bus riders' use of trip planning information. The hypothesis associated with this objective was:

> *Transit Tracker will provide bus riders with accurate and useful information with which they can make informed decisions about their trips in real-time.*

A comparison of the use of several types of fixed-schedule information (e.g., paper timetables, schedules posted at stops, 238-RIDE information line, online schedules) showed no differences in reported use of the information before and after Transit Tracker. Interestingly, in the After survey, many more respondents reported using the Transit Tracker information display than the fixed-schedule information. Only about 35 percent of respondents before and after implementing Transit Tracker reported that they *frequently* or *almost always* used the schedule guides posted at the stops (the most frequently used source of fixed-schedule information in both the Before and After survey). In contrast, 78 percent of the respondents reported that they *frequently* or *almost always* used the Transit Tracker information display.

On the Online survey, respondents were asked to indicate for what reasons they accessed the Transit Tracker Online information. Ninety percent of the respondents reported that they had used Transit Tracker Online *when they did not want to wait too long at the bus stop.* Half of the respondents reported that they had used Transit Tracker Online *when they were not sure of the scheduled arrival time of the bus and wanted the real-time arrival information instead* and/or *when they wanted to know if they had already missed their bus.* The most common single response (given by 34 percent of respondents) was the combination of the three response choices.

The majority of riders on the After-intercept survey and the Online survey reported that they used the Transit Tracker information to make one or more decisions about their trip (e.g., take and alternate bus route, wait for the bus in a more sheltered location). The most common decision made by riders surveyed at the bus stops was *leave the stop and return when the bus is due.* The most common decision made by riders surveyed online was *wait longer before leaving home/work for the bus stop.* Thirty-eight percent of riders surveyed at the bus stops reported making multiple decisions based on the information received from the Transit Tracker display, while 77 percent of riders surveyed online reported making multiple decisions based on the information received from Transit Tracker Online.

Regarding decisions made after consulting Transit Tracker, a comparison was made between the response distributions at three stops that had recently been implemented with a Transit Tracker display to the stop at Salmon and 5th, where the display had been in place for 18 months prior to the survey. A visual examination of the response distributions suggests that more riders at the bus stop at Salmon and 5th used the information to make decisions about their trips, and more riders made multiple trip decisions based on the information. This could indicate that users at this stop learned, over the 18-month time period, how to use the information for their benefit. A follow-up survey at the other three stops would show whether this is the case or not.

Assess Bus Riders' Perceptions of Transit System Efficiency

The second objective of the evaluation was to assess bus riders' perceptions of transit system efficiency. The hypothesis associated with this objective was:

> *Transit Tracker will increase bus riders' perceptions of bus system efficiency, even if there is no change in the actual system performance.*

Riders' perceptions of on-time performance before and after Transit Tracker differed very little overall. Statistical comparisons of the response distributions at each of the stops showed no significant differences at two of the three stops surveyed both before and after Transit Tracker; however a significant difference was found at the bus stop at Burnside and 28th Street. From the distributions, there appears to have been a shift from *don't know [if the bus is usually on time]* responses in the Before survey to *yes [the bus is usually on time]* responses in the After survey at this stop.

In addition to asking riders up front if their bus was usually on-time, riders' perceived wait times were used as a surrogate for perceived efficiency. Statistical comparisons of wait times (those reported as integer values only) showed that no change in mean perceived wait time after the installation of Transit Tracker. In addition, there was no decrease in the variability of reported wait times after the installation of Transit Tracker.

On the Before survey, riders were asked how satisfied they were with the bus' adherence to the posted schedules. The overwhelming majority of riders, 91 percent, reported that they were either *satisfied* or *extremely satisfied*. These results show that riders were already very satisfied with bus efficiency before the installation of Transit Tracker, which might explain why there were not more significant differences found between the before and after results.

Assess Bus Riders' Perceptions of Personal Security

The third objective of the Transit Tracker evaluation was to assess bus riders' perceptions of personal security. The hypothesis associated with this objective was:

> *Transit Tracker will increase bus riders' perceptions of personal security, even if there are no other measures taken to increase security.*

An overwhelming majority (97 and 98 percent in the Before and After survey, respectively) reported that they *agreed* or *completely agreed* that they felt safe waiting for the bus at the stops during the day. Somewhat fewer respondents (63 and 79 percent in the Before and After survey, respectively) reported that they *agreed* or *completely agreed* that they felt safe waiting for the bus at the stops at night.

A statistical comparison of riders' perceptions of personal security before and after Transit Tracker showed no significant difference between the perceptions of security at two of the three stop during the day or at night. The results did show a significant difference in response distribution between the Before and After surveys at Burnside and 28th Street during the day and at night. From the response distributions, it appears that the significant difference lies in a shift in respondents from *agreement* with the statements about feeling safe in the Before survey to *complete agreement* with the statements in the After survey.

On the Online survey, the majority of respondents *agreed* or *completely agreed* that Transit Tracker Online made them feel safer knowing they would not have to wait a long time at the bus stop. In addition, one comment at the end of the survey was specifically related to safety: "It [Transit Tracker Online] allows me to be safer, [which is] important to me as I am a woman usually traveling alone."

A look at nighttime ridership at the stops showed no changes in ridership after the installation of Transit Tracker. In the adjacent stop analysis, only the stop at Burnside and 28th showed a considerable shift of riders to the Transit Tracker equipped location. Before Transit Tracker was implemented, 78 percent of the riders in the vicinity of Burnside and 28th boarded at Burnside and 28th. After Transit Tracker was installed, 86 percent of the riders in the vicinity of Burnside and 28th actually boarded at that stop.

Assess Bus Riders' Perceptions of Transit Tracker Service

The fourth objective of the Transit Tracker evaluation was to assess bus riders' perceptions of the Transit Tracker service. The hypothesis associated with this objective was:

> *Transit Tracker will provide bus riders with accurate and useful information that will be understandable and easy to use.*

The majority of riders surveyed at the bus stops reported that the Transit Tracker sign/information at the stops was *almost always* working (84 percent), useful (73 percent), and accurate (56 percent). Very few riders (less than 5 percent) reported that the Transit Tracker sign/information was *rarely* or *almost never* working, useful, or accurate. Likewise, the majority of riders rated the visibility of the sign (62 percent) and the understandability of the information (72 percent) as *very good*. Forty-four percent of riders rated the information accuracy as *very good*. Very few riders rated the Transit Tracker sign/information as *poor* or *very poor* (less than 5 percent).

Many of the riders' felt that the Transit Tracker information at bus stops helped them in a number of ways. Sixty percent reported that the information *reduced their anxiety at the bus stop*, 55 percent reported that the information *increased their sense of security at the bus stop*, 43 percent reported that the information *gave them more control over their travel*, and 7 percent reported that the information *saved them time at the bus stop.* In fact, 17 percent of respondents reported that the information did *all of the above*.

On the Online survey, 96 percent of respondents *agreed* or *completely agreed* that Transit Tracker Online was easy for them to use (only four respondents *disagreed* with the statement), and 95 percent of respondents *agreed* or *completely agreed* that Transit Tracker Online saved them time. Regarding its accuracy and usefulness, 86 percent of respondents reported that Transit Tracker Online was *frequently* or *almost always* accurate, and 85 percent of respondents reported that Transit Tracker Online information is *frequently* or *almost always* useful for making decisions about their trips.

Overall, 61 percent of riders surveyed at bus stops rated the Transit Tracker as *very good,* and 31 percent rated it as *good*. The ratings of the Online Transit Tracker were comparable; 51 percent of online users reported that they were *completely satisfied* with Transit Tracker Online, and 42 percent of users reported that they were *satisfied* with the service.

Assess Bus Riders' Overall Satisfaction With the System

The final objective of the Transit Tracker evaluation was to assess bus riders' overall perceptions of the bus service. The hypothesis associated with this objective was:

Transit Tracker will increase bus riders' overall satisfaction with bus service.

An overwhelming 91 percent of respondents in both the Before and After surveys indicated that they were either *satisfied* or *extremely satisfied* with the bus service at the stops. About 5 percent reported being *dissatisfied* or *extremely dissatisfied* before Transit Tracker, and a mere 1 percent reported being *dissatisfied* or *extremely dissatisfied* after Transit Tracker. A statistical comparison of riders' satisfaction with bus service before and after Transit Tracker at the stops showed no significant difference between the satisfaction ratings. This could be attributed to the fact that riders were very satisfied before Transit Tracker was deployed.

Eighty-nine percent of riders surveyed online *agreed* or *completely agreed* that Transit Tracker Online increased their satisfaction with bus services. Only 9 and 2 percent were neutral or disagreed, respectively.

CONCLUSIONS

Based on the evaluation results, the following conclusions are made:

- Bus riders surveyed at the stops like the Transit Tracker information displays; the large majority of riders surveyed feel that the information provided is understandable, useful, and accurate. Riders' feel that the information helps them by reducing their anxiety, increasing their sense of security, giving them more control over their travel, and saving them time.

- Riders at stops use the real-time Transit Tracker information more frequently than all other available sources of fixed-schedule information. The flexibility that Transit Tracker's real-time information provides to riders appears to be a significant improvement over that provided by fixed-schedule information.

- There is evidence to suggest that riders learn over time how to use the real-time information for their benefit. Many riders surveyed at the bus stops and online reported making multiple decisions about their trips (e.g., taking a different bus route) with the Transit Tracker information at hand. It appears that riders use the real-time bus arrival information provided by Transit Tracker to more effectively and creatively plan and execute their trips.

- An overwhelming majority of riders were *satisfied* or *extremely satisfied* with bus adherence to the posted schedules before Transit Tracker; therefore, there was little "room for improvement" in perceptions of on-time performance after Transit Tracker. (There was no significant difference in mean reported wait times before and after Transit Tracker, and there were no significant differences in reported on-time performance before and after Transit Tracker at two of the three stops.)

- There is evidence to suggest, at least at one bus stop, that the presence of the Transit Tracker information has a positive influence on riders' perceptions of on-time performance, while, at the same time, helps riders to have a better idea of whether the bus is running on-time.

- The large majority of riders reported feeling safe at the stops during the day and at night both before and after Transit Tracker, and there was no significant difference in the before and after ratings; however, there is evidence to suggest, at least at one bus stop, that Transit Tracker has a positive impact on riders' perceptions of personal security during the day and at night.

- At this point, there are no changes in nighttime ridership at the bus stops as a result of Transit Tracker; however, at one of the stops, a considerable increase in "vicinity" boardings at the Transit Tracker equipped location since the installation suggests that riders have shifted from adjacent stops to the Transit Tracker equipped location to have access to the information.

- The overwhelming majority of riders surveyed at the bus stops are satisfied with the bus service at the stop; however, because riders were already very satisfied with bus service prior to the installation of Transit Tracker, there was not a significant improvement in customer satisfaction.

- Transit Tracker Online users like the system; the overwhelming majority of users feel that the system is easy to use, that the information provided is useful and accurate, and that it saves them time during the day.

- The majority of Transit Tracker Online users access the information for multiple reasons. They maximize their time at home, work, or school before leaving for the bus stop. When running late, users check Transit Tracker Online to see if they have already missed their bus and, at the same time, can check the predicted arrival time for the next bus.

- The majority of Transit Tracker Online users feel safer knowing they do not have to wait a long time at the bus stop as a result of the information.

- Overall, users are satisfied with Transit Tracker Online and agree that the service increases their satisfaction with bus service as a whole.

Based on the results of this evaluation and the conclusions drawn, the hypotheses stated up front have either been supported by the results of the evaluation or have not been supported by the results of the evaluation:

- Hypothesis: Transit Tracker will provide bus riders with accurate and useful information with which they can make informed decisions about their trips in real-time—*Supported.*

- Hypothesis: Transit Tracker will increase bus riders' perceptions of bus system efficiency, even if there is no change in the actual system performance—*Supported at Burnside & 28th; Not supported at other locations.*

- Hypothesis: Transit Tracker will increase bus riders' perceptions of personal security, even if there are no other measures taken to increase security—*Supported at Burnside & 28th and by Transit Tracker Online users; Not supported at other locations.*

- Hypothesis: Transit Tracker will provide bus riders with accurate and useful information that will be understandable and easy to use— *Supported.*

- Hypothesis: *Transit Tracker will increase bus riders' overall satisfaction with bus service—Supported, at least by Transit Tracker Online users.*

1. INTRODUCTION

The Portland, Oregon metropolitan region has a long history of investing in multi-modal transportation solutions to enhance mobility and maintain the region's livability standards and reputation.[2] Since the early 1990s, the Portland region has been actively involved in the planning and deployment of ITS infrastructure. Considering a projected regional population increase of nearly 500,000 residents by the year 2040, and a related increase of 55 percent in vehicle miles traveled (VMT) on regional transportation facilities in the next 20 years, integrated ITS deployment is considered critical in meeting future transportation demands.[3]

Under the direction and partial funding of the United States Department of Transportation (USDOT), independent national evaluations are being conducted to accelerate the integration and interoperability of ITS in metropolitan and rural areas, to investigate the success of ITS across the country, and to provide insights into the potential strengths and weaknesses of the overall national integration program. In fiscal year 2000, the Oregon Regional ITS Integration Program was selected for national evaluation. Specifically, four projects were selected for evaluation:

- Regional Intermodal Transit Traveler Information and Security System –Transit Tracker.

- I-5/Barbur Boulevard Parallel Corridor Traffic Management Demonstration Project.

- Rural California/Oregon Advanced Transportation System (COATS), a bi-state rural integration project.

- Transit Buses as Traffic Probes project.

This document outlines the evaluation strategies, data collection approach, and a comparison of baseline and post-deployment results for "Transit Tracker," a real-time transit arrival information system in Portland. This is the first of four Phase III documents that will be delivered as part of this evaluation.

Science Applications International Corporation was selected as the Independent Evaluator for this project. This Phase III Report is structured in the following format:

- **Section 1 – Introduction**. Provides information on the Oregon Regional ITS Integration Program projects that are being evaluated nationally.

- **Section 2 – Background**. Provides background information on ITS in Oregon and a description of the Transit Tracker system, including project goals. This section also summarizes the evaluation approach, hypotheses and measures of effectiveness developed previously and detailed in the Evaluation Plan.

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[2] *Tri-Met 5-Year Intelligent Transportation System Plan Final Report*, February 2000. PB Farradyne, Battelle.

[3] Ibid.

- **<u>Section 3 – Before and After Intercept Interviews</u>.** Details the data collection plan and process, and provides a comparison of the baseline and post-deployment results from the Transit Tracker intercept surveys.

- **<u>Section 4 – Ridership Data Analysis</u>.** Details an analysis of ridership data, specifically nighttime boardings and adjacent stop boardings before and after implementation of Transit Tracker.

- **<u>Section 5 – Transit Tracker Online Survey</u>.** Details the data collection plan and process, and presents the results from the Transit Tracker Online survey.

- **<u>Section 6 – Summary and Conclusions</u>.** Summarizes the major findings of the evaluation, states the major conclusions drawn from the results, and lists recommendations to FHWA for next steps.

2. BACKGROUND

Portland's commitment to ITS as a solution to transportation problems is evidenced by *TransPort 2000*, a regional ITS plan consisting of 16 integrated and interoperable projects.[4] *Transport 2000* includes significant bi-state, urban-rural, and multi-modal components. This project plan represents the joint planning efforts of a regional committee consistent with statewide and regional planning processes in Oregon and Washington. The *TransPort 2000* projects build on the region's significant existing ITS infrastructure investment and fills current gaps in planning, emergency management, traveler information, and parking subsystems. When deployed, the projects will complete the region's core ITS infrastructure, consistent with the USDOT's national ITS goals for safety, efficiency, productivity, mobility, and environmental improvements.[5]

The *TransPort 2000* project partners have been working to continue progress on the incremental conceptualization, planning, design, and deployment of operational ITS. The project partners include the following agencies:

- Washington and Oregon Departments of Transportation (WSDOT and ODOT).

- City of Portland Department of Transportation.

- Metro—The directly-elected regional government.

- Southwest Washington Regional Transportation Council (RTC)—The metropolitan planning organization for Southwest Washington.

- The Port of Portland.

- Tri-County Metropolitan Transportation District of Oregon (TriMET)—The public transit provider for the Portland metropolitan area.

- C-TRAN—Clark County's public transit provider.

- Academic and private partners.

The remainder of this section is organized as follows:

- 2.1 Transit Tracker System Description

- 2.2 Participants and Stakeholders

- 2.3 Evaluation Objectives

- 2.4 Hypotheses and Measures of Effectiveness

- 2.5 General Evaluation Approach

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[4] *TransPort 2000*, A FY 2000 Federal Transportation Appropriations Bill Project Request, June 15, 2001.

[5] Ibid.

2.1   TRANSIT TRACKER SYSTEM DESCRIPTION

Transit Tracker uses global positioning system (GPS) technology to track how far a bus is along its scheduled route. Every TriMet bus is equipped with a transmitter that allows continuous satellite tracking with an accuracy of approximately 30 feet. This real-time location information is used to calculate real-time bus and train arrival information. The information is then routed to electronic displays in the frequently used bus shelters and to the Transit Tracker Online Website in the form of arrival countdowns (Figure 2-1 and Figure 2-2, respectively).

Figure 2-1. Transit Tracker Display (Bus Shelter)

Arrival countdowns are estimates of when the bus will arrive (number of minutes) based on the location of the bus (the distance from the stop) and the scheduled speed along its route. If the system cannot make an accurate prediction (e.g., the vehicle is too far away or the transmitter on the vehicle is not working), the scheduled arrival time is displayed instead. In the event of an emergency, Transit Tracker information displays at bus stops can also provide important information and instructions to riders.[6]

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[6] TriMet Transit Tracker Online, **www.trimet.org/transittracker/pickroute.htm**.

Figure 2-2. Transit Tracker Online Display

2.2   TRANSIT TRACKER SYSTEM DEPLOYMENT

The first two Transit Tracker information displays were installed in January 2001 at SE 17th Street and Center and at NE Martin Luther King, Jr. Boulevard and Killingsworth. As of July 31, 2003, there were 18 Transit Tracker information displays at bus stops and 33 Transit Tracker information displays at light rail stops (however, the rail installations currently display only scheduled arrival times rather than real time updates). By January 1, 2004, TriMet plans to have Transit Tracker information displays installed at 33 to 38 bus stops, with an additional 25 installations per year through 2006. TriMet expects to have the Transit Tracker displays at the light rail stops showing real time arrival information by January 1, 2004. Transit Tracker Online, available on TriMet's Website, displays real-time arrival information for every bus stop in Portland. Transit Tracker Online became fully operational in September 2002.

2.3   EVALUATION OBJECTIVES

The evaluation of Transit Tracker was based on standard evaluation practices developed by USDOT. For each evaluation objective, hypotheses were formulated to identify anticipated impacts of the project. One or more measures of effectiveness (MOEs) were then associated with each hypothesis to assess the accuracy of the hypothesis. This section presents a discussion of the evaluation objectives and lists the hypothesis and MOEs associated with each objective.

The Transit Tracker evaluation was structured to collect and analyze data reflecting changes in bus riders' behaviors, perceptions, and satisfaction as a result of the Transit Tracker information displays and Transit Tracker Online. The evaluation was designed to meet the following five objectives as more fully described in Sections 2.3.1 through 2.3.5:

- Assess bus riders' use of trip planning information.

- Assess bus riders' perceptions of transit system efficiency.

- Assess bus riders' perceptions of personal security.

- Assess bus riders' perceptions of Transit Tracker service.

- Assess bus riders' overall satisfaction with the system.

2.3.1   Use of Trip Planning Information

One of the objectives of the Transit Tracker evaluation was to assess riders' use of trip planning information. The hypothesis stated that Transit Tracker would provide riders with accurate and useful information with which they could make informed decisions about their trips in real-time. Before Transit Tracker, riders could access only fixed-schedule information (e.g., paper brochures, schedules posted at bus stops, on-line schedules). Although frequent users may have memorized many of their schedules and routes, newer or less frequent riders may not be aware of when or how often the buses operate. Transit Tracker information displays allow riders to see the number of minutes until the next two buses arrive. With this type of information, transit riders may have more opportunities to make alternative route or travel decisions. This information may also afford riders the opportunities to make better use of their time by, for example, running an errand while waiting, instead of waiting at the stop longer than necessary. This information could also be especially useful during inclement weather conditions (which are common in Portland) when riders may not want to wait outside too long for the bus to arrive.

2.3.2   Perceptions of System Efficiency

Another objective of the Transit Tracker evaluation was to assess riders' perceptions of system efficiency. It was hypothesized that riders would perceive an increase in bus system efficiency in terms of on-time performance, even if there were no change in the actual system performance. This premise of this hypothesis is that Transit Tracker provides riders with real-time bus arrival information. Even though the bus may be operating behind schedule, the Transit Tracker displays show the actual (versus scheduled) time of arrival. If the system is accurate, the bus arrives when the counter on the display nears zero and the sign displays the word "Due." In the minds of riders, a bus arriving when the display says it will arrive (whether or not it is at the scheduled arrival time) may constitute and be perceived as an improvement in system efficiency.

2.3.3   Perceptions of Personal Security

Another objective of the Transit Tracker evaluation was to assess transit riders' perceptions of personal security. The hypothesis stated that riders would perceive an increase in personal security, even if there were no other measures taken to increase

security (e.g., increased police presence). While the Transit Tracker information, per se, has no impact on the actual security of transit riders, having access to more accurate arrival time information may afford travelers the opportunity to wait elsewhere for the bus (e.g., a coffee shop) if they have a long wait, if it is after dark, or if they are not familiar or comfortable with the area. In addition, the online information can enable riders to leave home/work later for the bus stop, thereby shortening their wait time at the stop, and therefore, their exposure to potential harm. Having information available to make these types of decisions could impact users' perception of personal security.

2.3.4   Perceptions of Transit Tracker Service

If Transit Tracker is to be successful, the system must be easy for riders to use and understand. The hypothesis stated that Transit Tracker would provide bus riders with accurate and useful information that would be understandable and easy to use This information could allow people to stay at home/work longer before leaving for the bus stop and could allow opportunities to do other things while they wait for their bus (e.g., running an errand), while remaining confident about the bus' arrival time.

2.3.5   Overall Satisfaction with Bus Service

There are many aspects of transit service that may contribute to riders' perceptions of service quality (frequency of buses, on-time arrivals, cleanliness of bus, friendliness of driver, etc.). The hypothesis stated that Transit Tracker, in and of itself, has the potential to increase riders' satisfaction with bus services. Assuming all other things remain constant, an increase in overall customer satisfaction could be attributed to the deployment of Transit Tracker.

2.4   HYPOTHESES AND MEASURES OF EFFECTIVENESS

The MOEs associated with each of the hypotheses generated for the Transit Tracker evaluation are identified in Table 2-1.

Table 2-1. Hypotheses and Measures of Effectiveness for the Evaluation of Transit Tracker

Hypothesis	Measures of Effectiveness
Transit Tracker will provide bus riders with accurate and useful information with which they can make informed decisions about their trips in real-time.	Riders' use of pre-trip planning information (e.g., types of information used, frequency of use, how information is used) and the impacts of the information use on time savings and perceptions of personal security.
Transit Tracker will increase bus riders' perceptions of bus system efficiency, even if there is no change in the actual system performance.	Riders' perceptions of system efficiency.
Transit Tracker will increase bus riders' perceptions of personal security, even if there are no other measures taken to increase security.	Riders' perceptions of personal security.
Transit Tracker will provide bus riders with accurate and useful information that will be understandable and easy to use.	Riders' satisfaction ratings of Transit Tracker (e.g., ease of use, usefulness and accuracy of information).
Transit Tracker will increase bus riders' overall satisfaction with bus service.	Riders' overall satisfaction ratings of bus services.

2.5   GENERAL EVALUATION APPROACH

The approach to the Transit Tracker evaluation was three-fold and involved the following elements:

- Administration of a before-and-after intercept survey of bus riders at bus stops.
- Analysis of ridership data at the bus stops surveyed.
- Administration of an Online survey of Transit Tracker Online users.

3. BEFORE AND AFTER INTERCEPT INTERVIEWS

The first step in the Transit Tracker evaluation was to administer "Before" and "After" intercept surveys to bus riders. The goal was to use one survey instrument to obtain information for each of the five objectives of the Transit Tracker evaluation:

- Assess riders' use of trip planning information.

- Assess riders' perceptions of transit system efficiency.

- Assess riders' perceptions of personal security.

- Assess riders' perceptions of Transit Tracker service (After survey and Online survey only).

- Assess riders' overall satisfaction with bus service.

This section describes the survey approach, respondent characteristics, and the findings from the Before and After Transit Tracker intercept surveys, and is organized as follows:

- 3.1 Survey Approach

- 3.2 Summary of Respondent Characteristics

- 3.3 Findings

3.1   SURVEY APPROACH AND LOCATION SELECTION

The Before surveys were administered on Tuesday afternoon, January 22, 2002 through Friday morning, January 25, 2002. The After surveys were administered on Tuesday morning, February 4, 2003 through Thursday afternoon, February 6, 2003. The Before surveys were conducted at four stops located in different areas throughout the city of Portland. These locations were chosen based on two criteria: (1) locations where Transit Tracker information displays had not yet been installed, but where plans existed for near-term installation; and (2) locations where bus ridership was high enough to obtain a reasonable number of completed surveys over a three- to four-day survey period.

Table 3-1 shows the mean weekday boardings from 2002 and 2003 for the five Transit Tracker locations at which TriMet passengers were interviewed and the variation in ridership between location and between time periods. Surveys were administered during the time periods when ridership was the highest at each of the locations (e.g., during the morning peak at Barbur Transit Center).

Table 3-1. Ridership Data for Transit Tracker Bus Stops in Portland

Bus Stop	Mean Weekday Boardings by Time of Day (Spring)					
	7 – 9 a.m.		9 a.m. – 4 p.m.		4 – 6 p.m.	
	2002	2003	2002	2003	2002	2003
Barbur Transit Center	284	292	141	142	55	58
Weidler at Lloyd Center	12	11	146	139	68	68
Burnside and 28th	67	62	172	157	42	38
Burnside & Grand	28	23	94	94	39	40
Salmon and 5th	97	90	607	551	387	336

Barbur Transit Center is located approximately 4 miles south of downtown Portland. It has an adjacent park-and-ride lot and serves mostly downtown commuters who are inbound in the morning. This stop is located on a major north-south arterial serving downtown Portland and the southern suburbs. The land use surrounding this stop is primarily suburban commercial and residential.

Weidler at Lloyd Center is located less than 1 mile northeast of downtown Portland. It is adjacent to a shopping mall and serves mostly non-commuters in the midday. The land use surrounding this stop is primarily commercial/shopping.

Burnside and Grand and Burnside and 28th are located between ½ mile and 1 mile east of downtown Portland. They serve some inbound morning commuters as well as non-commuters in the midday. Burnside and 28th is more residential, while Burnside and Grand, located closer to the river and railroad tracks, is more industrial.

Salmon and 5th is located in downtown Portland. It serves outbound commuters in the evening, as well as non-commuters and tourists throughout the day. This stop is located in a high-density employment and shopping district. It is well-served by transit and has a lot of pedestrian activity.

After surveys were conducted at three of the four locations shown in Table 3-1. After surveys were not administered at Burnside and Grand, as the Transit Tracker information display was not installed at that location at the time of After-survey administration. Instead, After surveys were conducted at Salmon and 5th Street because the Transit Tracker information display had been in place at that location since June 2001, about a year longer than at the other locations. This site was chosen as the Evaluation Team believed that responses at the Salmon and 5th Street location might differ from those at the other locations, as riders had more time to use the information and form opinions about its accuracy and usefulness.

Surveys were administered by a team of two at each stop during the morning peak (7 – 9 a.m.), midday (11:30 a.m. – 1:00 p.m.), and/or during the evening peak (4 – 6 p.m.). Riders were approached and informed that surveyors were asking a few questions related to customer satisfaction with the TriMet service. They were asked if they would

be willing to answer the questions while they waited for their bus to arrive. Riders who agreed to participate were given a copy of the survey to follow along visually as the surveyor read each question aloud. Surveyors recorded each rider's responses on a separate survey form.

Overall, bus riders were extremely receptive and cooperative. In fact, about 9 out of 10 people agreed to participate in the survey. The only difficulty experienced in survey administration was the ability to complete the survey before the bus arrived. Between 10 and 20 percent of the time, surveys were not able to be completed before the bus arrived, and therefore, could not be used in the analyses. This was particularly problematic on cool, rainy days at small shelters, as many riders arrived at the stops just before the bus arrived.

Table 3-2 shows the number of completed surveys obtained at each bus stop. In all, surveyors were able to obtain 240 complete Before surveys and 278 complete After surveys.

Table 3-3 shows the percentage of total daytime riders (7 a.m. to 6 p.m.) surveyed at each stop. For most of the study sites, the number of riders interviewed totaled approximately 20 percent of the number of average daily boardings. The exceptions were the stops at Burnside and Grand and at Salmon and 5th where the percentage was about 10%.

Table 3-2. Number of Completed Transit Tracker Surveys

Bus Stop	Number of Completed Surveys	
	Before	**After**
Barbur Transit Center	109	83
Weidler at Lloyd Center	53	48
Burnside and 28th	62	61
Burnside and Grand	16	Not Surveyed
Salmon and 5th	Not Surveyed	86
Total	240	278

Table 3-3. Percent of Riders Surveyed at Each Bus Stop

Bus Stop	2002 (Before)			2003 (After)		
	Average Daily Boardings (7am – 6pm)	# Surveys (7am – 6pm)	# Surveys /Average Daily Boardings	Average Daily Boardings (7am – 6pm)	Completed Surveys (7am – 6pm)	# Surveys /Average Daily Boardings
Barbur Transit Center	480	109	23%	492	83	17%
Weidler at Lloyd Center	226	53	23%	218	48	22%
Burnside and 28th	281	62	22%	257	61	24%
Burnside and Grand	161	16	10%	Not Surveyed		
Salmon and 5th	Not Surveyed			977	86	9%
Total	1148	240	21%	1944	278	14%

It should be noted that Transit Tracker information displays were installed at only a few bus stops prior to conducting the Before surveys. To account for this, as well as any operational variability among the locations, survey questions were worded to pertain to the stop at which the survey was being administered. For example, one question was worded, "*At this bus stop*, how satisfied are you with bus adherence to the posted schedules?" By phrasing the questions in this manner, riders were asked to focus on that particular bus stop when responding to questions, and not another stop that may not have a Transit Tracker information display or that may have a different display. Copies of the Transit Tracker Before and After intercept surveys are in Appendix A and Appendix B, respectively.

3.2   SUMMARY OF RESPONDENT CHARACTERISTICS

Of the 240 bus riders surveyed in the Before survey, 43 percent were male and 57 percent were female. Of the 278 bus riders' surveys in the After survey, 46 percent were male and 54 percent were female. A comparison of the age distribution of the respondents is illustrated in Figure 3-1, which shows that respondents represented every age category, and that the age distribution was very similar in the two surveys. Statistical comparisons were made of the age and gender distributions of the respondents at the three bus stops where surveys were administered both before and after the Transit Tracker installation (i.e., Barbur Transit Center, Weidler at Lloyd Center, and Burnside and 28th Street). The results showed no significant differences between the distribution of responses on the Before and After surveys.

Figure 3-2 shows the frequency with which respondents reported riding the bus. The distributions are nearly identical for the Before and After surveys. About three quarters of respondents reported that they rode the bus *nearly every day*, and nearly one quarter reported that they rode the bus *1 – 4 days per week*. Only 3 percent of respondents reported riding the bus *less than 1 day per week*. Therefore, the large majority of survey respondents, in both the Before and After survey, were regular and frequent bus riders. It should be noted that those respondents who reported riding the bus five days per week for work (but usually not on weekends) in the After survey are represented in the *nearly every day* category. A statistical comparison was made of the distributions of the respondents' riding frequencies at the three bus stops. The results showed no differences between the frequencies with which respondents rode the bus in the Before and After surveys.
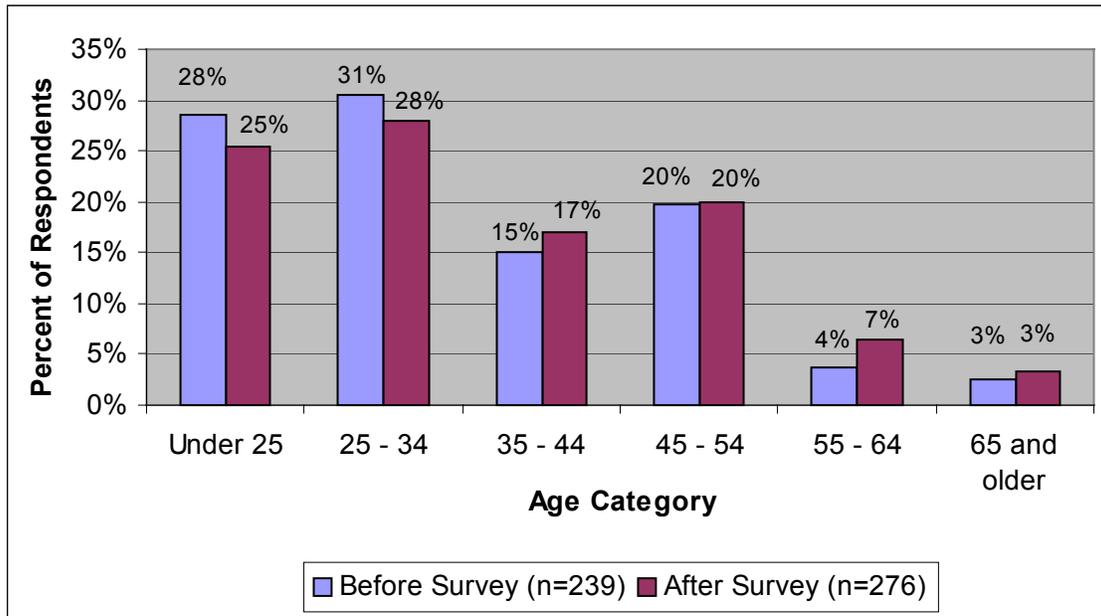
Figure 3-1. Age Distribution Comparison of Before and After Survey Respondents
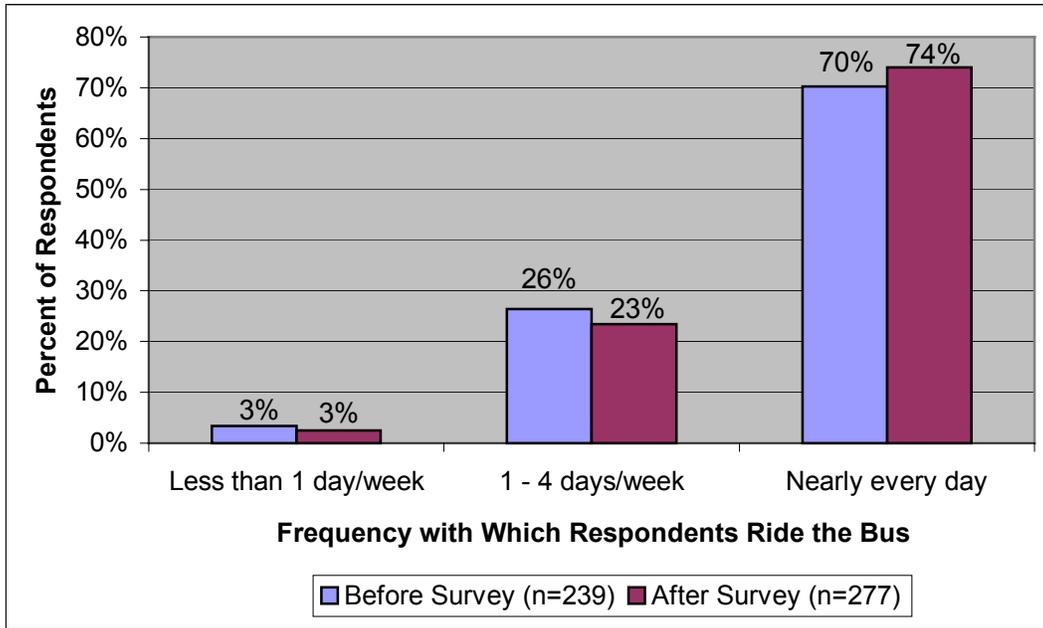
Figure 3-2. Frequency with which Respondents Ride the Bus

Respondents were also asked to indicate for which trip purposes they most frequently rode the bus. Trip purposes included on the survey were: *work*, *school*, *shopping*, *recreation*, *other*, and for *most all trips*. Respondents were asked to "mark all that apply". The distribution of responses is shown in Figure 3-3.
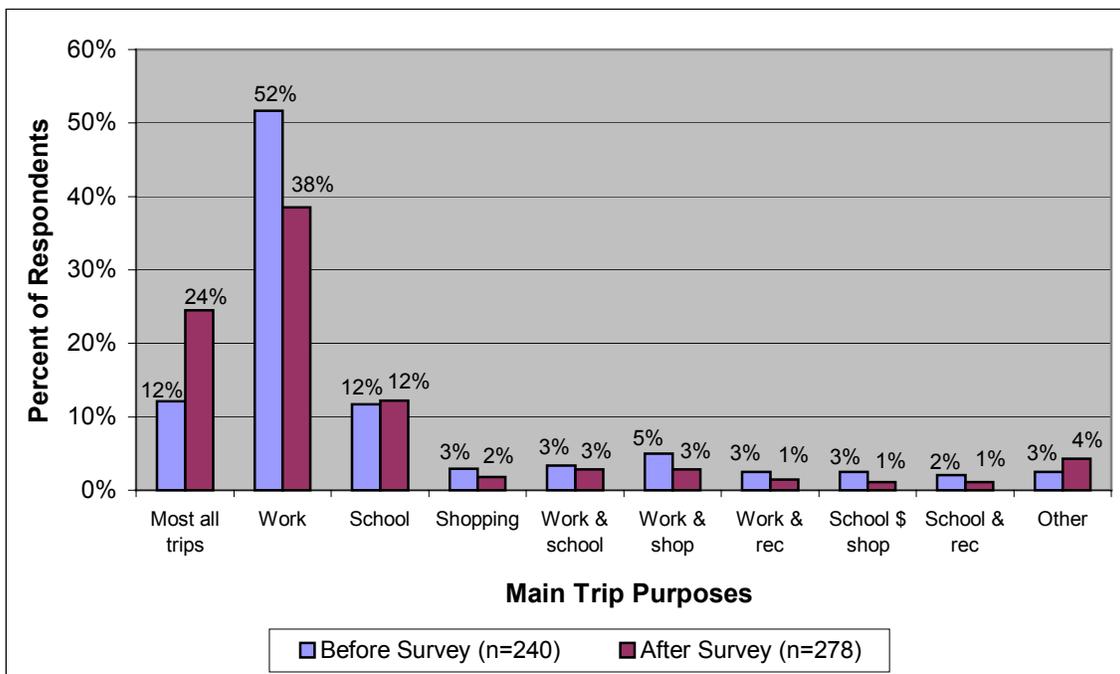
Figure 3-3. Response Distributions for Main Trip Purpose

Statistical comparisons were made of the distribution of trip purposes at the three bus stops surveyed before and after Transit Tracker. The results showed that there was not a significant difference between the before and after response distributions at Barbur Transit Center or at Burnside and 28th Street. The before and after responses distributions at Weidler at Lloyd Center, however, were significantly (x^2 = 6.084, ρ = 0.048) different. The responses distributions for the three most popular responses (*work, school,* and *most all trips*) are shown in Figure 3-4. From a visual examination of the distributions, it appears that more respondents in the Before survey rode the bus mainly for work trips than in the After survey. Likewise, it appears that more respondents in the After survey rode the bus for most all their trips than in the Before survey.
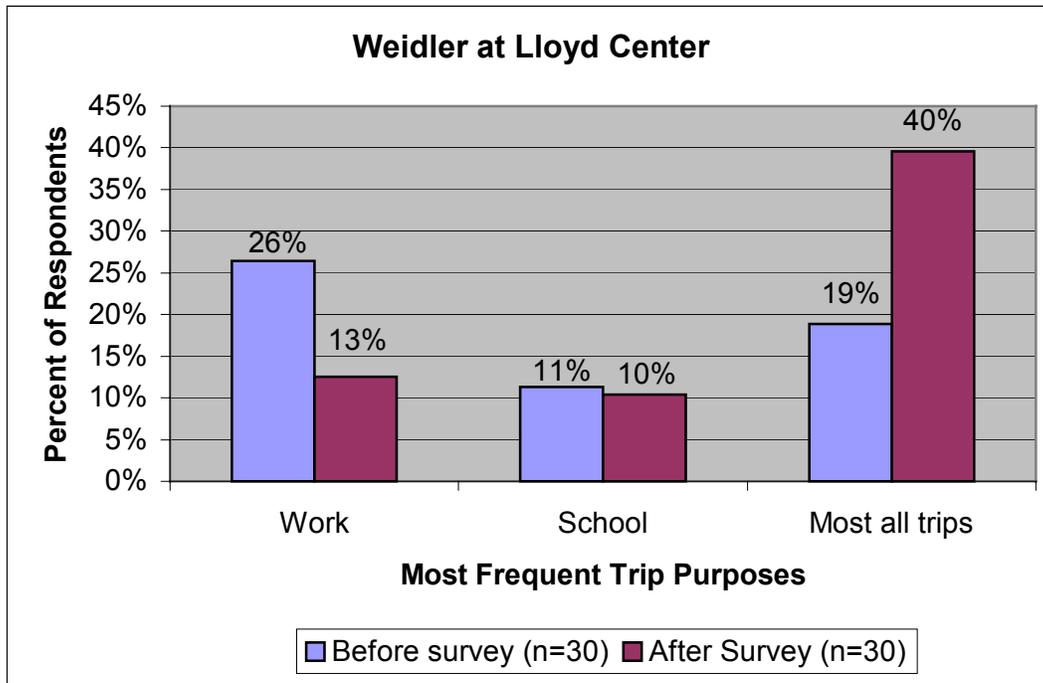
Figure 3-4. Distribution of Most Frequent Trip Purposes

When asked whether or not they had an automobile available for their use, 62 percent of the respondents on the Before survey indicated that they had an automobile available, compared to 58 percent on the After survey. A little over one-third of the bus riders surveyed, both before and after Transit Tracker, were transit-dependent. Statistical comparisons of the response distributions on the Before and After surveys showed no significant differences at the stops for automobile availability.

It should be noted that the sample sizes of 240 and 278 riders in the Before and After Transit Tracker surveys, respectively, are not representative of the entire bus riding population in Portland (the sample sizes are not large enough and the data were not gathered at enough locations). However, as nearly 20 percent of the average daily riders were surveyed at each stop, and the characteristics of the respondents in the two samples at each of the locations are not significantly different, it could be assumed that the sample of riders at each location is representative of the bus riders at that location. The exception may be the bus stop at Weidler at Lloyd Center. While there were no significant differences between the gender, age, and frequency-of-use distributions of

the respondents between the two samples, there was a significant difference between the trip purpose distributions between the two samples at this stop. This difference could represent a systematic difference between the respondents in the Before and After surveys. Therefore, any statistical differences found between the Before and After surveys at this location should be interpreted cautiously.

3.3   FINDINGS

The findings are presented in terms of the five evaluation objectives: assess riders' use of trip planning information, assess riders' perceptions of transit system efficiency, assess riders' perceptions of personal security, assess riders' perceptions of Transit Tracker service (After survey and Online survey only), and assess riders' overall satisfaction with bus service. In the following sub-sections, the frequency distributions of before-and-after responses are presented in one graph (rather than one graph for each bus stop); however, due to the varied nature of the bus stops surveyed (stop and rider characteristics) all before-and-after comparisons are made at the stop-level.

3.3.1   Use of Trip Planning Information

The first objective of the evaluation was to assess bus riders' use of trip planning information. The hypothesis associated with this objective was:

> *Transit Tracker will provide bus riders with accurate and useful information with which they can make informed decisions about their trips in real-time.*

Therefore, several questions on the surveys were geared toward determining what type of fixed-schedule information the respondents used (e.g., schedules posted at bus stops) and how often they used each type of information. In the After survey, respondents were also asked to rate their level of agreement with several statements regarding how they used the real-time Transit Tracker information, and what kind of trip-related decisions (e.g., take a different bus route) they had made after consulting Transit Tracker.

3.3.1.1   Use of Fixed-Schedule Information

In both the Before and After surveys, respondents were asked how often they used various sources of fixed-schedule information, including: paper timetables, schedule guides posted at stops, on-line schedules, and the 238-RIDE phone line. The response distributions from both surveys are shown in Figure 3-5, which shows that the frequency-of-use patterns varied little between the Before and After surveys. A statistical comparison was made between the response distributions from the two surveys at the three stops where surveys were administered both before and after Transit Tracker. The results showed that there were no significant differences between respondents' reported use of fixed-schedule information before and after the availability of the Transit Tracker information.

Paper Timetables

Frequently or Almost Always: 30%, 24%
Sometimes: 25%, 26%
Rarely or Almost Never: 45%, 50%

Schedules Posted at Bus Stop

Frequently or Almost Always: 34%, 37%
Sometimes: 25%, 21%
Rarely or Almost Never: 41%, 42%

238-RIDE Phone Number

Frequently or Almost Always: 7%, 6%
Sometimes: 17%, 11%
Rarely or Almost Never: 76%, 83%

Online Internet Schedules

Frequently or Almost Always: 16%, 20%
Sometimes: 18%, 18%
Rarely or Almost Never: 66%, 62%

■ Before Survey (n=240)   ■ After Survey (n=278)

Figure 3-5. Frequency With Which Respondents Use Various Sources of Bus Schedule Information

3.3.1.2   Use of Transit Tracker Real-Time Information

In the After survey, respondents were asked to indicate how often they used the Transit Tracker signs at bus stops, as well as how often they accessed Transit Tracker Online. Figure 3-6 shows that the large majority of respondents (78 percent) reported using the Transit Tracker signs *frequently* or *almost always*. The same respondents, however, reported using Transit Tracker Online very infrequently; 95 percent reported using Transit Tracker Online *rarely* or *almost never*. It should be noted, however, that the online version of Transit Tracker had been available less than four months at the time the After survey was administered.
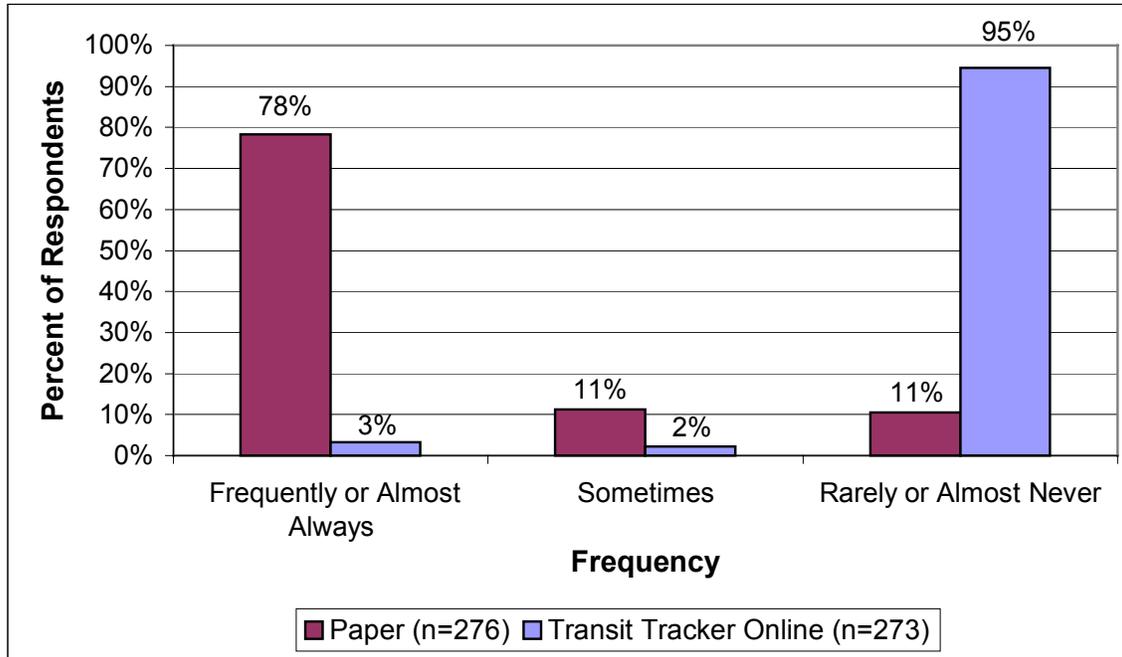
**Figure 3-6. Frequency With Which Respondents Use
Tranist Tracker Signs and Transit Tracker Online**

Riders were also asked to indicate whether they had ever used the information provided by Transit Tracker to make important decisions about their trips. Respondents were asked, "Have you ever used Transit Tracker information AT THIS STOP to do any of the following?" The response choices were as follows:

a.   Take an alternate bus route.

b.   Wait for the bus in a more sheltered location.

c.   Leave the stop and return when the bus is due.

d.   Find another way to travel to your destination instead of by bus.

e.   Other.

Respondents were asked to mark all the of the responses choices that applied to them. Figure 3-7 shows the results of those riders surveyed at Barbur Transit Center, Weidler at Lloyd Center, and Burnside and 28th Street. The results are shown in two different ways in the figures. The solid bars show the percentage of total respondents that selected each response choice a, b, c, d, and e, or none of the above. Because respondents were allowed to choose more than one response, these percentages total to more than 100 percent. The cross-hatched in the figures show the results when considering every individual's unique response, and the fact that they may have selected more than one option (i.e., the distribution of different combinations of response choices by individuals). While not every possible combination is shown in the figure, those shown make up about 87 percent of all the responses.
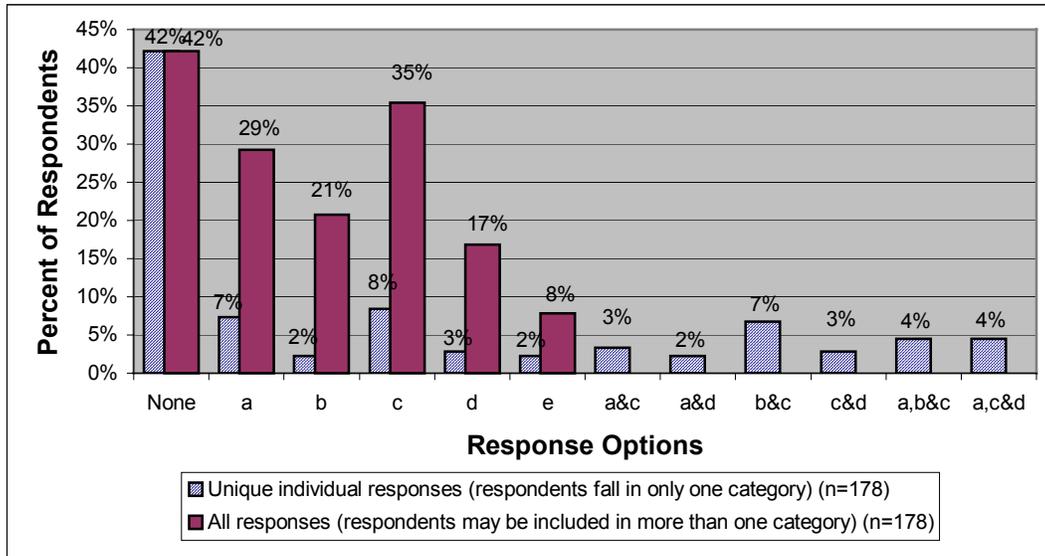
Figure 3-7. Use of Transit Tracker Information by Riders at Three Bus Stops Surveyed Both Before and After Installation

The most common response given at these three stops was *none of the above*. The second and third most common responses were *leave the stop and return when the bus is due* (given by 35 percent of respondents) and *take an alternate bus route* (given by 29 percent of respondents). It is interesting that while 42 percent of respondents reported not really using the Transit Tracker information for their benefit, that nearly a third of the respondents had actually used it to take an alternate route.

Figure 3-8 shows the results of those riders surveyed at Salmon and 5th. It was hypothesized that riders at Salmon and 5th might use the information differently than riders at the other stops, because the information was available longer at this location (since June 2001), and because the riders had more time to determine how best to use it. A visual examination of the distributions in Figure 3-7 and Figure 3-8 shows that this may indeed be the case. At the three stops where Transit Tracker had been installed for only a few months, 42 percent of riders reported that they had not made any of the decisions listed as a result of consulting Transit Tracker. At Salmon and 5th, only 23 percent of riders reported they had not made any of the decisions listed. In almost every case, there was a higher percentage of riders at Salmon and 5th making use of the information than at the other three stops. From these results, it might be concluded that, over time, bus riders learned to use the information for their benefit; however, this result could be a function of the stop or the riders at the stop, and a more detailed comparison of stop characteristics would be required before making a firm conclusion.
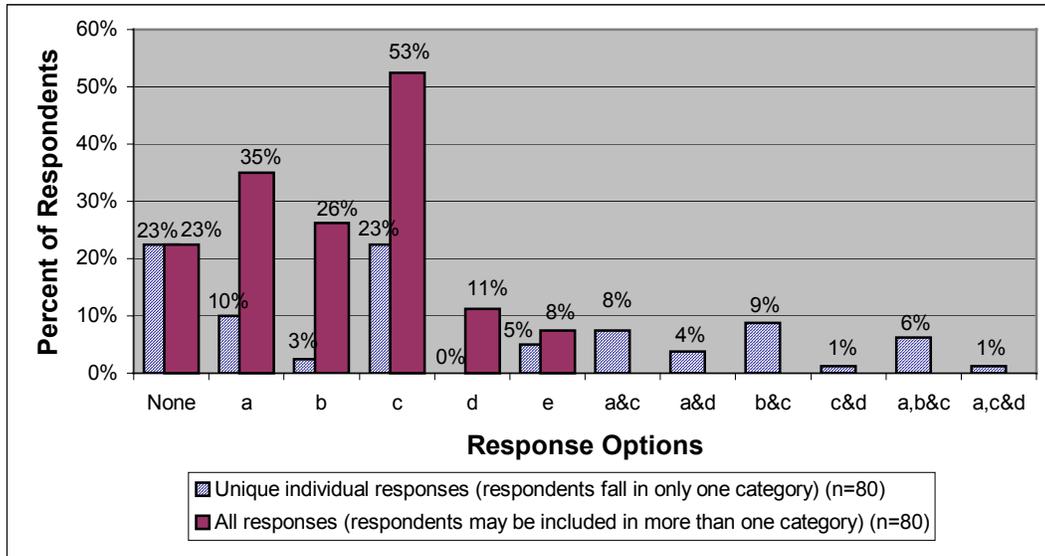
**Figure 3-8. Use of Transit Tracker Information
by Riders at Salmon and 5ᵗʰ**

3.3.2   Perceptions of Transit System Efficiency

The second objective of the evaluation was to assess bus riders' perceptions of transit system efficiency. The hypothesis associated with this objective was:

> *Transit Tracker will increase bus riders' perceptions of bus system efficiency, even if there is no improvement in on-time arrivals.*

Riders were asked several questions about the on-time performance of the buses and about how long they generally waited for the bus to arrive. In both the Before and After survey, riders were asked if the bus they usually rode at that stop was generally on time. It was hypothesized that if the Transit Tracker arrival information were accurate, there would be an increase in the number of respondents who perceived the bus to be on time (even if the bus was running behind schedule). Figure 3-9 shows that, overall, there was very little difference in the responses on the Before and After surveys; however, there does appear to be slightly fewer *don't know* responses and slightly more *yes* responses (the anticipated result).

A statistical comparison was made of the response distributions at Barbur Transit Center, Weidler at Lloyd Center, and Burnside and 28ᵗʰ Street. While there were no significant differences at Barbur Transit Center or Weidler at Lloyd Center, there was a significant difference at Burnside and 28ᵗʰ (^{2} = 7.213, ρ = 0.027). The before- and after- distributions of riders' perceptions of on-time performance at Burnside and 28ᵗʰ Street are shown in Figure 3-10.

Is the Bus You Ride at This Stop Usually on Time?
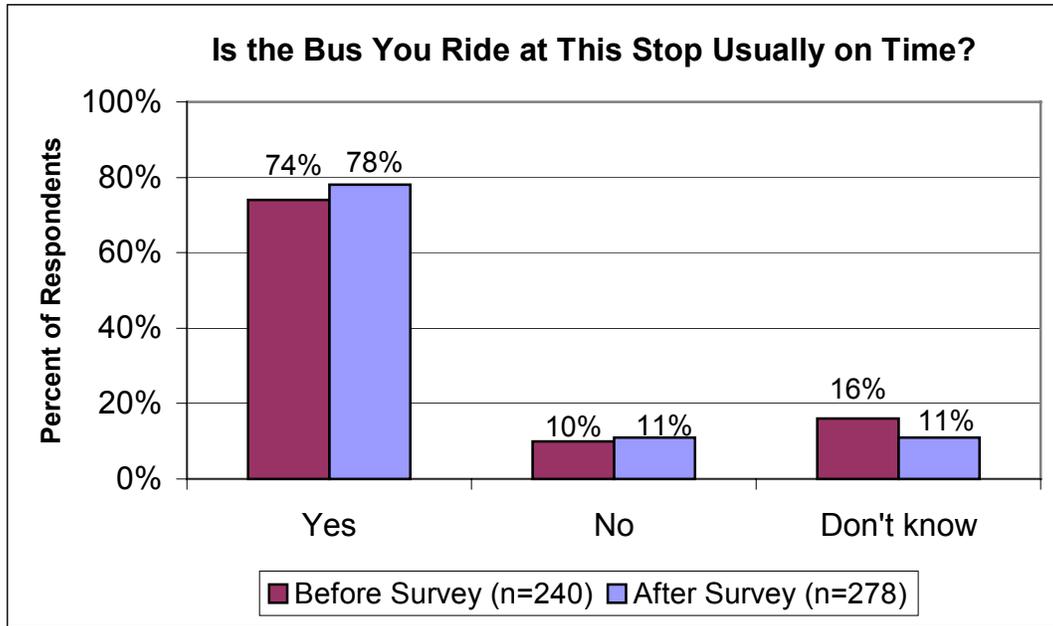
Figure 3-9. Riders' Perceptions of the On-time Performance

Is the Bus You Ride at This Stop Usually on Time?
(Burnside and 28th Street)
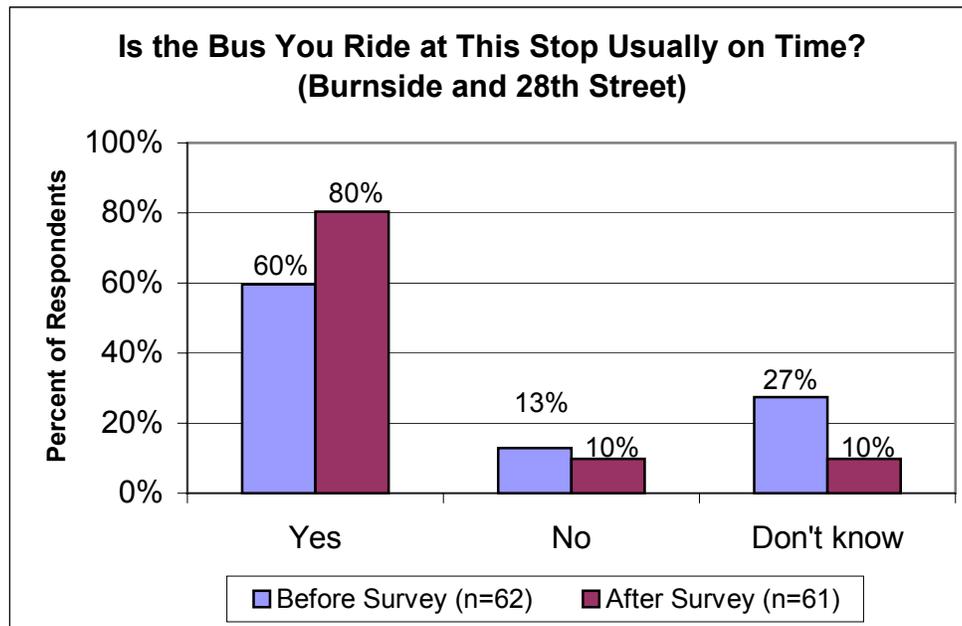
**Figure 3-10. Riders' Perceptions of On-Time Performance
at Burnside and 28th Street**

It can be seen in the figure that more riders in the After survey perceived the bus to be on time (80 percent after compared to 60 percent before). Likewise, fewer riders in the After survey indicated that they did not know if the bus was on time (10 percent after compared to 27 percent before. There was only a slight decrease in the percentage of

riders who reported that the bus was not usually on time. It might be concluded that the presence of the Transit Tracker information had a positive influence on riders perceptions of on-time performance at this stop; at the same time, the information helped riders to have a better idea of whether the bus was running on-time or not.

According to TriMet's *Time of Day Route Performance Report*, actual on time performance at the Transit Tracker study sites deteriorated slightly between Spring 2002 and Spring 2003 as shown in Table 3-4.

Table 3-4. Actual On-Time Performance

			% Trips On Time	
Location	**Route**	**Direction**	**Spring 2002**	**Spring 2003**
Burnside & 28th				
	Rte 9	Inbound	92%	88%
	Rte 20	Inbound	78%	76%
Barbur Transit Center				
	Rte 12	Inbound	91%	89%
	Rte 94	Inbound	94%	92%
Weidler @ Lloyd Center				
	Rte 9	Outbound	73%	69%
	Rte 77	Outbound	85%	79%

Riders were also asked to indicate how long they usually waited for the bus at the stop being surveyed. It was hypothesized that the Transit Tracker information would make riders more aware of the actual time they waited for the bus (even if it was no shorter/longer than before). Often times, when one is in a hurry, the passage of time can seem longer than it really is. With Transit Tracker, riders are given real-time information about the estimated arrival of their bus from the time they arrive at the stop. Therefore, there is less uncertainty associated with their wait.

In response to the question of how long they usually wait for the bus, about 64 percent of riders in the Before survey gave an integer response, 23 percent gave a time range (e.g., 5 – 10 minutes), and 13 percent said they did not know. In the After survey, about 61 percent of riders gave an integer response, 33 percent gave a time range, and 6 percent said they did not know. The response distributions for those reporting an integer are shown in Figure 3-11. The mean reported wait time before Transit Tracker was 8.6 minutes, with a standard deviation of 4.4 minutes. The mean reported wait time after Transit Tracker was 8.8 minutes, with a standard deviation of 4.5 minutes. In other words, overall, there was no change in perceived wait time after the installation of Transit Tracker. In addition, overall, there was no decrease in the variability of reported wait times after the installation of Transit Tracker.
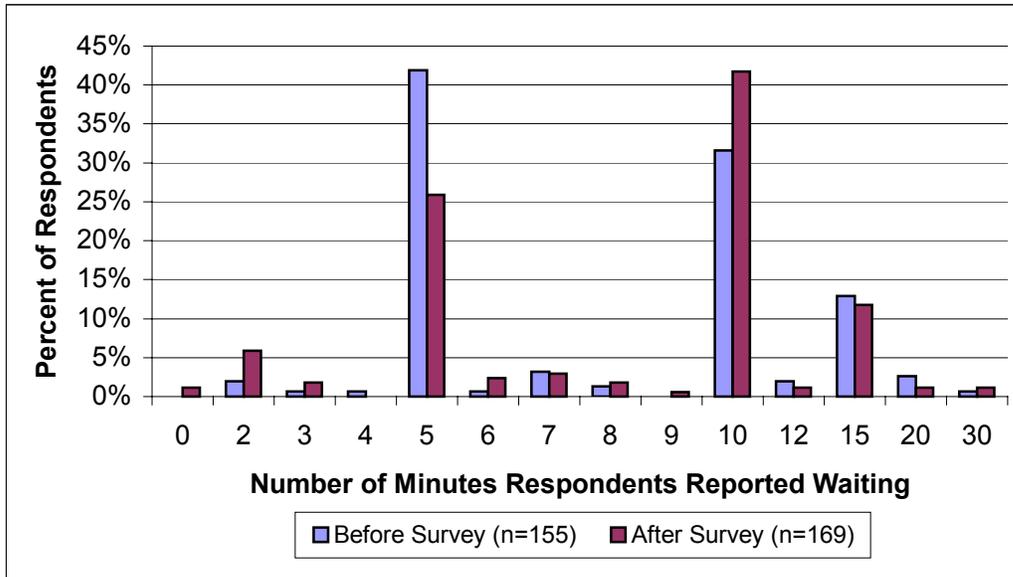
Figure 3-11. Distribution of Integer Responses for Wait Time

The mean wait times (integer values) before and after Transit Tracker were compared statistically at Barbur Transit Center, Weidler at Lloyd Center, and Burnside and 28th Street. There were no significant differences in mean reported wait times before and after Transit Tracker at any of the three bus stops.

The response distributions for those reporting wait time as a range before and after Transit Tracker are shown in Figure 3-12 and Figure 3-13, respectively.
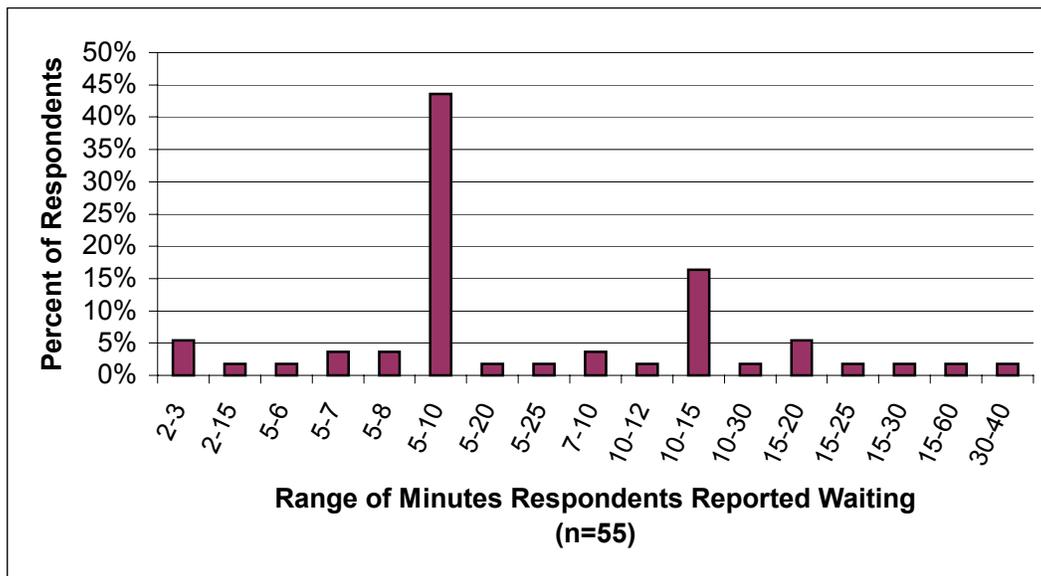
Figure 3-12. Distribution of Responses for Those Giving a Range for Wait Time in the Before Survey
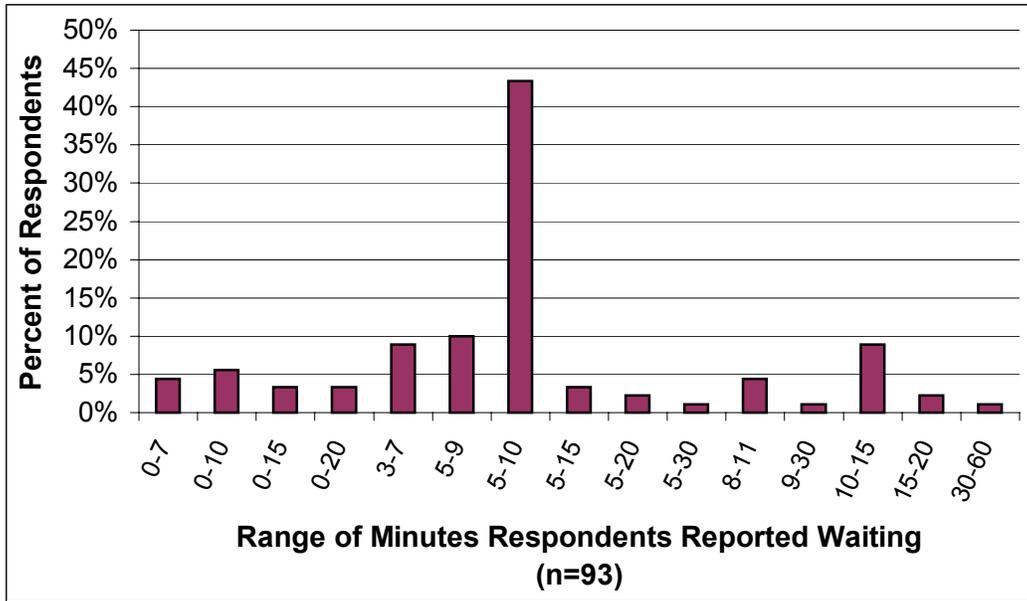
**Figure 3-13. Distribution of Responses for Those Giving a Range
for Wait Time in the After Survey**

Taking an average of each range given, the overall average wait time reported before Transit Tracker was 10.6 minutes, with a standard deviation of 6.6 minutes. The overall average wait time reported after Transit Tracker was 8.4 minutes, with a standard deviation of 5 minutes. In this case, overall, the wait times given after Transit Tracker appear to be about 2 minutes shorter than those given before Transit Tracker (and less variable as well). No statistical comparison was performed on these mean wait times, as they are the result of averaging ranges reported by respondents.

On the Before survey, riders were asked how satisfied they were with the bus' adherence to the posted schedules. The results are shown in Figure 3-14, which shows that the overwhelming majority of riders, 91 percent, reported that they were either *satisfied* or *extremely satisfied* with bus adherence to the posted schedules. The results show that riders were already very satisfied with the bus efficiency, even before the installation of Transit Tracker, which may account for why there were not more significant differences found between the before and after responses.
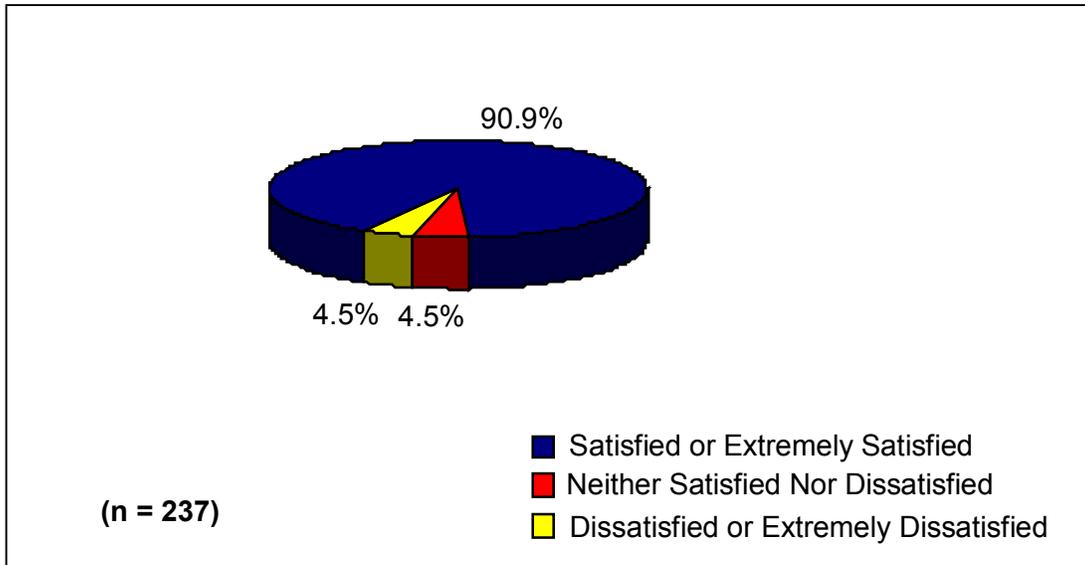
**Figure 3-14. Riders' Satisfaction with Bus Adherence
to Posted Schedules Before Transit Tracker**

3.3.3   Perception of Personal Security

The third objective of the Transit Tracker evaluation was to assess bus riders'
perceptions of personal security. The hypothesis associated with this objective was:

> *Transit Tracker will increase bus riders' perceptions of personal security, even if
> there are no other measures taken to increase security.*

In both the Before and After surveys, riders were asked to rate the degree to which
they agreed with the following two statements:

- I feel safe waiting for the bus at this bus stop **DURING THE DAY**.

- I feel safe waiting for the bus at this bus stop **AT NIGHT**.

The results for are illustrated in Figure 3-15 (day) and Figure 3-16 (night), respectively.
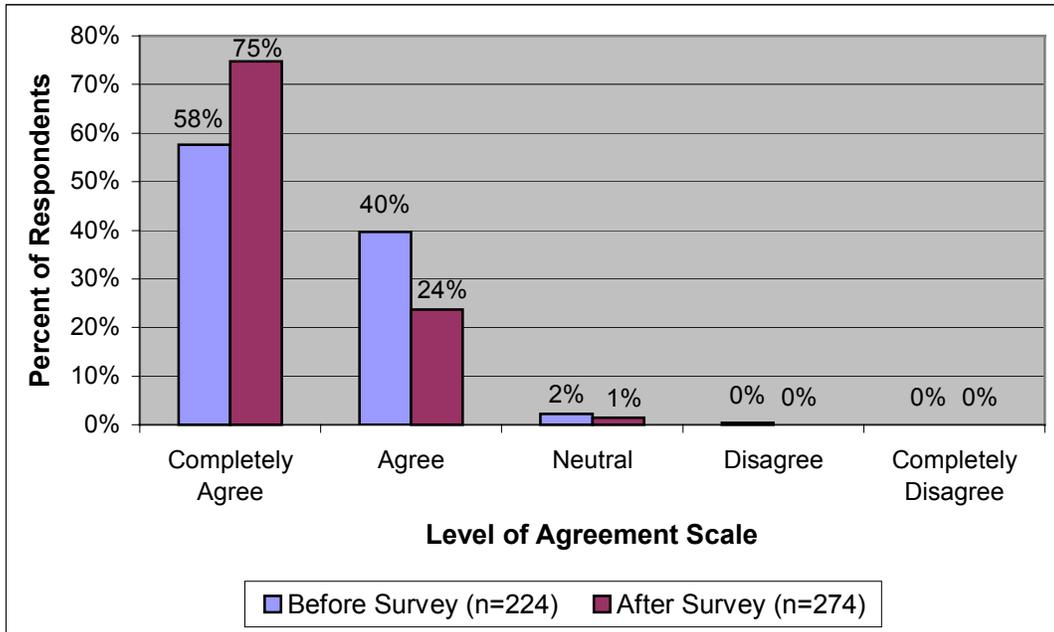
Figure 3-15. Respondents' Perceptions of Safety During the Day
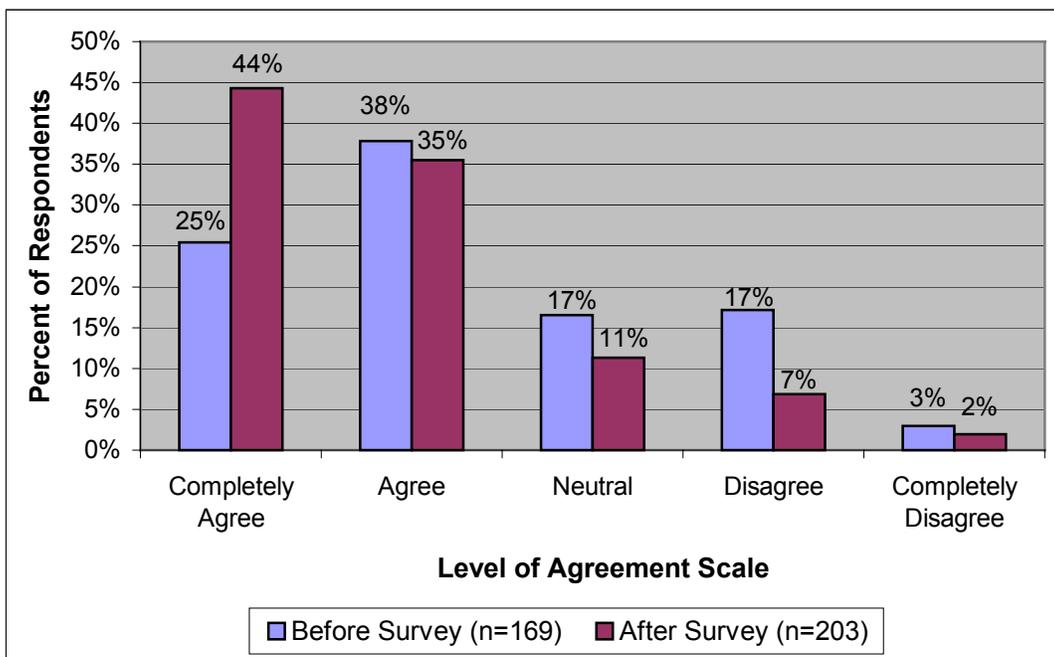
Figure 3-16. Respondents' Perceptions of Safety at Night

An overwhelming majority (97 and 98 percent in the Before and After survey, respectively) reported that they *agreed* or *completely agreed* that they felt safe waiting for the bus at the stops during the day. Somewhat fewer respondents (63 and 59 percent in the Before and After survey, respectively) reported that they *agreed* or *completely agreed* that they felt safe waiting for the bus at the stops at night.

A statistical comparison was made of riders' perceptions of personal security before and after Transit Tracker at Barbur Transit Center, Weidler at Lloyd Center, and Burnside and 28th Street. The results showed no significant difference between the response distributions at Weidler at Lloyd Center or at Barbur Transit Center during the day or at night. The results did show a significant difference in response distribution between the Before and After surveys at Burnside and 28th Street during the day ($\chi^2 = 8.064$, $\rho = 0.045$) and at night ($\chi^2 = 6.460$, $\rho = 0.040$). These distributions are shown in Figure 3-17 and Figure 3-18.

Figure 3-17. Respondents' Perceptions of Safety at Night

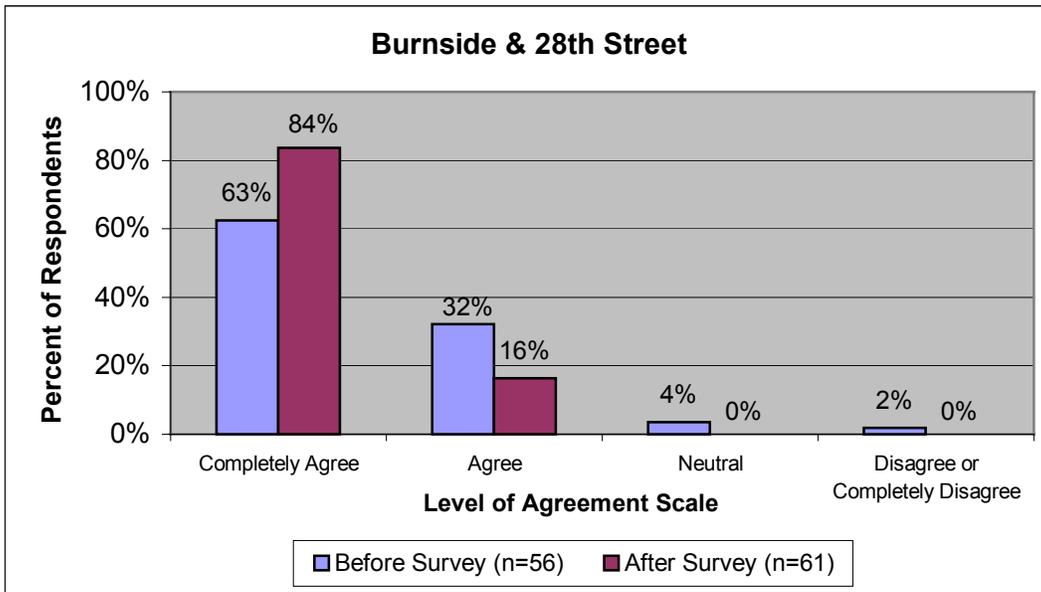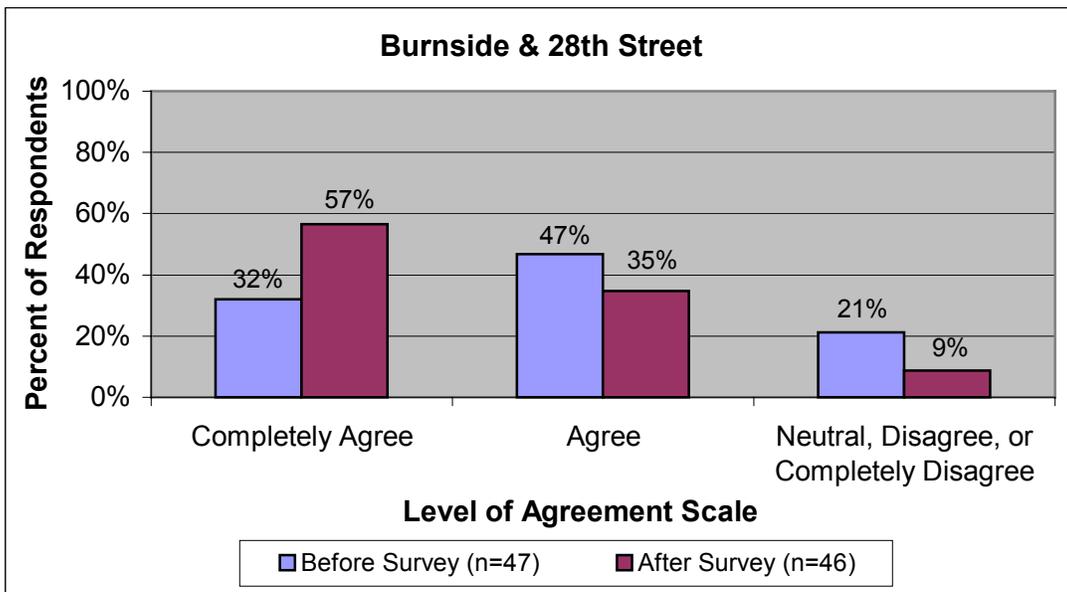**Figure 3-18. Perceptions of Safety During the Day
at Burnside and 28th Street**

Figure 3-17 and Figure 3-18 show that fewer riders at Burnside and 28th *agreed* that they felt safe during the day and at night after the installation of Transit Tracker; however, more riders *completely agreed* that they felt safe waiting during the day and at night after the installation of Transit Tracker. During the day, fewer riders were *neutral* about their feelings of safety after Transit Tracker (no one *disagreed* that they felt safe before or after Transit Tracker). Fewer riders were *neutral* or *disagreed* that they felt safe at night after Transit Tracker. It appears that the significant difference between the response distributions lies in the shift of respondents from *agreement* to *complete agreement* that they felt safe waiting at the stop.

It was also hypothesized that an increase in nighttime ridership could indicate that riders felt safer riding the bus at night. Results of the analysis of nighttime ridership are presented in Section 4.

3.3.4   Perceptions of Transit Tracker Service

The fourth objective of the Transit Tracker evaluation was to assess bus riders' perceptions of the Transit Tracker service. The hypothesis associated with this objective was:

> *Transit Tracker will provide bus riders with accurate and useful information that will be understandable and easy to use.*

Several questions on the After survey were geared toward determining how users' perceived the Transit Tracker information in terms of the functionality of the sign, as well as the information provided. In one question, riders were asked about how often the Transit Tracker sign was working and how often the information provided was useful and accurate. The results are shown in Figure 3-19, which shows that the majority of riders reported that the Transit Tracker sign/information at the stops was *almost always* working, useful, and accurate; fewer riders were able to report that the information was *almost always* accurate than it was useful or functional. Very few riders reported that the Transit Tracker sign/information was *rarely* or *almost never* working, useful, or accurate.

In addition, riders were asked to rate the visibility of the Transit Tracker sign, the understandability and accuracy of the information provided, and the Transit Tracker overall. The results are shown in Figure 3-20. The majority of riders rated the visibility of the sign and the understandability of the information as *very good*, while 44 percent of riders rated the information accuracy as *very good*. Very few riders rated the Transit Tracker sign/information as *poor* or *very poor*. Overall, 61 percent of riders rated the Transit Tracker as *very good,* and 31 percent rated it as *good*.
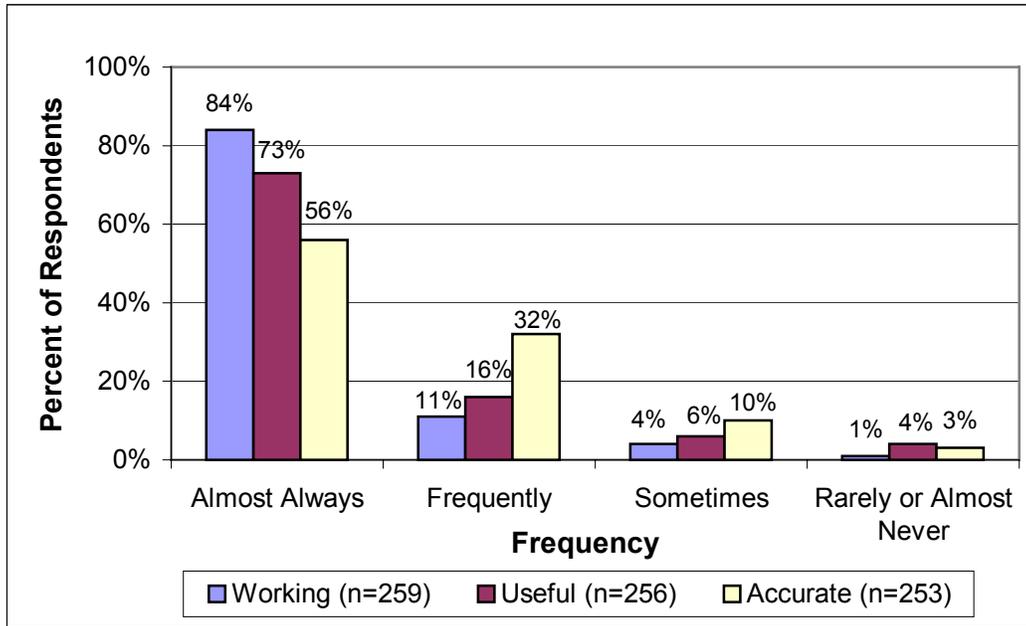
Figure 3-19. Frequency With Which the Transit Tracker Sign/Information is Working, Useful, and Accurate
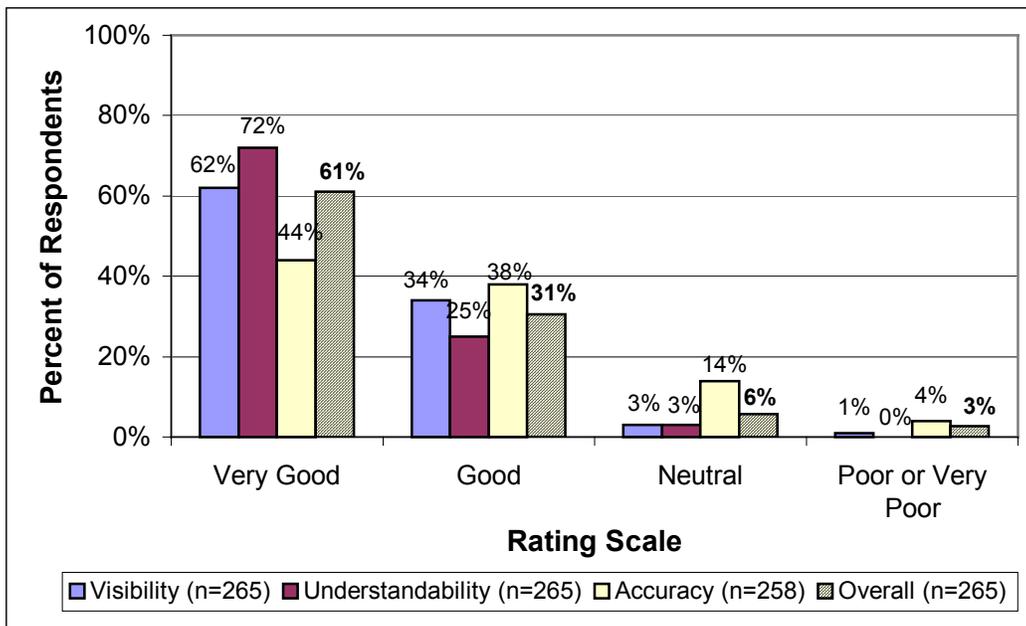
Figure 3-20. Respondents' Ratings of Transit Tracker Sign/Information

In addition, riders were asked to indicate if any of a series of statements about Transit Tracker information were true for them. Respondents were asked, "Which of the following statements about Transit Tracker information AT THIS STOP are true for you?" The response choices were as follows:

a. Increases my sense of security at the bus stop,

b. Reduces my anxiety at the bus stop,

c. Gives me more control over my travel,

d. Saves me time at the bus stop, and

e. Other.

Respondents were asked to mark all the of the responses choices that applied to them. The results are shown in two different ways in Figure 3-21. The solid bars show the percentage of total respondents that selected each response choice a, b, c, d, and e or none of the above. Because respondents were allowed to choose more than one response, these percentages total to more than 100 percent. The cross-hatched bars in the figures show the results when considering every individual's unique response, and the fact that they may have selected more than one option (i.e., the distribution of different combinations of response choices by individuals). While not every possible combination is shown in the figure, those shown make up about 89 percent of all the responses.

Figure 3-21 shows that many of the riders felt that Transit Tracker helped them in a number of ways. Sixty percent reported that the information *reduced their anxiety at the bus stop*, 55 percent reported that the information *increased their sense of security at the bus stop*, and 43 percent reported that the information *gave them more control over their travel*. In fact, 17 percent of respondents reported response choice "a, b, c, and d", which was the most common single response given.
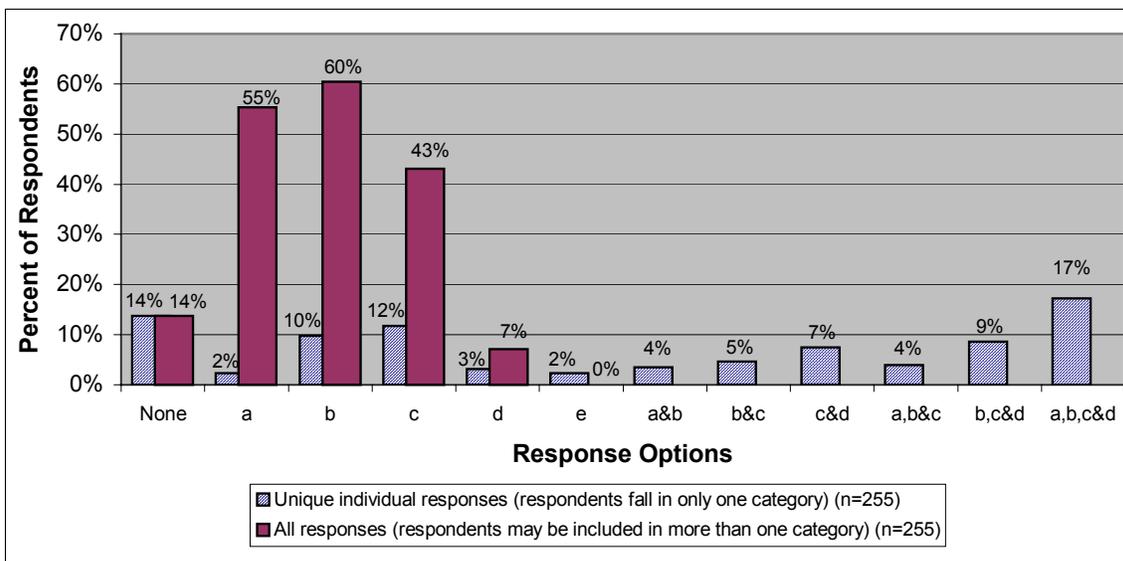
Figure 3-21. Respondents' Perceptions of the Transit Tracker System

3.3.5   Overall Satisfaction with Bus Service

The final objective of the Transit Tracker evaluation was to assess bus riders' overall perceptions of the bus service. The hypothesis associated with this objective was:

Transit Tracker will increase bus riders' overall satisfaction with bus service.

Overall satisfaction was measured by asking respondents to indicate, on a five-point scale, how satisfied they were with bus service at the stop where they were interviewed. Figure 3-22 shows that over 90 percent of respondents in both the Before and After surveys indicated that they are either *satisfied* or *extremely satisfied* with the bus service at the stop. About 5 percent reported being *dissatisfied* or *extremely dissatisfied* before Transit Tracker, and a mere 1 percent reported being *dissatisfied* or *extremely dissatisfied* after Transit Tracker. A statistical comparison of riders' satisfaction with bus service before and after Transit Tracker was performed for the riders at Barbur Transit Center, Weidler at Lloyd Center, and Burnside and 28th Street. The results showed no significant difference between the satisfaction ratings before and after Transit Tracker. This could be attributed to the fact that riders were already very satisfied before the Transit Tracker deployment.

These Before and After survey findings are in line with customer satisfaction ratings monitored annually by TriMet. In November 2002, 1,004 randomly selected residents 16 years of age or older in the TriMet service area were contacted by telephone as part of the most recent *TriMet Attitude and Awareness Survey*. Table 3-5 summarizes the responses to the following question:

TriMet is the local agency that runs the buses and MAX. Based on what you know or may have heard, overall, do you feel TriMet is doing an excellent, good, fair, or poor job?

As shown in Table 3-5, 85 percent of riders participating in the survey indicated that they felt that TriMet was doing a *good* or *excellent* job.
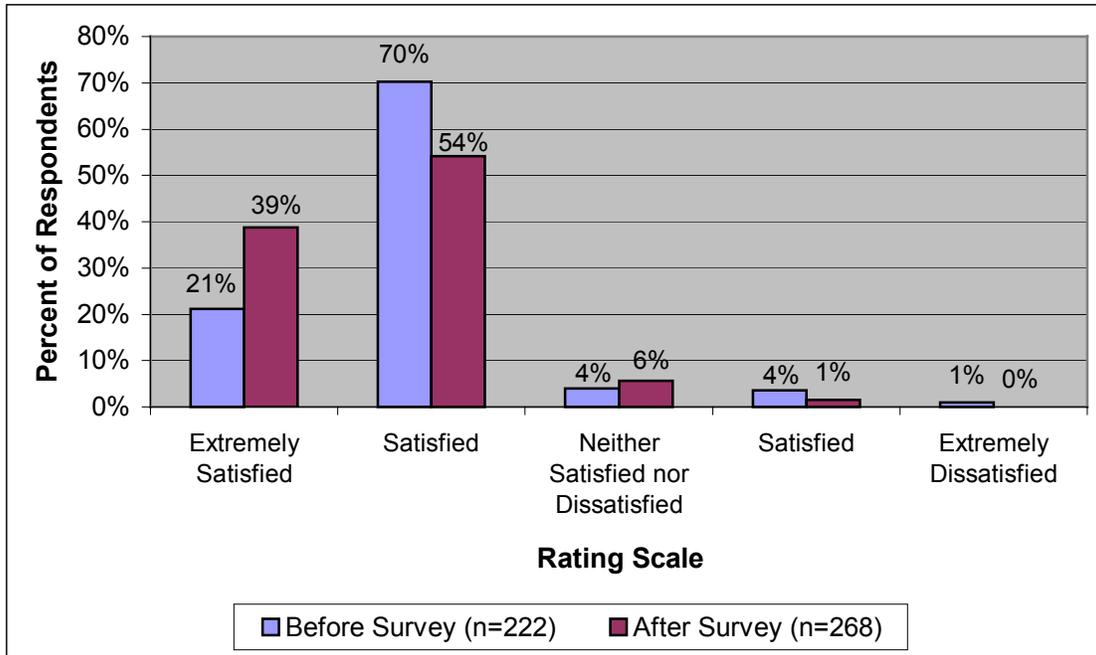
Figure 3-22. Riders' Perceptions of Overall Service Quality

Table 3-5. TriMet Service Area Residents' Perception of TriMet Job Performance

TriMet Job Rating	Total (n=1004)	Nonriders (n=555)	Riders[7] (n=449)
Excellent/Good (net)	**77%**	**70%**	**85%**
Excellent	26	20	35
Good	51	50	51
Fair/Poor (net)	**17%**	**20%**	**13%**
Fair	12	15	8
Good	5	5	5
Don't Know	**6%**	**10%**	**2%**

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[7] "Riders" were defined as respondents who said they made 2 or more one-way trips on a TriMet bus, MAX, the Portland Streetcar or another TriMet service in the past month.

4. RIDERSHIP DATA ANALYSIS

In addition to the data collected from riders with the Before and After intercept surveys, the evaluation team examined ridership statistics to identify any potential impacts of the introduction of the Transit Tracker displays. It was not expected that Transit Tracker displays at a handful of bus stops would influence system-wide ridership to any degree; however, it was hypothesized that the displays could have an impact on stop-level ridership. The evaluation team analyzed two aspects of stop-level ridership: nighttime boardings and boardings at adjacent stops.

4.1   NIGHTTIME BOARDINGS

As discussed in the previous section, one hypothesis was that riders would perceive an increase in personal security at a bus stop as a result of the implementation of Transit Tracker at that stop (i.e., knowing how long they will have to wait at that stop would make them feel safer). One indicator of an increased sense of security could be an increase in the use of a Transit Tracker-equipped stop at night. Certainly other factors could also influence the nighttime use of individual stops, and after a longer time in operation, a trend analysis of nighttime boardings may prove more illustrious.

Table 4-1 shows the mean weekday nighttime boardings for each of the four Transit Tracker locations (from the After survey) before and after implementation of the displays. These data are collected and reported by TriMet's onboard automatic passenger counting system. Spring 2002 data are shown for three of the four sites. The exception is the Salmon and 5th location, implemented late in 2001, for which Spring 2001 data are shown. At this relatively early stage in the deployment of the system, the data show virtually no change in the number of passengers boarding buses at the study sites during the nighttime hours.

Table 4-1. Nighttime Boardings Before and After Transit Tracker Implementation

Bus Stop	Nighttime Boardings (9 p.m. to close of service)	
	Before	**After**
Barbur Transit Center	12	13
Weidler & Lloyd Center	11	12
Burnside and 28th Street	19	21
Salmon and 5th Street	118	116

4.2   BOARDINGS AT ADJACENT STOPS

Another potential indicator of satisfaction with the Transit Tracker system could be that riders choose to use bus stops equipped with Transit Tracker displays rather than unequipped stops immediately adjacent to the equipped location. This shift could reflect a willingness on the rider's part to walk a block or so farther to a stop with the benefits of a Transit Tracker display.

Before and After stop-level boardings were compared for stops adjacent to each of the study sites, with the exception of Barbur Transit Center. The existence of a park-and-ride facility at the transit center and the low-density nature of the surrounding landuse make it highly unlikely that Transit Tracker would influence a rider's choice to use that stop rather than an adjacent stop.

In the case of the other three stops, boardings at bus stops just upstream and downstream of the Transit Tracker location were compared before and after implementation of the system. With the exception of the Salmon and 5th location, data from Fall 2001 were compared with data from Spring 2003, reflecting the availability of stop-level detail boarding information. It should be noted that boarding patterns are typically very similar during the fall and spring reporting periods (unlike summer and winter patterns). The analysis for Salmon and 5th is based on a comparison of boardings from Spring 2001 and Spring 2002, keeping in mind that this was one of the earliest Transit Tracker locations.

Table 4-2 shows the total number of boardings at the stops upstream and downstream of the Transit Tracker location (i.e., adjacent stops) for each bus route served and the boardings at the Transit Tracker location (i.e., equipped location). Figure 4-1 shows the proportion of the total "vicinity" boardings that took place at the Transit Tracker equipped location before and after the implementation of the displays. Only the Burnside and 28th location shows a considerable shift of riders to the Transit Tracker equipped location. Before Transit Tracker was implemented, 78 percent of the riders in the "vicinity" of Burnside and 28th (i.e., the stop just upstream of Burnside and 28th for each bus route served, the stop at Burnside and 28th, and the stop just downstream of Burnside and 28th for each bus route served) boarded at Burnside and 28th. After Transit Tracker was installed, 86 percent of the riders in he vicinity of Burnside and 28th actually boarded at that stop.[8] Boardings at the downstream stop decreased from 43 in the fall of 2001 to 6 in the spring of 2003. Given the proximity of the downstream stop (294 feet) at Burnside and 28th, this shift in boardings could indeed be related to the Transit Tracker display. (It should be noted that the other bus stops immediately upstream and downstream of the Transit Tracker locations are a bit farther away, within two-tenths of a mile.) Therefore, for the other stops, it would appear that the availability of Transit Tracker at stops between 780 and 1130 feet away was not worth the walk. It is also possible that riders at the adjacent stops did not know about the availability of Transit Tracker.

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[8] To calculate the significance of this finding, daily boardings at each stop are needed; however, TriMet does not archive boarding data on a daily basis for each stop, and therefore, the significance of the finding cannot be calculated.

Table 4-2. Boardings at Transit Tracker Locations and Locations Just Upstream and Downstream

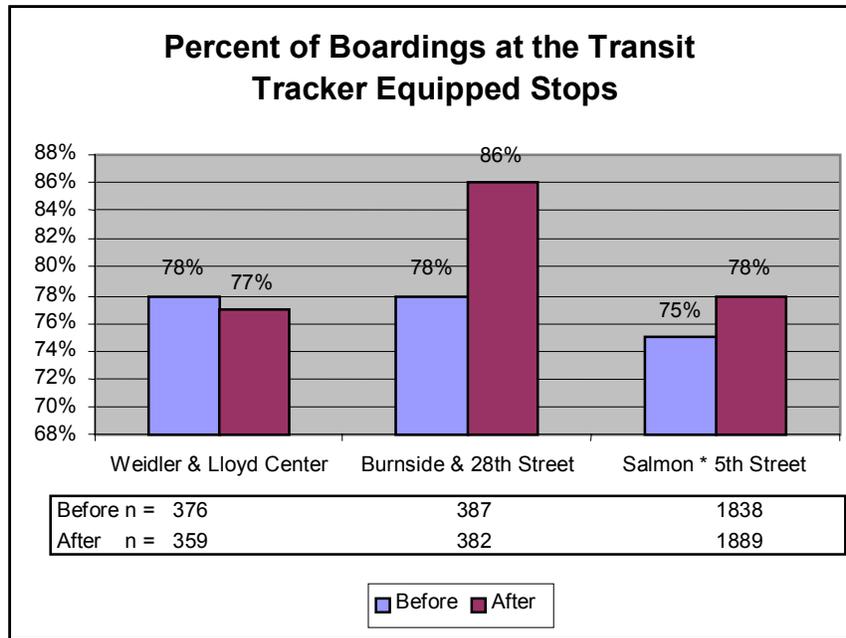| Bus Stop	Average Daily Boardings Before Transit Tracker			Average Daily Boardings After Transit Tracker		
	Adjacent Stops	Equipped Stop	Total	Adjacent Stops	Equipped Stop	Total
Weidler & Lloyd Center	82	294	376	81	278	359
Burnside and 28th Street	87	300	387	55	327	382
Salmon and 5th Street	459	1379	1838	424	1465	1889

Figure 4-1. Percent of Boardings at the Transit Tracker Equipped Stops

5. TRANSIT TRACKER ONLINE SURVEY

The second step in the evaluation of Transit Tracker was the administration of an online survey of Transit Tracker Online. The survey audience for this survey was very different than the audience of the Before and After intercept surveys. This section describes the survey approach, respondent characteristics, and findings from the Transit Tracker Online survey and is organized as follows:

- 5.1 Survey Approach

- 5.2 Web-Use Trend Data

- 5.3 Summary of Respondent Characteristics

- 5.4 Findings

5.1 SURVEY APPROACH

Information on riders' behaviors and perceptions was obtained through an Online survey. The survey was administered on the Transit Tracker Online Web page on TriMet's Website. The survey was available to Transit Tracker Online users from Monday, March 24, 2003 through Friday, April 11, 2003. During the three-week period, a pop-up window prompted every Transit Tracker Online user to take the survey. Users could opt to take the survey immediately, to be prompted again later, or to not take the survey (and not be prompted later). If users took the survey immediately, they were not prompted again (if they used the same computer). If a user took the survey in the morning from their home computer and then accessed Transit Tracker Online later that day from work, they would be prompted to take the survey again. A copy of the Transit Tracker Online survey can be found in Appendix C.

5.2 SURVEY AND TRANSIT TRACKER USEAGE

Over the three-week survey period, there were 409 "hits" on the survey from those visiting the Transit Tracker Website. In the first week there were 166 hits total from Monday through Friday, with an additional 25 hits over the weekend. During the second week, there were 128 hits total from Monday through Friday, with an additional 22 hits over the weekend. During the final week, there were 68 hits total from Monday through Friday. Upon the request of TriMet, the survey was removed from the Website at the end of the third week.

Of the 409 survey hits, 51 identified themselves as first-time users of Transit Tracker Online. First-time users were thanked for their interest and asked to come back and take the survey after using Transit Tracker. In TriMet's opinion, a response pool of 358 respondents was a large enough sample to be representative of the Transit Tracker Online users. This section summarizes the results of the 358 completed surveys.

TriMet uses an automated tool, "WebTrends" to monitor usage of the on-line version of Transit Tracker. Figure 5-1 shows the monthly visits,[9] along with a trend line from full deployment of the system in October 2002 through May 2003. The trend line shows nearly 43 percent increase in visits over the first eight months of operation.

It must be noted that at nearly 10,000 visits, the first month of full deployment (all routes and stops available on the system) had a very high level of usage.
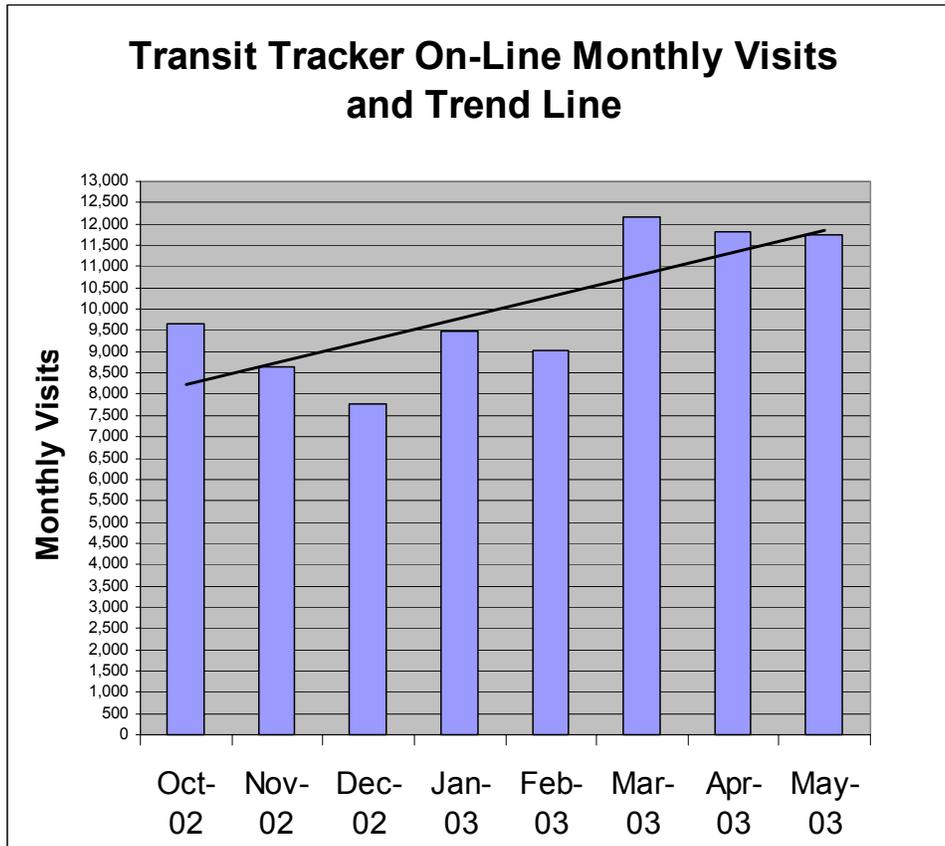
Figure 5-1. Transit Tracker Web-use Trend Data

5.3   SUMMARY OF RESPONDENT CHARACTERISTICS

Of the 358 respondents, 37 percent were female and 63 percent were male. The respondents ranged from under 25 years of age to between 55 and 64 years of age

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[9] Transit Tracker visits are calculated as the sum of visits to the following URLs: TriMet Transit Tracker (trimet.org/arrivals/pickroute.htm or trimet.org/ transittracker/pickroute.htm) and Route Stop Arrivals (trimet.org/arrivals/routeStopsList.jsp). If a visitor is idle longer than the idle-time limit, WebTrends assumes the visit ended. If the visitor continues to browse the site after reaching the idle-time limit, a new visit is counted. The default idle-time limit is 30 minutes.

(Figure 5-2). The age category in which the largest number of respondents fell (42 percent) was *25 to 34 years old*. The second largest category was the *under-25* category, with 22 percent. In fact, 81 percent of survey respondents were under 45 years old. There were no respondents in the *65 and older* age category.
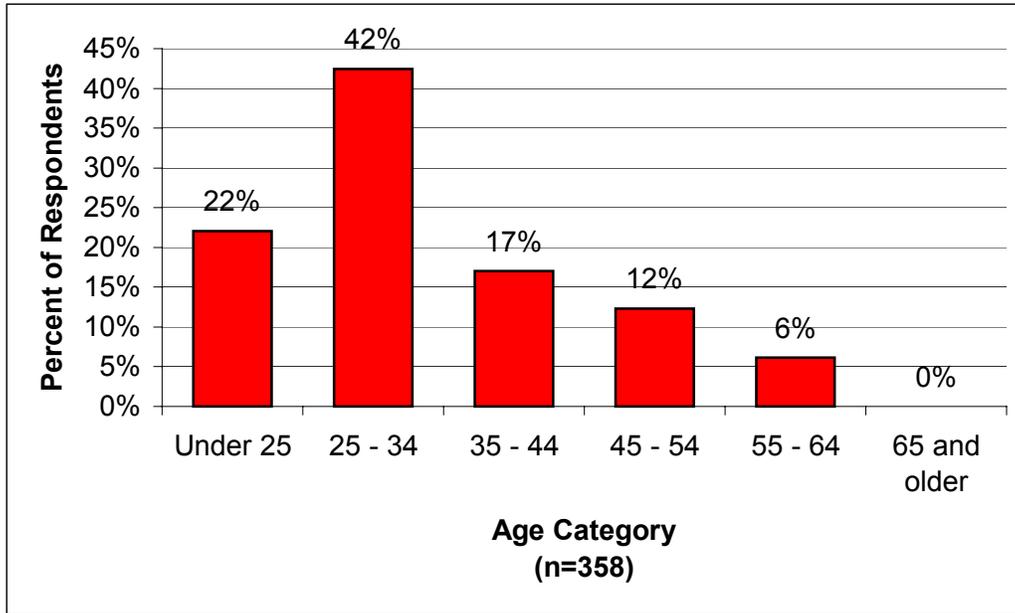
Figure 5-2. Age Distribution of Survey Respondents

The frequency with which respondents reported riding the bus is shown in Figure 5-3. Thirty-four percent of respondents reported that they rode the bus five days a week (presumably work/school commuters), and 32 percent of respondents reported that they rode the bus every day. Twenty-eight percent reported that they rode the bus one to four days a week, and only 6 percent reported that they rode the bus less than one day per week. Therefore, the large majority of survey respondents are frequent bus users, presumably experienced with the transit system in Portland.
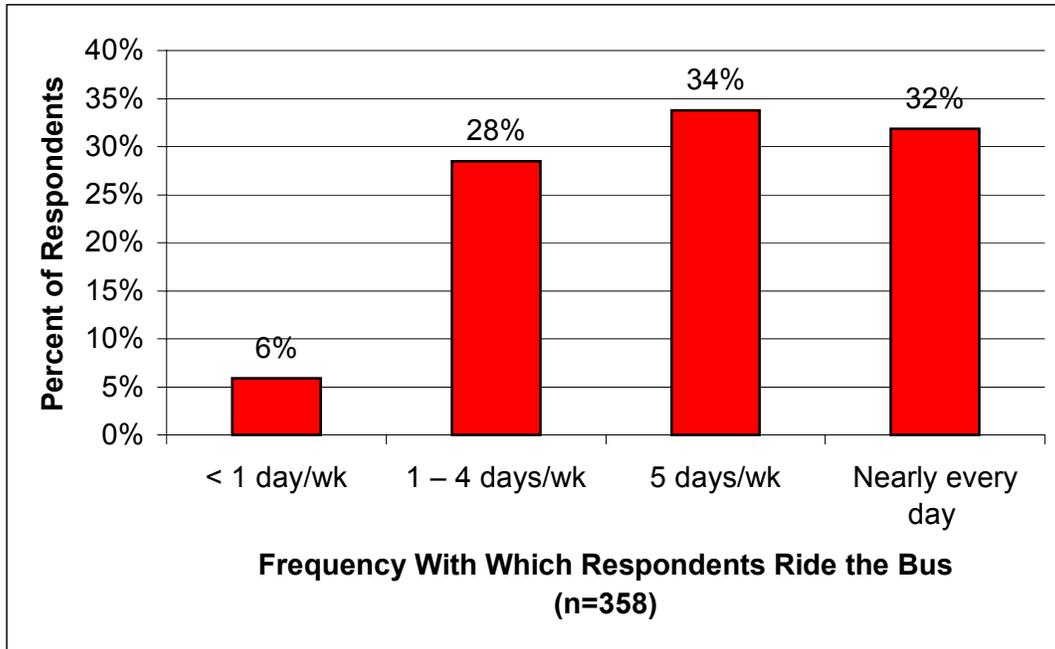
Figure 5-3. Frequency with Which Respondents Ride the Bus

Regarding access to an automobile, 65 percent respondents reported that they had an automobile available for their use, while the remaining 35 percent reported that they did not.

Users were also asked to indicate how they accessed Transit Tracker Online, and the options they were given included the following:

- Home computer.
- Work or school computer.
- Wireless Internet device (WID).
- Traveler information center (TIC).
- Other.

Respondents were asked to mark all options that applied. Seventy-seven percent of respondents indicated that they accessed Transit Tracker Online from a home computer, and 72 percent reported that they accessed Transit Tracker Online from a work or school computer. Six percent of users reported that they used a wireless Internet device to access Transit Tracker Online, and only 3 percent reported that they had accessed it from a traveler information center.

These results are presented slightly differently in Figure 5-4. Because respondents were asked to "mark all that apply," the percentages previously reported equal more than 100 percent of the respondents. Figure 5-4 shows the distribution of the unique individual responses of each respondent (i.e., the percentages sum to 100) and the different combinations of response choices. Here, the most common response was *home computer* and *work or school computer* (41 percent), which shows that many riders probably access Transit Tracker at least a couple of times a day for at least two

of their trips (e.g., home to work/school and work/school to home). *Home computer* only and *work or school computer* only were the second and third most common responses, with 28 and 22 percent of users, respectively. Those respondents who reportedly used a wireless Internet device or a traveler information center also access Transit Tracker Online at home and work/school. *Other* responses (less than 1 percent of responses) included an Internet café and a library.
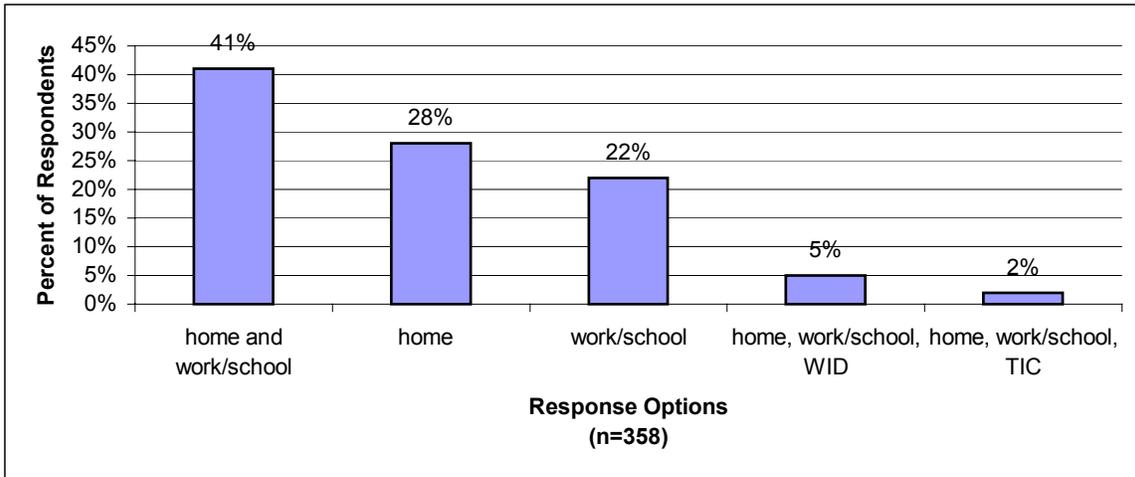
Figure 5-4. How Respondents Access Transit Tracker Online

5.4   FINDINGS

In general, survey respondents were very pleased with the Transit Tracker Online service. The results are summarized in terms of the MOEs used to assess riders' behaviors and perceptions related to use of the Transit Tracker Online system and information. The MOEs were:

- Riders' use of pre-trip planning information (e.g., types of information used, frequency of use, how information was used and the impacts of the information on time savings and perceptions of personal security).

- Riders' satisfaction with Transit Tracker Online service (e.g., ease of use, usefulness and accuracy of information).

- Riders' overall satisfaction with bus services.

5.4.1   Use of Trip Planning Information

The majority (76 percent) of respondents reported using Transit Tracker Online *frequently* or *almost always* when planning their trips. Only 19 percent reported that they *sometimes* use Transit Tracker Online, and only 5 percent reported that they *rarely* or *almost never* use Transit Tracker Online when planning their trips. Therefore, most of the survey respondents are familiar enough with Transit Tracker Online to assess the benefits associated with its use.

Respondents were next asked, "For which of the following reasons have you used Transit Tracker Online bus arrival information?" The response choices were as follows:

a. When I wasn't sure of the scheduled arrival time of the bus and wanted the real-time arrival information instead.

b. When I did not want to wait too long at the bus stop.

c. When I wanted to know if I had already missed my bus.

Respondents were asked to mark all the of the responses choices that applied to them.

The purpose of this question was to determine the primary reasons that transit riders use Transit Tracker Online. The results are shown in two different ways in Figure 5-5. The solid bars show the percentage of total respondents that selected each response choice a, b, and c. Because respondents were allowed to choose more than one response, these percentages total to more than 100 percent.

**Figure 5-5. Reasons Respondents Reported They
Have Used Transit Tracker Online**

Fifty-three percent of respondents reported that they used Transit Tracker Online because they were not sure of the scheduled arrival time of the bus. An overwhelming 90 percent reported that they used Transit Tracker Online to minimize the time they had to wait at the bus stop. Half of the respondents reported that they used Transit Tracker Online to see if they had already missed their bus.

The cross-hatched in Figure 5-6 show the results when considering every individual's unique response, and the fact that they may have selected more than one option (i.e., the distribution of different combinations of response choices by individuals). While not every possible combination is shown in the figure, those shown make up about 94 percent of all the responses. The most common single response was the combination

of response choices a, b, and c (given by 34 percent). The second most common single response was response choice b alone (given by 28 percent). Therefore, the majority of riders use the information to serve more than one purpose.

Respondents were also asked, "After consulting Transit Tracker online, have you ever decided to…?" The response choices were as follows:

a. Choose a different bus route.

b. Wait longer before leaving home/work for the bus stop.

c. Run an errand while waiting for the bus to arrive.

d. Wait for the bus in a location near the stop (such as a coffee shop).

e. Find another way to travel to your destination instead of by bus.

Respondents were asked to mark all of the response choices that applied to them.

The purpose of this question was to determine what decisions riders were able to make, regarding their trips, with the new real-time information. The results are shown in two different ways in Figure 5-6. The cross-hatched show the percentage of total respondents that selected each response choice a, b, c, d, and e. Because respondents were allowed to choose more than one response, these percentages total to more than 100 percent.
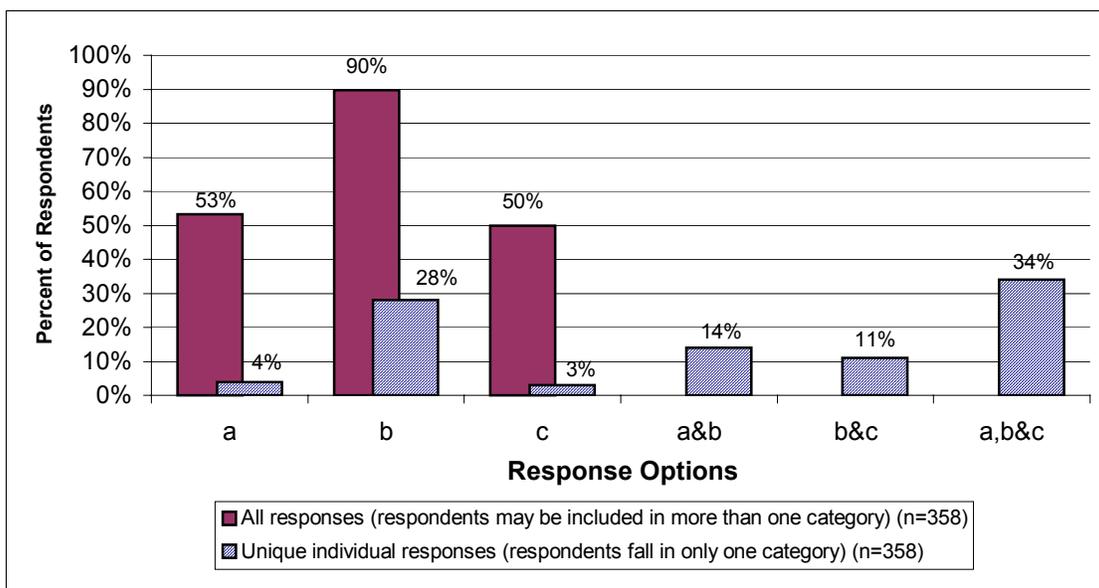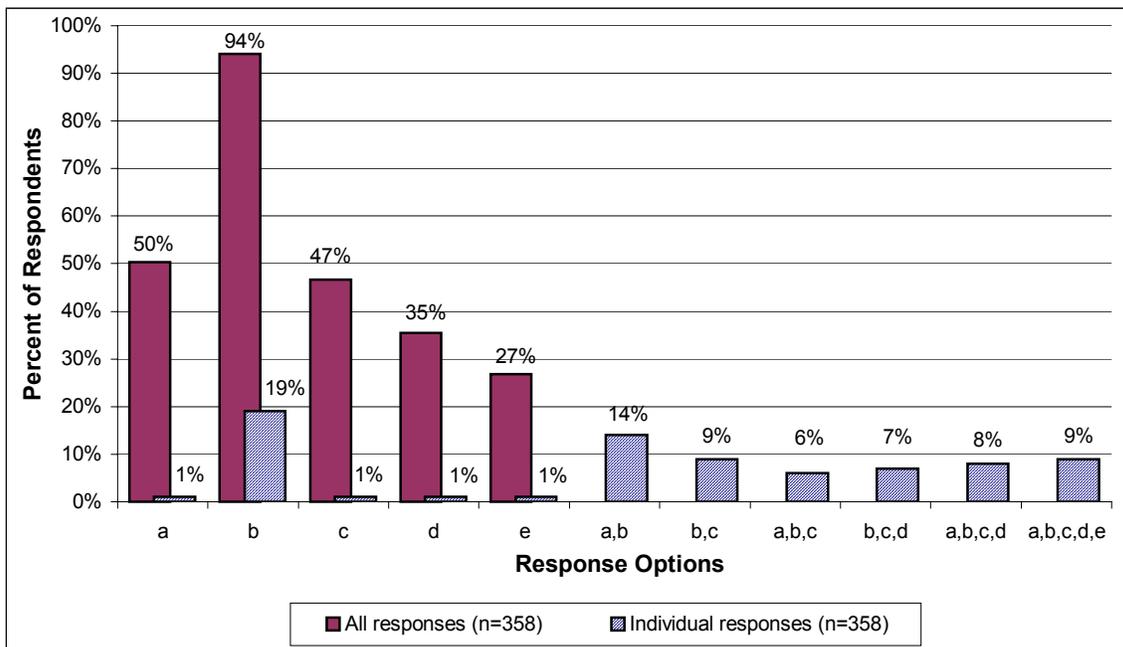

Figure 5-6. Decisions Respondents Reported Making After Consulting Transit Tracker Online

Fifty percent of respondents reported that they had decided to *choose a different bus route* after consulting Transit Tracker Online. An overwhelming 94 percent of

respondents reported that they had decided to *wait longer before leaving home/work for the bus stop* after consulting Transit Tracker Online. Forty-seven percent of respondents reported that they had decided to *run an errand while waiting for the bus to arrive*. Thirty-five percent of respondents reported that they had decided to *wait for the bus in a location near the stop*, and 27 percent reported that they had decided to *find another way to travel to their destination instead of by bus* after consulting Transit Tracker Online. These results show that Transit Tracker Online provides sufficient information for travelers to make wise and useful decisions about their trips.

The cross-hatched bars in Figure 5-6 show the results when considering individual responses and the fact that respondents may have selected more than one option (i.e., the distribution of different combinations of response choices by individuals). While not every possible combination of responses is shown in the figure, the response combinations shown make up over 75 percent of all responses. The most common single response (given by 19 percent of respondents) was response choice b alone. The second most common single response was the combination of response choices a and b (given by 14 percent of the respondents). These results show that, although almost all Transit Tracker Online users have used the information to *wait longer before leaving home/work for the bus stop*, most of the respondents also use the information to make multiple decisions related to their bus trips.

5.4.2   Perceptions of Transit Tracker Online Service

Respondents were asked to report their level of agreement with three aspects of Transit Tracker Online according to the following statements:

- Transit Tracker Online is easy for me to use.

- Transit Tracker Online saves me time, because I know more precisely when my bus will arrive.

- Transit Tracker Online makes me feel safer knowing I don't have to wait a long time at the bus stop.

The results, including efficiency and personal safety, are shown in Figure 5-7. Ninety-six percent of respondents agreed or completely agreed that Transit Tracker Online is easy for them to use. Only four respondents disagreed with the statement. Ninety-five percent of respondents agreed or completely agreed that Transit Tracker Online saves them time. In addition, several respondents made specific comments at the end of the survey related to the time savings/management benefit of using Transit Tracker Online. These comments are listed below:

- It allows me to maximize my workday and not waste time waiting. I am able to get home quickly and spend time with my family.

- It's very useful and saves me lots of time in the morning. I take a pretty long trip downtown (usually 40 minutes to an hour) and being able to look at the accurate arrival times saves me plenty of time.

- This helps to optimize my time at work and home without waiting around for the bus.

- It allows me to make better use of my time.

- I can get more work done at the office knowing when the bus is coming.

- It really cuts down on time wasted waiting at the curb.
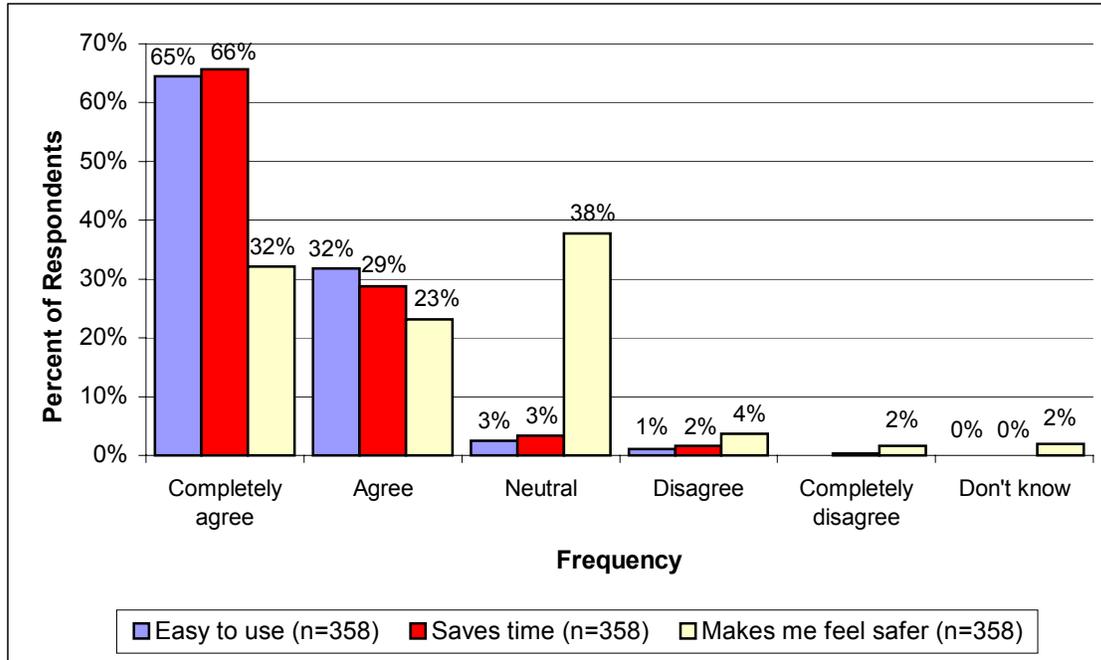
**Figure 5-7. Respondents' Perceptions of Three Aspects
of Transit Tracker Online**

Regarding personal security, fewer respondents agreed that Transit Tracker Online makes them feel safer than saves them time; however, a majority still agreed or completely agreed that Transit Tracker Online does make them feel safer knowing they will not have to wait a long time at the bus stop. There was one comment at the end of the survey specifically related to safety. The comment was: "It allows me to be safer, important to me as I am a woman usually traveling alone."

Respondents were asked to indicate the frequency with which Transit Tracker Online is accurate and useful. The results are shown in Figure 5-8.
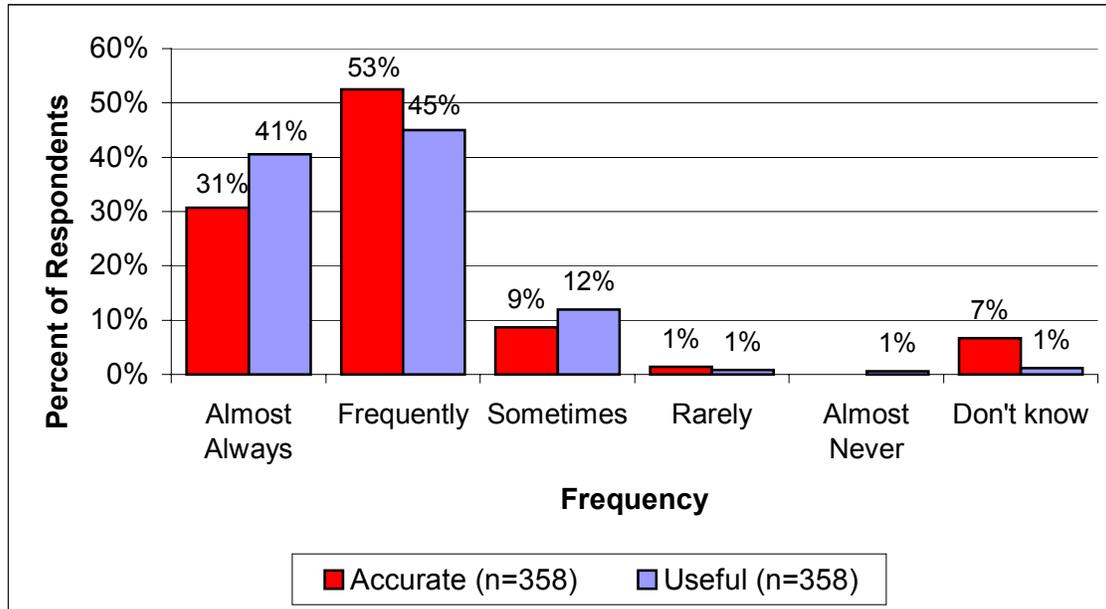
Figure 5-8. Reported Frequency of Transit Tracker Usefulness and Accuracy

Eighty-six percent of respondents reported that Transit Tracker Online is *frequently* or *almost always* accurate. In addition, several respondents made specific comments at the end of the survey related to the accuracy and inaccuracy of Transit Tracker Online. Respondents' comments related to the accuracy of Transit Tracker Online were as follows:

- This service is most helpful. I hate waiting for the bus after work and this system is nearly always accurate.

- This is a great service! I live right by a bus stop. My roommates and I have tested the Transit Tracker's accuracy. We'll look out the window when the Transit Tracker says the bus is due, and there it is! I've never seen Transit Tracker ever be wrong.

- It's very accurate information, congratulations.

- It's very useful, and saves me lots of time in the morning. I take a pretty long trip downtown (usually 40 minutes to an hour) and being able to look at the accurate arrival times saves me plenty of time.

Nine percent of respondents reported that Transit Tracker Online was *sometimes* accurate, and only 1 percent reported that it was *rarely* accurate. However, at the end of the survey, there were more comments related to the inaccuracy of Transit Tracker Online than the accuracy of it. The comments related to inaccuracy of the system were as follows:

- Online Transit Tracker is great, except sometimes it does not work; I have seen it not work in these ways: the Website does not respond; the times shown for the next bus [the second bus to arrive] are WAY off, like 30 minutes. But most of the time, it works great!

- I have noticed that the times given for PSU stops are not accurate. The times are off by one minute. I have missed my bus because of this.

- It is not quite accurate. Especially during the weekends. On one instance, I arrived 5 minutes prior to specified time and missed the bus. It would be nice to track the bus real-time via GPS.

- The Tracker is not accurate during heavy rain. That is reasonably often in Portland.

- Make it more accurate, please.

- I do find this service useful, but I have found that in the evening the 55 tends to run between 5-10 minutes behind what the Tracker says it does. I have learned to mentally add 5 minutes to whatever the Tracker tells me and it is often still late…

- Great when I'm in the city - but I live on the 20 bus line out in Beaverton and have frequently been unhappy with its accuracy out there.

- Just try to make it a little more accurate. Most of the time it is right, but every so often it gets off by two minutes, and I have missed one bus because of that. Other than that though, it is good.

- The time for buses at 1st and Arthur will often be up to 10 minutes off online.

Regarding the usefulness of the real-time arrival information, 85 percent of respondents reported that Transit Tracker bus arrival information is *frequently* or *almost always* useful for making decisions about their trips. In addition, six respondents specifically commented at the end of the survey that Transit Tracker Online was *useful* and three respondents specifically commented that it was *helpful*.

When asked to rate their level of satisfaction with Transit Tracker Online, 51 percent of respondents reported they were *completely satisfied*, and 42 percent reported they were *satisfied* (Figure 5-9). Only 4 percent and 2 percent of respondents reported they were *neutral* or *dissatisfied*, respectively, with Transit Tracker Online.
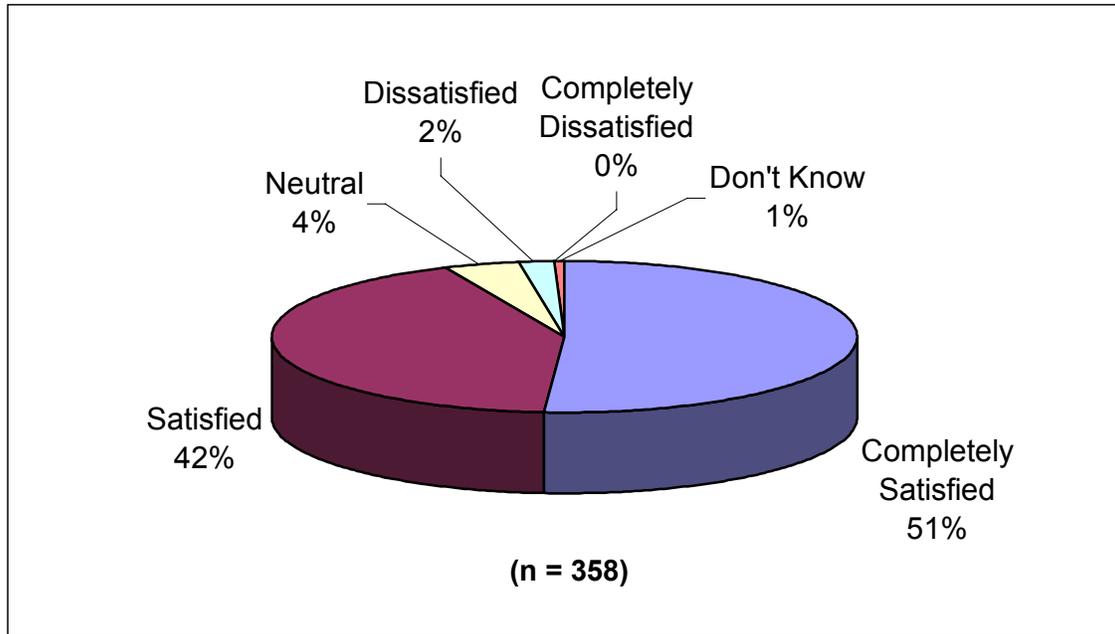
Figure 5-9. Respondents' Level of Satisfaction With Online Transit Tracker

Upon further investigation of the survey responses for the individuals who were reportedly dissatisfied with Transit Tracker Online, only one respondent provided a written comment at the end of the survey, which was that the system *takes too long to use*. Because several of the individuals provided positive responses to many of the survey questions (e.g., they agreed that the system provided useful information), the responses, and reasons for the dissatisfaction, were difficult to interpret.

Of the seven individuals who were reportedly dissatisfied, three reported using Transit Tracker *sometimes* when planning their bus trips, and two reported using it *almost never*. It is unclear whether they are dissatisfied as a result of their infrequent use of (or their unfamiliarity with) the system, or whether they use it infrequently because they are dissatisfied. In most cases, dissatisfaction can be linked to a perceived lack of ease of use of the system, perceived inaccuracy of the real-time information, or the lack of system/information use by a respondent.

5.4.3   Overall Satisfaction with Bus Service

Respondents were asked to indicate the impact of the Transit Tracker Online information on their overall perception with bus services. The results are shown in Figure 5-10. Eighty-nine percent of respondents agreed or completely agreed that Transit Tracker Online increases their satisfaction with bus services. Only 9 and 2 percent were neutral or disagreed, respectively.
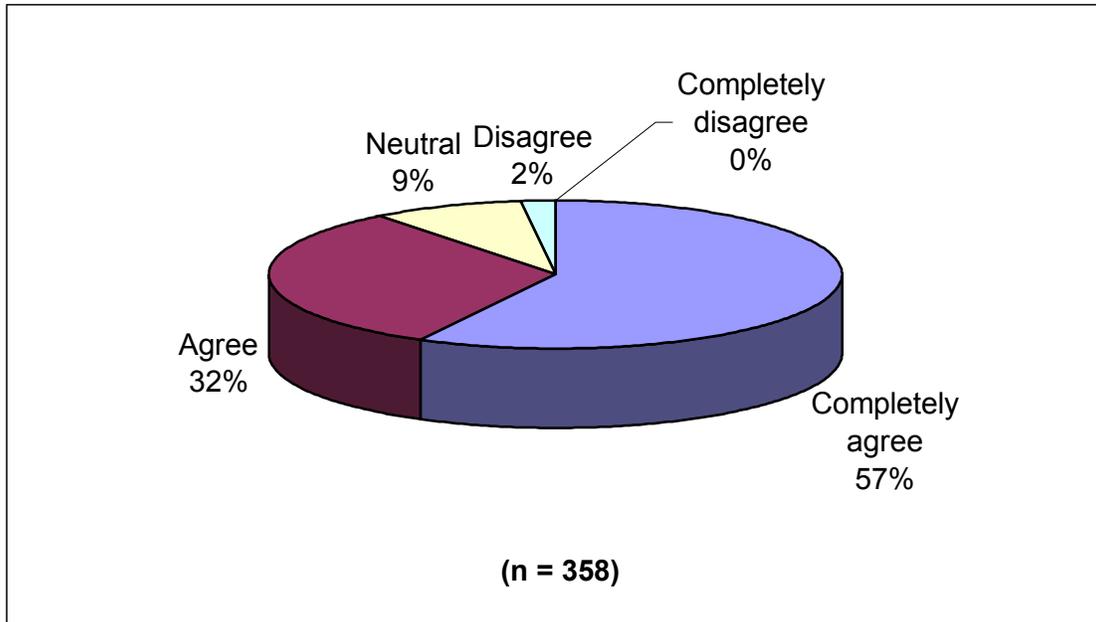
Figure 5-10. Transit Tracker Online Increases My Satisfaction With Bus Services

5.5   OTHER COMMENTS

Forty percent of the respondents gave additional comments at the end of the survey. Ten percent of these comments were with regard to the great service provided by Transit Tracker Online. The following are a few exceptional comments given by respondents at the end of the survey:

- It greatly reduces my anxiety/stress about wondering when the bus will arrive.

- It's an amazing service that completely alters the bus-riding experience.

- I find this feature to be extremely useful, a really significant new step in mass transit.

- It improves the quality of our lives, as does the transit system as it is designed.

Comments specifically related to weather included:

- It's very nice because if the bus is late I don't freeze or get soaked outside.

- It lets me stay out of the cold and rain longer.

- Also, limits my time in harsh outdoor weather conditions.

There were a few comments related to providing Transit Tracker information elsewhere (e.g., bus malls, stores). One respondent wrote, "It would be great to encourage businesses along transit streets to make Transit Tracker information available [on display] for patrons who want to know how much time they have to shop/eat before their

bus arrives." In addition, 16 respondents commented that they would like to access the Transit Tracker information via cell phone or wireless application protocol phone, or WAP.

There were very few comments related to a misunderstanding of how Transit Tracker Online works. There were a few complaints related to the unavailability of the Transit Tracker Online server/information. Other complaints listed by respondents, although few in number, were related mostly to transit service in general, not specifically to the Transit Tracker service.

6.   SUMMARY AND CONCLUSIONS

6.1   INTRODUCTION

This document has presented the evaluation strategies and objectives, the data collection methodologies, and the results of the evaluation of "Transit Tracker," a real-time transit arrival information system in Portland, Oregon.

6.2   SUMMARY

The results of the Before and After intercept surveys, the online survey, and the ridership analysis are summarized here according to each of the five evaluation objectives:

*   Assess bus riders' use of trip planning information.

*   Assess bus riders' perceptions of transit system efficiency.

*   Assess bus riders' perceptions of personal security.

*   Assess bus riders' perceptions of Transit Tracker service.

*   Assess bus riders' overall satisfaction with the system.

6.2.1   Assess Bus Riders' Use of Trip Planning Information

The first objective of the evaluation was to assess bus riders' use of schedule information. The hypothesis associated with this objective was:

> *Transit Tracker will provide bus riders with accurate and useful information with which they can make informed decisions about their trips in real-time.*

A comparison of the use of several types of fixed-schedule information (e.g., paper timetables, schedules posted at stops, 238-RIDE information line, online schedules) showed no differences in reported use of the information before and after Transit Tracker. Interestingly, in the After survey, many more respondents reported using the Transit Tracker information display than the fixed-schedule information. Only about 35 percent of respondents before and after implementing Transit Tracker reported that they *frequently* or *almost always* used the schedule guides posted at the stops (the most frequently used source of fixed-schedule information in both the Before and After survey). In contrast, 78 percent of the respondents reported that they *frequently* or *almost always* used the Transit Tracker information display.

On the Online survey, respondents were asked to indicate for what reasons they accessed the Transit Tracker Online information. Ninety percent of the respondents reported that they had used Transit Tracker Online *when they did not want to wait too long at the bus stop.* Half of the respondents reported that they had used Transit Tracker Online *when they were not sure of the scheduled arrival time of the bus and wanted the real-time arrival information instead* and/or *when they wanted to know if they had already missed their bus.* The most common single response (given by 34 percent of respondents) was the combination of the three response choices.

The majority of riders on the After-intercept survey and the Online survey reported that they used the Transit Tracker information to make one or more decisions about their trip (e.g., take an alternate bus route, wait for the bus in a more sheltered location). The most common decision made by riders surveyed at the bus stops was *leave the stop and return when the bus is due*. The most common decision made by riders surveyed online was *wait longer before leaving home/work for the bus stop*. Thirty-eight percent of riders surveyed at the bus stops reported making multiple decisions based on the information received from the Transit Tracker display, while 77 percent of riders surveyed online reported making multiple decisions based on the information received from Transit Tracker Online.

Regarding decisions made after consulting Transit Tracker, a comparison was made between the response distributions at the three stops that had recently been implemented with a Transit Tracker display to the stop at Salmon and 5th (where the display had been in place for 18 months prior to the survey). A visual examination of the response distributions suggests that more riders at the bus stop at Salmon and 5th used the information to make various decisions about their trips. This could indicate that users at this stop learned, over the 18-month time period, how to use the information for their benefit. A follow-up survey at the other three stops would show whether this is the case or not.

6.2.2   Assess Bus Riders' Perceptions of Transit System Efficiency

The second objective of the evaluation was to assess bus riders' perceptions of transit system efficiency. The hypothesis associated with this objective was:

> *Transit Tracker will increase bus riders' perceptions of bus system efficiency, even if there is no change in the actual system performance.*

Riders' perceptions of on-time performance before and after Transit Tracker differed very little overall. Statistical comparisons of the response distributions at each of the stops showed no significant differences at Weidler at Lloyd Center or at Barbur Transit Center; however a significant difference was found at Burnside and 28th Street. From the distributions, there appears to have been a shift from *don't know [if the bus is usually on time]* responses in the Before survey to *yes [the bus is usually on time]* responses in the After survey at this stop.

In addition to asking riders up front if their bus was usually on-time, riders' perceived wait times were used as a surrogate for perceived efficiency. Statistical comparisons of wait times (those reported as integer values only) showed that there was no change in mean perceived wait time after the installation of Transit Tracker. In addition, there was no decrease in the variability of reported wait times after the installation of Transit Tracker.

On the Before survey, riders were asked how satisfied they were with the bus' adherence to the posted schedules. The overwhelming majority of riders, 91 percent, reported that they were either *satisfied* or *extremely satisfied*. These results show that riders were already very satisfied with bus efficiency before the installation of Transit Tracker, which might explain why there were not more significant differences found between the before and after results. In other words, there was no "room for improvement".

6.2.3 Assess Bus Riders' Perceptions of Personal Security

The third objective of the Transit Tracker evaluation was to assess bus riders' perceptions of personal security. The hypothesis associated with this objective was:

Transit Tracker will increase bus riders' perceptions of personal security, even if there are no other measures taken to increase security.

An overwhelming majority (97 and 98 percent in the Before and After survey, respectively) reported that they *agreed* or *completely agreed* that they felt safe waiting for the bus at the stops during the day. Somewhat fewer respondents (63 and 79 percent in the Before and After survey, respectively) reported that they *agreed* or *completely agreed* that they felt safe waiting for the bus at the stops at night.

A statistical comparison of riders' perceptions of personal security before and after Transit Tracker showed no significant difference between the perceptions of security at Weidler at Lloyd Center or at Barbur Transit Center during the day or at night. The results did show a significant difference in response distribution between the Before and After surveys at Burnside and 28th Street during the day and at night. From the response distributions, it appears that the significant difference lies in a shift in respondents from *agreement* with the statements about feeling safe in the Before survey to *complete agreement* with the statements in the After survey.

On the Online survey, the majority of respondents *agreed* or *completely agreed* that Transit Tracker Online made them feel safer knowing they would not have to wait a long time at the bus stop. In addition, one comment at the end of the survey was specifically related to safety: "It [Transit Tracker Online] allows me to be safer, [which is] important to me as I am a woman usually traveling alone."

A look at nighttime ridership at the stops showed no changes in ridership after the installation of Transit Tracker. In the adjacent stop analysis, only the stop at Burnside and 28th showed a considerable shift of riders to the Transit Tracker equipped location. Before Transit Tracker was implemented, 78 percent of the riders in the vicinity of Burnside and 28th boarded at Burnside and 28th. After Transit Tracker was installed, 86 percent of the riders in the vicinity of Burnside and 28th actually boarded at that stop.

6.2.4 Assess Bus Riders' Perceptions of Transit Tracker Service

The fourth objective of the Transit Tracker evaluation was to assess bus riders' perceptions of the Transit Tracker service. The hypothesis associated with this objective was:

Transit Tracker will provide bus riders with accurate and useful information that will be understandable and easy to use.

The majority of riders surveyed at the bus stops reported that the Transit Tracker sign/information at the stops was *almost always* working (84 percent), useful (73 percent), and accurate (56 percent). Very few riders (less than 5 percent) reported that the Transit Tracker sign/information was *rarely* or *almost never* working, useful, or accurate. Likewise, the majority of riders rated the visibility of the sign (62 percent) and the understandability of the information (72 percent) as *very good*. Forty-four percent of

riders rated the information accuracy as *very good*. Very few riders rated the Transit Tracker sign/information as *poor* or *very poor* (less than 5 percent).

Many of the riders' felt that the Transit Tracker information at bus stops helped them in a number of ways. Sixty percent reported that the information *reduced their anxiety at the bus stop*, 55 percent reported that the information *increased their sense of security at the bus stop*, 43 percent reported that the information *gave them more control over their travel*, and 7 percent reported that the information *saved them time at the bus stop.* In fact, 17 percent of respondents reported that the information did *all of the above*.

On the Online survey, 96 percent of respondents *agreed* or *completely agreed* that Transit Tracker Online was easy for them to use (only four respondents *disagreed* with the statement), and 95 percent of respondents *agreed* or *completely agreed* that Transit Tracker Online saved them time. Regarding its accuracy and usefulness, 86 percent of respondents reported that Transit Tracker Online was *frequently* or *almost always* accurate, and 85 percent of respondents reported that Transit Tracker Online information is *frequently* or *almost always* useful for making decisions about their trips.

Overall, 61 percent of riders surveyed at bus stops rated the Transit Tracker as *very good,* and 31 percent rated it as *good.* The ratings of the Online Transit Tracker were comparable; 51 percent of online users reported that they were *completely satisfied* with Transit Tracker Online, and 42 percent of users reported that they were *satisfied* with the service.

6.2.5 Assess Bus Riders' Overall Satisfaction With the System

The final objective of the Transit Tracker evaluation was to assess bus riders' overall perceptions of the bus service. The hypothesis associated with this objective was:

> *Transit Tracker will increase bus riders' overall satisfaction with bus service.*

An overwhelming 91 percent of respondents in both the Before and After surveys indicated that they were either *satisfied* or *extremely satisfied* with the bus service at the stops. About 5 percent reported being *dissatisfied* or *extremely dissatisfied* before Transit Tracker, and a mere 1 percent reported being *dissatisfied* or *extremely dissatisfied* after Transit Tracker. A statistical comparison of riders' satisfaction with bus service before and after Transit Tracker was performed for Barbur Transit Center, Weidler at Lloyd Center, and Burnside and 28th Street. The results showed no significant difference between the satisfaction ratings before and after Transit Tracker. This could be attributed to the fact that riders were very satisfied before the Transit Tracker deployment.

Eighty-nine percent of riders surveyed online *agreed* or *completely agreed* that Transit Tracker Online increased their satisfaction with bus services. Only 9 and 2 percent were neutral or disagreed, respectively.

6.3   CONCLUSIONS

Based on the evaluation results, the following conclusions are made:

- Bus riders surveyed at the stops like the Transit Tracker information displays; the large majority of riders surveyed feel that the information provided is

understandable, useful, and accurate. Riders' feel that the information helps them
by reducing their anxiety, increasing their sense of security, giving them more control
over their travel, and saving them time.

- Riders at stops use the real-time Transit Tracker information more frequently than all
  other available sources of fixed-schedule information. The flexibility that Transit
  Tracker's real-time information provides to riders appears to be a significant
  improvement over that provided by fixed-schedule information.

- There is evidence to suggest that riders learn over time how to use the real-time
  information for their benefit. Many riders surveyed at the bus stops and online
  reported making multiple decisions about their trips (e.g., taking a different bus
  route) with the Transit Tracker information at hand. It appears that riders use the
  real-time bus arrival information provided by Transit Tracker to more effectively and
  creatively plan and execute their trips.

- An overwhelming majority of riders were *satisfied* or *extremely satisfied* with bus
  adherence to the posted schedules before Transit Tracker; therefore, there was little
  "room for improvement" in perceptions of on-time performance after Transit Tracker.
  (There was no significant difference in mean reported wait times before and after
  Transit Tracker, and there were no significant differences in reported on-time
  performance before and after Transit Tracker at two of the three stops.)

- There is evidence to suggest, at least at one bus stop, that the presence of the
  Transit Tracker information has a positive influence on riders' perceptions of on-time
  performance, while, at the same time, helps riders to have a better idea of whether
  the bus is running on-time.

- The large majority of riders reported feeling safe at the stops during the day and at
  night both before and after Transit Tracker, and there was no significant difference in
  the before and after ratings; however, there is evidence to suggest, at least at one
  bus stop, that Transit Tracker has a positive impact on riders' perceptions of
  personal security during the day and at night.

- At this point, there are no changes in nighttime ridership at the bus stops as a result
  of Transit Tracker; however, at one of the stops, a considerable increase in "vicinity"
  boardings at the Transit Tracker equipped location since the installation suggests
  that riders have shifted from adjacent stops to the Transit Tracker equipped location
  to have access to the information.

- The overwhelming majority of riders surveyed at the bus stops are satisfied with the
  bus service at the stop; however, because riders were already very satisfied with
  bus service prior to the installation of Transit Tracker, there was not a significant
  improvement in customer satisfaction.

- Transit Tracker Online users like the system; the overwhelming majority of users feel
  that the system is easy to use, that the information provided is useful and accurate,
  and that it saves them time during the day.

- The majority of Transit Tracker Online users access the information for multiple
  reasons. They maximize their time at home, work, or school before leaving for the

bus stop. When running late, users check Transit Tracker Online to see if they have already missed their bus and, at the same time, can check the predicted arrival time for the next bus.

- The majority of Transit Tracker Online users feel safer knowing they do not have to wait a long time at the bus stop as a result of the information.

- Overall, users are satisfied with Transit Tracker Online and agree that the service increases their satisfaction with bus service as a whole.

Based on the results of this evaluation and the conclusions drawn, the hypotheses stated up front have either been supported by the results of the evaluation or have not been supported by the results of the evaluation:

- Hypothesis: Transit Tracker will provide bus riders with accurate and useful information with which they can make informed decisions about their trips in real-time—*Supported.*

- Hypothesis: Transit Tracker will increase bus riders' perceptions of bus system efficiency, even if there is no change in the actual system performance—*Supported at Burnside & 28th; Not supported at other locations.*

- Hypothesis: Transit Tracker will increase bus riders' perceptions of personal security, even if there are no other measures taken to increase security— *Supported at Burnside & 28th and by Transit Tracker Online users; Not supported at other locations.*

- Hypothesis: Transit Tracker will provide bus riders with accurate and useful information that will be understandable and easy to use— *Supported.*

- Hypothesis: *Transit Tracker will increase bus riders' overall satisfaction with bus service—Supported, at least by Transit Tracker Online users.*

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APPENDIX A: TRANSIT TRACKER "BEFORE" SURVEY

TRANSIT TRACKER USER SATISFACTION BASELINE QUESTIONNAIRE

1) **HOW OFTEN DO YOU USE** the following types of **bus schedule information** when scheduling your transit trips? (Use a scale of 1 to 5, with 1 being "Almost Always" and 5 being "Almost Never.")

HOW OFTEN DO YOU USE . . .	Almost Always 1	Frequently 2	Sometimes 3	Rarely 4	Almost Never 5
the printed paper schedules from Tri-Met?	❑	❑	❑	❑	❑
theTri-Met guides posted at bus stops?	❑	❑	❑	❑	❑
on-line Internet schedules?	❑	❑	❑	❑	❑
238-RIDE	❑	❑	❑	❑	❑
Transit Tracker signs at bus stops?	❑	❑	❑	❑	❑
Transit Tracker Online (Internet)?	❑	❑	❑	❑	❑

2) Please rate **HOW OFTEN** the following statements are **TRUE:**

I generally do not use the Tri-Met schedule information – I just go to the bus stop and wait for the next bus to arrive.

Almost Always	Frequently	Sometimes	Rarely	Almost Never
1	2	3	4	5

o------------------o-------------------o-----------------o---------------------o

3) I generally do not use the Tri-Met schedule information, because I have most of my times/routes memorized.

Almost Always	Frequently	Sometimes	Rarely	Almost Never
1	2	3	4	5

o------------------o-------------------o-----------------o---------------------o

3) Please rate how often the schedule information you use is **ACCURATE** (again, with 1 being "almost always" and 5 being "almost never").

Almost Always	Frequently	Sometimes	Rarely	Almost Never
1	2	3	4	5

o------------------o-------------------o-----------------o---------------------o

4) About **how long do you usually wait** for the bus **AT THIS BUS STOP**?

❑ _____minutes

❑ Don't know.

5) Is the bus you catch **AT THIS BUS STOP** **usually on time**?

❑ Yes

❑ No ➔ In general, about how many minutes early / late is it? _____ minutes   early / late

❑ Don't know (circle one)

6) At this bus stop, how satisfied are you with bus adherence to the posted schedules?

Extremely Satisfied	Satisfied	Neither Satisfied Nor Dissatisfied	Dissatisfied	Extremely Dissatisfied	N/A
1	2	3	4	5	

o------------------o-------------------o---------------------o---------------o--------------o

7) On a scale of 1 to 5, with 1 being "completely agree" and 5 being "completely disagree," **how strongly do you agree** with the following statements?

	Completely Agree 1	Agree 2	Neutral 3	Disagree 4	Completely Disagree 5	N/A
I feel safe waiting **at this stop** during the **DAY**.	❑	❑	❑	❑	❑	❑
I feel safe waiting **at this stop** at **NIGHT**.	❑	❑	❑	❑	❑	❑

8) On a scale of 1 to 5, how satisfied are you with bus service **AT THIS BUS STOP?**

Extremely Satisfied	Satisfied	Neutral	Dissatisfied	Extremely Dissatisfied	N/A
1	2	3	4	5	

❑-----------------❑-----------------❑-----------------❑-----------------❑------------❑

9) For what purposes do you **most frequently** take the bus? (Mark all that apply.)

❑ Work ❑ Recreation

❑ School ❑ For most all my trips

❑ Shopping ❑ Other _____

10) Do you have an automobile available for your use?

❑ Yes

❑ No

11) On average, **how often** do you ride the bus?

❑ Less than one day per week

❑ 1 – 4 days per week

❑ Nearly every day

12) Please stop me when I've read the age category that contains your age:

❑ Under 25

❑ 25 - 34

❑ 35 - 44

❑ 45 - 54

❑ 55 – 64

13) Have you ever waited to catch a bus at a bus stop where there was a Transit Tracker display, a real-time electronic sign showing when the next bus will arrive?

❑ Yes (if so, where?)_____

❑ No

APPENDIX B: TRANSIT TRACKER "AFTER" SURVEY

Transit Tracker "After" User Satisfaction Questionnaire

1) __HOW OFTEN DO YOU USE__ the following types of **bus schedule information** when scheduling your transit trips? (Use a scale of 1 to 5, with 1 being "Almost Always" and 5 being "Almost Never.")

HOW OFTEN DO YOU USE . . .	Almost Always 1	Frequently 2	Sometimes 3	Rarely 4	Almost Never 5
the printed paper schedules from Tri-Met?	❑	❑	❑	❑	❑
the Tri-Met guides posted at bus stops?	❑	❑	❑	❑	❑
on-line Internet schedules?	❑	❑	❑	❑	❑
238-RIDE	❑	❑	❑	❑	❑
Transit Tracker signs at bus stops?	❑	❑	❑	❑	❑
Transit Tracker Online (Internet)?	❑	❑	❑	❑	❑

2) Please rate the Transit Tracker <u>sign</u> **AT THIS BUS STOP.** (Use a scale of 1 to 5, with 1 being "Very Good" and 5 being "Very Poor")

RATE THE…	Very Good 1	Good 2	Neutral 3	Poor 4	Very Poor 5
Transit Tracker sign OVERALL	❑	❑	❑	❑	❑
VISIBILITY of the sign	❑	❑	❑	❑	❑
UNDERSTANDABILITY of the information on the sign	❑	❑	❑	❑	❑
ACCURACY of the information on the sign	❑	❑	❑	❑	❑

3) HOW OFTEN is the <u>Transit Tracker bus arrival information</u> **AT THIS BUS STOP** working, accurate and useful? (Use a scale of 1 to 5, with 1 being "Almost Always" and 2 being "Almost Never")

HOW OFTEN IS THE BUS ARRIVAL INFORMATION…	Almost Always 1	Frequently 2	Sometimes 3	Rarely 4	Almost Never 5
WORKING?	❑	❑	❑	❑	❑
ACCURATE?	❑	❑	❑	❑	❑
USEFUL?	❑	❑	❑	❑	❑

4) Have you ever used **Transit Tracker information** AT THIS BUS STOP to do any of the following? (Mark all that apply.)

❑ Take an alternate bus route.

❑ Wait for the bus in a more sheltered location.

❑ Leave the stop and return when the bus is due.

❑ Find another way to travel to your destination instead of the bus.

❑ Other _____

5) Which of the following statements about **Transit Tracker information** AT THIS BUS STOP are true for you? (Mark all that apply.)

TRANSIT TRACKER…

❑ Increases my sense of security at the bus stop

❑ Reduces my anxiety at the bus stop

❑ Gives me more control over my travel

❑ Saves me time at the bus stop

❑ Other _____

6) About **how long do you usually wait** for the bus **AT THIS BUS STOP**?

    ❑ _____minutes

    ❑ Don't know.

7) Is the bus you catch **AT THIS BUS STOP** <u>usually on time</u>?

    ❑ Yes

    ❑ No ➔ In general, about how many minutes early / late is it? _____ minutes   <u>early / late</u>

    ❑ Don't know   (circle one)

8) On a scale of 1 to 5, with 1 being "completely agree" and 5 being "completely disagree," **how strongly do you agree** with the following statements?

	Completely Agree 1	Agree 2	Neutral 3	Disagree 4	Completely Disagree 5	N/A
I feel safe waiting **at this stop** during the **DAY**.	❑	❑	❑	❑	❑	❑
I feel safe waiting **at this stop** at **NIGHT**.	❑	❑	❑	❑	❑	❑

9) On a scale of 1 to 5, how satisfied are you with bus service **AT THIS BUS STOP?**

Extremely Satisfied 1	Satisfied 2	Neutral 3	-	Dissatisfied 4	Extremely Dissatisfied 5	N/A
❑------------------	❑------------------	❑------------------		❑------------------	❑------------------	❑--------------❑

10) For what purposes do you **most frequently** take the bus? (Mark all that apply.)

        ❑ Work

        ❑ School

        ❑ Shopping

        ❑ Recreation

        ❑ Other_____

        ❑ For most all my trips

11) Do you have an automobile available for your use?

      ❑ Yes

      ❑ No

12) On average, **<u>how often</u>** do you ride the bus?

      ❑ Less than one day per week

      ❑ 1 – 4 days per week

      ❑ 5 days per week

      ❑ Nearly every day

13) Please stop me when I've read the age category that contains your age:

      ❑ Under 25

      ❑ 25 - 34

      ❑ 35 - 44

      ❑ 45 - 54

      ❑ 55 – 64

      ❑ 65 or older

APPENDIX C: TRANSIT TRACKER ONLINE SURVEY

Transit Tracker Online Survey

PLEASE NOTE: Transit Tracker also refers to the electronic displays at bus stops, but please consider ONLY THE ONLINE VERSION of Transit Tracker when answering the survey questions.

1. **HOW OFTEN** do you use the online Transit Tracker bus arrival information to plan your trips?

Almost Always 1	Frequently 2	Sometimes 3	Rarely 4	Almost Never 5	This is the first time
❑	❑	❑	❑	❑	❑

2. For which of the following reasons **HAVE YOU USED** the online Transit Tracker bus arrival information?
   (Please mark **all that apply**.)

   ❑ I wasn't sure of the scheduled arrival time of the bus.
   ❑ I wanted to minimize the time that I had to wait at the bus stop.
   ❑ I wanted to know if I had already missed my bus.
   ❑ Other: _____

3. Please indicate to what extent you agree or disagree with the following statements.

TRANSIT TRACKER ONLINE …	Completely Agree 1	Agree 2	Neutral 3	Disagree 4	Completely Disagree 5	Don't Know
… is easy for me to use.	❑	❑	❑	❑	❑	❑
… saves me time because I know more precisely when my bus will arrive.	❑	❑	❑	❑	❑	❑
… makes me feel safer knowing I don't have to wait a long time at the bus stop.	❑	❑	❑	❑	❑	❑
… increases my satisfaction with bus services.	❑	❑	❑	❑	❑	❑

4. **HOW OFTEN** is the online Transit Tracker bus arrival information **ACCURATE**?

Almost Always 1	Frequently 2	Sometimes 3	Rarely 4	Almost Never 5	Don't Know
❑	❑	❑	❑	❑	❑

5. **HOW OFTEN** is the online Transit Tracker bus arrival information **USEFUL** for making decisions about your trips?

Almost Always 1	Frequently 2	Sometimes 3	Rarely 4	Almost Never 5	Don't Know
❑	❑	❑	❑	❑	❑

6. Please indicate your response to the following questions with either **YES** or **NO**.

After consulting Transit Tracker online, have you ever decided to...	Yes	No
... choose a different bus route?	❑	❑
... wait longer before leaving home/work for the bus stop?	❑	❑
... run an errand while waiting for the bus to arrive?	❑	❑
... wait for the bus in a location near the stop (such as a coffee shop)?	❑	❑
... find another way to travel to your destination instead of by bus?	❑	❑
other: _____		

7. Please indicate your level of satisfaction with the online Transit Tracker bus arrival information.

Extremely Satisfied 1	Satisfied 2	Neutral 3	Dissatisfied 4	Extremely Dissatisfied 5	Don't Know
❑	❑	❑	❑	❑	❑

8. How do you access the online Transit Tracker bus arrival information? (Please mark **all that apply**.)

❑ Home computer
❑ Work or School computer
❑ Wireless Internet Device
❑ Traveler Information Center
❑ Other: _____

9. On average, how often do you ride the bus?

❑ Less than one day per week
❑ 1 – 4 days per week
❑ 5 days per week
❑ Nearly every day

10. For what purposes do you most frequently ride the bus? (Please mark **all that apply**.)

❑ Work
❑ School
❑ Shopping
❑ Recreation
❑ Other: _____
❑ For most of my trips

11. Do you have an automobile available for your use?

    ❑ Yes
    ❑ No

12. Which of the following categories contains your age?

    ❑ Under 25
    ❑ 25-34
    ❑ 35-44
    ❑ 45-54
    ❑ 55-64
    ❑ 65 or older

13. What is your gender?

    ❑ Male
    ❑ Female

In the following box, please provide any comments you have regarding the online Transit Tracker bus arrival information.