Evaluation of the South Lake Tahoe Coordinated Transit System (CTS) Project

Phase III Evaluation Report

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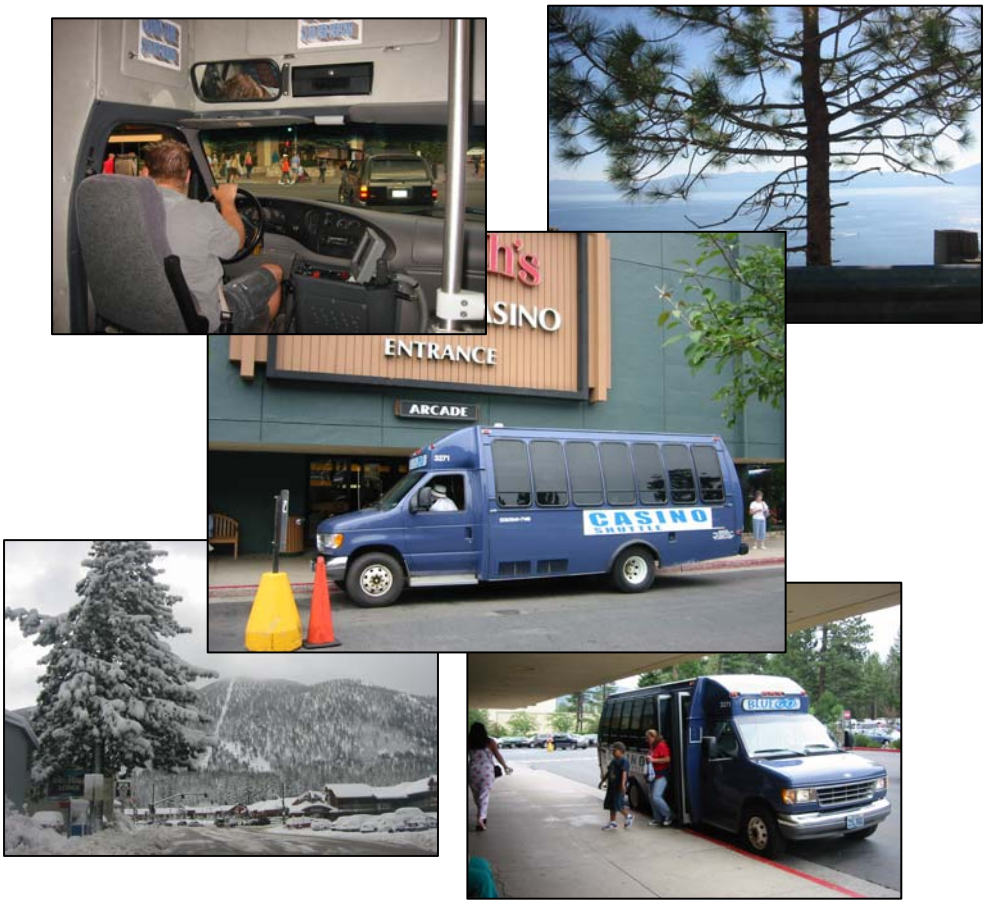

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16. Abstract This report presents the results of the national evaluation of the South Lake Tahoe Coordinated Transit System (CTS) Project. The CTS Project involved combining transit services offered by private and public sector stakeholders in South Lake Tahoe into one centrally-dispatched operation that uses intelligent transportation system (ITS) technologies to improve transit efficiency and to create a more visitor-friendly transit system. The coordinated transit system spans the jurisdictions of two counties in two states as well as one city, and incorporates the private transit resources of five casinos and one ski resort. The evaluation consisted of a system impact study primarily focused on determining the impact of consolidating the services on ridership, customer satisfaction, and operating efficiency; and an institutional issues review focused on gathering and documenting the organizational and institutional challenges encountered by the project stakeholders. Lessons learned in deploying and operating the technologies and the system were also gathered from the stakeholders throughout the course of the evaluation. The evaluation approach involved conducting passenger intercept surveys on-board the demand-response casino shuttles both before and after consolidation of the services, gathering transit ridership data and operational cost data from the transit operator, and gathering tourism measures (hotel room-nights sold data, traffic count data, and gambling revenue data) to approximate seasonal changes and trends in visitation in the South Lake Tahoe area. The results of the customer satisfaction analysis showed that customers are as satisfied with the consolidated casino shuttle service as they were with the independent casino shuttles that operated pre-CTS. Customers were generally satisfied with the operation of the service (wait time, travel time, and number of stops to pick up and drop off other passengers), as well as with the cost of the service and with the trip-booking technologies. In terms of benefit to transit staff, interviews with shuttle drivers and dispatchers revealed that drivers saw the largest benefit in receiving automated trip changes through their Mobile Data Terminals while dispatchers saw the biggest benefit in having real-time vehicle location at their fingertips and in having some kiosk trip requests automatically assigned by the CAD system. In terms of operating efficiency, it was found that the consolidation of casino shuttle services allowed the transit operator to provide a similar level of service with less vehicles. Another efficiency gain noted was that the operator was able to share resources between the two demand-response services on occasion.			
Key Words Intelligent Transportation Systems, ITS, Automated Vehicle Location, AVL, Computer-Aided Dispatch, CAD, Interactive Voice Response, IVR, Mobile Data Terminal, MDT, Coordinated Transit System, Paratransit, Demand-Response, Public/Private Partnership, Kiosk, Tourism, Evaluation, Transit Operations, Customer Satisfaction		18. Distribution Statement No restrictions. This document is available to the public from: The National Technical Information Service, Springfield, VA 22161.	
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ABBREVIATIONS

ATIS	Advanced Traveler Information Systems
ATM	Area Transit Management
AADT	Annual Average Daily Traffic
APC	Automated Passenger Counter
AVL	Automated Vehicle Location
CAD	Computer-Aided Dispatch
CTS	Coordinated Transit System
DOT	Department of Transportation
EPA	Environmental Protection Agency
FTA	Federal Transit Administration
GPS	Global Positioning System
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
ITS JPO	Intelligent Transportation Systems Joint Program Office
MCO	CTS Management Company Board
MDT	Mobile Data Terminal
MOE	Measure of Effectiveness
SS/TMA	South Shore Transportation Management Association
TRPA	Tahoe Regional Planning Agency
TTD	Tahoe Transportation District
USDOT	United States Department of Transportation
VMT	Vehicle Miles of Travel

EXECUTIVE SUMMARY

INTRODUCTION

This document presents the evaluation strategies and objectives, data collection methodologies, and results of the evaluation of the Coordinated Transit System (CTS) in South Lake Tahoe.

PROJECT DESCRIPTION

The South Lake Tahoe Coordinated Transit System (CTS) Project involved combining transit services offered by private and public sector stakeholders into one centrally dispatched operation that uses intelligent transportation system (ITS) technologies to improve transit efficiency and to create a more visitor-friendly transit system.

The CTS spans the jurisdictions of two counties in two States as well as one city and incorporates the private transit resources of five casinos and one ski resort. The CTS project serves the operational and market objectives of both the public and private sectors through the centralized operation of a fleet of 42 vehicles.

The ITS technologies deployed as part of the CTS project included:

- **Automated Vehicle Location (AVL).** Nearly all of the vehicles in the coordinated fleet are equipped with a GPS-based vehicle location system; dispatchers can track the location and speed of each vehicle in real-time.
- **Computer-Aided Dispatch (CAD).** A CAD system provides real-time system performance monitoring and automated trip scheduling / dispatching for demand-response services.
- **Mobile Data Terminals (MDT).** All demand-response vehicles are equipped with MDTs to facilitate communication between drivers and dispatchers and to improve the efficiency of trip assignment through coordination with the CAD system.
- **Automatic Passenger Counters (APC).** A limited number of fixed route buses are equipped with automated passenger counters.
- **Trip Reservation / Information Kiosks.** Kiosks at key locations in the South Shore area support trip scheduling and dispatch services and provide transit and traveler information to patrons (e.g., traffic delays, weather, traffic surveillance camera feeds, and information on local events and attractions).
- **Interactive Voice Response (IVR) System for Trip Booking by Telephone.** An IVR system provides customers with access to trip scheduling and dispatching services by phone. Although this system was in place for a short time on both the casino shuttle and the door-to-door service, it was pulled from operation during the course of the evaluation due to technical difficulties.
- **Traffic Surveillance Cameras.** Real-time traffic surveillance video for two key locations in South Lake Tahoe is available online.

EVALUATION OVERVIEW

The national evaluation of the CTS project involved two major components. The first, and most extensive, is a *System Impact Study* designed to measure the effect of the new technology on the transportation system and the people who use it. The second component is an *Institutional Issues Review* designed to document the organizational and institutional challenges that the stakeholders encountered during development, deployment, and operation of the coordinated transit system. Lessons learned in deploying and operating the technologies and the system were also gathered from stakeholders throughout the course of the evaluation.

The purpose of the systems impact portion of the evaluation was to assess the overall impact of the combination of technologies being deployed as part of the CTS project. The objectives of the evaluation were as follows:

- Assess the impact of CTS on transit ridership.
- Assess the impact of CTS on traffic congestion.
- Assess the impact of CTS on transit system efficiency.
- Assess transit operator perceptions of the system and the technologies.
- Assess the impact of CTS on customer satisfaction with transit services in South Lake Tahoe.

The evaluation studied the following hypotheses:

- CTS will result in increased transit ridership.
- CTS will result in increased use of transit by visitors.
- CTS will result in reduced traffic volumes.
- With CTS, transit services will operate with greater efficiency than the existing transit system.
- CTS will benefit transit operators.
- With CTS, transit riders will be more satisfied with available transit services.

The evaluation involved the following data collection and analysis activities:

- Before/after analysis of standard ridership reports.
- Before/after analysis of traffic counts and visitor activity estimates.
- Before/after analysis of standard operating performance reports.
- Analysis of post-implementation transit operator interviews.
- Analysis of before/after passenger surveys.

SUMMARY OF SYSTEM IMPACT STUDY FINDINGS

The findings of this evaluation are summarized here according to each of the five evaluation objectives.

Assess the Impact of CTS on Transit Ridership

In order to assess the impacts of CTS on transit ridership, the evaluation team obtained transit ridership data from the transit operator for the BlueGO Casino Shuttle (beginning in October 2003) and for the BlueGO Door-to-Door service (beginning in January 2002). Transit ridership on the casino shuttle was studied along with other factors expected to influence ridership on this tourist-focused service (including room-nights sold data and gaming revenue data for casinos). The evaluation team obtained these data from the Lake Tahoe Visitor's Authority.

It appears that ridership on the casino shuttle decreased significantly post-CTS. However, this decrease cannot necessarily be attributed to the consolidation of the services or to the addition of technologies. There were accompanying changes to the "brand" of the service and to the cost of the service (shuttles that were previously free now cost a $1.00 fare per one-way trip), which likely affected the ridership, and it will take some time for the service to recover from these changes. Since the implementation of the MDTs, CAD, and kiosks 2 years ago (in October 2003), ridership has increased overall for the casino shuttle. The casino shuttle has experienced a 10.3 percent increase in summer peak ridership and a 14.3 percent increase in winter peak ridership. It was found that the casino shuttle ridership data since the addition of CTS does in fact track closely with room-nights sold. Although the number of room-nights sold has decreased over the past 5 years, it has stabilized in the last 2 years and is now showing a positive upward trend.

Ridership on the door-to-door service was significantly affected by some of the technological changes associated with the initial roll-out of the CTS project. Passenger trips for the door-to-door service declined by 45 percent from July 2003 to November 2003. This time period coincides with the initial rollout of the kiosks and phone system that were initially planned for use on the door-to-door service (as many riders had difficulties using the automated trip reservation system). Since the automated phone reservation system was removed from operation, the door-to-door service has shown a steady pattern of growth. While it has not reached pre-CTS levels of ridership, the service is showing a positive trend over the past 2 years.

Assess the Impact of CTS on Traffic Congestion

Traffic congestion was measured by gathering traffic count data from continuous count stations in California and Nevada along US Route 50 and comparing data before and after CTS deployment (from January 2000 through September 2005).

Surprisingly, traffic volumes do not show the significant seasonal variance seen in the room-nights sold data, and there are several possible explanations for this discrepancy. The most likely explanation is a reduction in the duration of visits (i.e., the number of people traveling to the Lake Tahoe area has not changed, but their hotel stays are shorter or non-existent in the case of a day trip by car). A less likely scenario involves fewer visitors flying to Reno or Sacramento and traveling to the area via mass transit.

The winter peak season traffic volumes show more variation from year to year than the summer peak seasons. When comparing 2005 to 2003, the summer peak is down 10.2 percent and the winter peak is down 7.7 percent. There are a number of factors that influence vehicle trips, especially in an area with a tourist-driven economy. But as

transit ridership is improving, specifically on the casino shuttle, traffic counts in the Lake Tahoe area are decreasing. These data provide some indication that CTS has likely impacted VMT in the area, and that the main periods of impact are during times of high tourist volume.

Another indication that traffic volumes in Tahoe may be on a downward trend is that the percent of respondents who reported having access to a car while visiting South Lake Tahoe dropped from 91 to 80 percent from August 2002 to August 2004. This bodes well for the stakeholders' goal of increasing the number of visitors who leave their car at home.

Assess the Impact of CTS on Transit System Efficiency

Transit system efficiency was assessed by evaluating passenger trips, operating hours, and operating costs for fixed-route and demand-response services. Operational cost data was provided by the transit operator. Information on other operational efficiencies was obtained from TRPA and other stakeholder interviews and correspondence. Only passenger counts were available for the privately operated casino shuttle service that operated before the new CTS casino shuttle service existed. Therefore, passengers per operating hour and operating cost per hour were calculated for all services with the exception of the casino shuttle services.

Number of Vehicles

At the inception of the casino shuttle service, the stakeholders believe that anywhere from five to eight buses were providing the on-demand casino shuttle service at any given time with wait times between 15 and 20 minutes during peak times. Due to the addition of the technology and the consolidation of services, the current system provides the same level of service with only three to four buses. The reduction of the vehicles is an approximation of the operator; the number of buses deployed at any given time varies somewhat depending on the demand for the service. This reduction is a tangible benefit of the CTS project that should mean reduced operational costs, fuel consumption, and wear on CTS vehicles over time.

Due to the consolidation of the services and the combined operations at one dispatch center, the transit operator has the ability to switch vehicles between the door-to-door and Casino shuttle services on an impromptu basis to meet needs. Although this does not occur on a daily basis, the operator now has more flexibility in meeting the ever-changing demand of the two services.

Operating Costs

The door-to-door service has experienced a slight decrease in operating costs while experiencing a slight increase in passenger trips. This indicates more passenger trips with a similar level of service, although the exact number of service hours data for FY 2005 is not available. This small gain in efficiency for the door-to-door service is a positive sign, but the data is inconclusive in terms of showing whether the improvements employed in the CTS project had any significant effect on cost efficiency for the service.

Operating Efficiency

A 20 percent increase in passenger-trips per service hour from 2002-03 to 2003-04 makes it appear promising that efficiency is improving. Due to the significant changes implemented by CTS that affected ridership, it is difficult to make conclusive statements about increases in efficiency; however, the data do suggest a positive trend after the initial drop in ridership in FY 2003. This improvement can likely be at least partially attributed to technological improvements implemented with the CTS project.

Passenger Trips per Mile (Door-to-Door Service)

Because the door-to-door service is on demand, there is not a clear sense that a higher number of passenger trips per mile of service is measuring "better" efficiency for that service. A higher value of this statistic would imply that more passengers are riding a vehicle simultaneously, which is one view of efficiency. However, because of the wide area of coverage for the service, multiple travelers on the same vehicle trip could mean a significantly lower level of service for passengers (i.e., as origins and destinations are farther apart, trips with multiple pick-ups and drop-offs are longer for passengers). Taking this into consideration, the fact that the door-to-door service is maintaining an acceptable level of efficiency reflects positively on the service and the changes implemented with CTS.

Assess Transit Operator Perceptions of the System and the Technologies

Transit operator perceptions of the system and the technologies were gathered through informal interviews that the evaluation team undertook while conducting the on-board surveys. The evaluation team inquired about the drivers' experience with the MDTs and the CAD system. When talking with the dispatchers, the team inquired about their experiences with the AVL interface, the CAD system, and the IVR system.

Although most drivers expressed general satisfaction with the MDT units, some had specific complaints about the user interface, stressing that driver focus groups would have helped to ensure that the interface would meet their needs. When it came to the CAD system, many felt that it was not effective at efficiently assigning trips among the vehicles. They felt that assignments can be made more efficiently through radio communication between the dispatcher and the various drivers considering that there are never more than five vehicles on the road at any given time and that the casino shuttle service area is not geographically very large. The dispatchers for the most part agreed with the drivers about the effectiveness of the CAD system for their needs, particularly for the door-to-door service.

In terms of the AVL, the dispatchers were satisfied with the interface and felt that there is truly a benefit in knowing where the buses are in real-time. The most significant benefit that they noted was being able to tell customers where the buses are in real-time.

The benefit to operators is perhaps best summed up by the statement of one operator: "In the end, I think we got the product we wanted, but we're using it in different ways [than we expected]. It's good to know we will have these tools available down the road when we need them when we add or expand services. We've made the initial investment and now the cost will be incremental to expand."

Assess the Impact of CTS on Customer Satisfaction with Transit Services in South Lake Tahoe

In terms of respondents' overall impression of transit services in South Lake Tahoe, opinions did not change significantly between the before and after surveys: customers generally had a good impression. A high percentage of baseline and post-CTS respondents (89 percent and 81 percent, respectively) indicated a "positive" or "very positive" impression overall.

In terms of reactions to the trip reservation capabilities (by phone and by kiosk), respondents seemed generally satisfied. Of those who had used a phone or kiosk to book a trip, the overwhelming majority reported being "satisfied" or "very satisfied" with the ease of scheduling a trip (78 percent of those booking by phone and 67 percent of those booking via a kiosk). With that said, satisfaction with the ease of trip-booking did decrease from the baseline survey (90 percent of baseline survey respondents indicated that they were "satisfied" or "very satisfied" with the ease of booking a trip) When it came to satisfaction with the information received about expected wait time using the phone and kiosk, 72 percent receiving information by phone were "satisfied" or "very satisfied" while 62 percent receiving information via a kiosk were "satisfied" or "very satisfied." Of those who indicated that they had not used a phone or kiosk to book a trip, about a third reported that the reason they did not use that option was that they were not aware of it. A lower percentage of respondents reported that they were aware of the option but did not want to use it (20 percent of those referring to the phone and 16 percent of those referring to the kiosk).

In terms of customer satisfaction with the overall operations of the casino shuttle, respondents' satisfaction with *the number of stops to pick up and drop off other passengers* was nearly the same before and after CTS with the majority of respondents indicating that they are either "satisfied" or "very satisfied" (83 percent of baseline respondents and 80 percent of post-CTS respondents). When asked to rate their level of satisfaction with four different aspects of the service (*time spent waiting for a shuttle*, the *cost of a trip*, the *total travel time*, and the *service overall*), respondents reported a high level of satisfaction in all areas (78 to 89 percent were "satisfied" or "very satisfied"). In terms of expectation about wait time, respondents were satisfied. Approximately 86 percent reported that the wait time was about what they expected or was shorter than they expected.

Among the 212 respondents indicating that they had used the prior independently-operated casino shuttle services, there was general agreement that the new consolidated service is as good as the previous service, if not better. Eighty-five to 88 percent of respondents reported that the service was "about the same as before," "somewhat better than before," or "significantly better than before" when asked about *time spent waiting for a shuttle*, *travel time*, and the *number of stops to pick up and drop off other customers*.

CONCLUSIONS

The following is a summary of the conclusions regarding the hypotheses developed for testing in the evaluation of the Tahoe CTS Project:

- **Hypothesis**: **CTS will result in increased transit ridership**. The hypothesis is not supported as CTS technologies actually resulted in a significant drop in

ridership on the door-to-door service over the few months that the IVR telephone trip reservation system and initial kiosk user-interface were in place. Since the IVR system has been removed from operation and the kiosk interface has been simplified, however, ridership on the service has increased steadily.

- **Hypothesis**: **CTS will result in increased use of transit by visitors**. This hypothesis is inconclusive. Although ridership on the casino shuttle appears to have decreased significantly since the consolidation of the services, it is not clear that ridership numbers from before and after CTS can be compared. Additionally, the number of visitors to South Lake Tahoe appears to have decreased in recent years (the number of room-nights sold decreased by 15 percent from August 2002 to August 2004), which means that there was a decrease in the population of potential riders. Furthermore, the customer intercept surveys revealed that there has been an increase in the number of residents riding the casino shuttle (the percent of those surveyed reporting that they were residents decreased from 97 percent in August 2002 to 77 percent in August 2004), which means that studying total ridership on this tourist-focused service is no longer the best indication of the level of transit use by visitors.

- **Hypothesis**: **CTS will result in reduced traffic volumes**. This hypothesis is supported by traffic volume counts and by customer satisfaction surveys. When comparing 2003 to 2005, traffic volumes on US 50 in South Lake Tahoe decreased by 10.2 percent and 7.7 percent, respectively, for the winter and summer peaks. This is further supported by the fact that the casino shuttle experienced a 7.5 percent increase in riders over this time and by the fact that the percent of survey respondents reporting having access to a car dropped from 91 to 80 percent from August 2002 to August 2004.

- **Hypothesis**: **With CTS, transit services will operate with greater efficiency than the existing transit system**. This hypothesis is supported for the casino shuttle service, but is inconclusive for the door-to-door service with the current data. The consolidation of casino shuttle services as a result of CTS resulted in an efficiency gain in terms of providing a similar level of service with less vehicles. Also, being able to share resources between the two demand-response services on occasion is another direct operational efficiency benefit of CTS. There were small measured efficiency gains on the door-to-door service in terms of “cost per passenger-trip,” ”passenger trips per operating hour,” and ”passenger trips per mile”; however, the data is inconclusive in terms of demonstrating whether the CTS project had any significant effect on these efficiency gains.

- **Hypothesis**: **CTS will benefit transit operators**. This hypothesis is supported by information gathered through formal and informal interviews with shuttle drivers and dispatchers. Drivers saw the biggest benefit in receiving automated trip changes through their Mobile Data Terminals while dispatchers saw the biggest benefit in having real-time vehicle location at their fingertips and in having some kiosk trip requests automatically assigned by the CAD system.

- **Hypothesis**: **With CTS, transit riders will be more satisfied with available transit services**. This hypothesis is supported through the customer satisfaction surveys. Customers are as satisfied with the casino shuttle service as they were with the independent casino shuttles that operated pre-CTS. Customers are generally satisfied with the operation of the service (e.g., wait time, travel time, and

number of stops to pick up and drop off other passengers) as well as with the cost of the service and the trip-booking technologies.

1 INTRODUCTION

1.1 OVERVIEW

In 2000, the U.S. Congress earmarked funds for selected projects that were assessed as supporting improvements in transportation efficiency, promoting safety, increasing traffic flow, reducing emissions, improving traveler information, enhancing alternative transportation modes, building on existing intelligent transportation systems (ITS), and promoting tourism. A small number of these projects were selected for national evaluation. The Tahoe Coordinated Transit System (CTS) project was among those selected.

Together, the United States Department of Transportation (USDOT) ITS Joint Program Office (JPO) and the Federal Transit Administration (FTA) selected an independent evaluation team to develop and implement a "before and after" evaluation of the CTS project deployment. The overriding purposes of this evaluation were to determine whether the project goals were met and to provide valuable information and lessons learned to assist others across the nation who may be considering similar deployments.

The Evaluation Plan[1] prepared in July 2002 identified a set of evaluation activities, some of which had a baseline (or "before") data collection component in addition to a post-deployment (or "after") component. The Phase II Evaluation Report[2] published in February 2003, prior to deployment of CTS, provided a summary of the results of the baseline data collection activities. This Phase III Evaluation Report presents the findings of the national evaluation now that the majority of the elements called for in the original CTS project have been successfully deployed.

The evaluation involved two components: a *System Impact Study* that addresses transportation system impacts, operational impacts, and changes in customer satisfaction and an *Institutional Issues Review* that documents the CTS project's unique institutional arrangements. Lessons learned in deploying and operating the technologies and the system were also gathered from the stakeholders throughout the course of the evaluation.

1.2 ORGANIZATION OF THE REPORT

The remainder of this Phase III Report is structured as follows:

- **Section 2 – Background on CTS Project.** Provides background information on the Tahoe CTS project, including project goals.

[1] *Tahoe Coordinated Transit System Evaluation Plan*, July 5, 2002. Prepared for the USDOT ITS Joint Program Office.

[2] *Tahoe Coordinated Transit System Final Phase II Report*, February 3, 2003. Prepared by for the USDOT ITS Joint Program Office.

- **Section 3 – Evaluation Overview.** Summarizes the evaluation approach and presents the hypotheses, measures of effectiveness, and data collection activities developed previously and detailed in the Evaluation Plan.[3]
- **Section 4 – Findings from System Impact Study.** Details the data collection plan and process and provides a comparison of the baseline and post-deployment results from the data collection activities.
- **Section 5 – Findings from Institutional Issues Review.** Provides a summary of the institutional issues experienced by the wide range of stakeholders over the course of the planning and deployment of the CTS project.
- **Section 6 – Technology Lessons Learned.** Provides a summary of lessons learned by the stakeholders in terms of deploying and operating the various transit ITS technologies that comprise the CTS project.
- **Section 7 – Summary and Conclusions.** Summarizes the major findings of the evaluation and states the major conclusions drawn from the results.

[3] *Tahoe Coordinated Transit System Evaluation Plan*, July 5, 2002. Prepared for the United States Department of Transportation, ITS Joint Program Office.

2 BACKGROUND ON CTS PROJECT

2.1 OVERVIEW

The South Lake Tahoe area is a bustling tourist community nestled in the Sierra Nevada Mountains at the southern end of Lake Tahoe, a 22-mile long lake known for its crystal clear waters. The developed area of South Lake Tahoe spans portions of two counties in two States. The combination of the natural beauty of the area, the ski slopes on the California side, and the casinos on the Nevada side, is a powerful draw for tourists. The area attracts nearly 2 million visitors per year with large spikes up to 200,000 visitors per day on peak-season days. This large influx of tourists not only creates congestion problems (with some local roadways regularly reaching level-of-service E or F), but also causes pollution that endangers the air and water quality that contribute to the natural beauty of the region. One dramatic piece of evidence pointing to the problems associated with new growth and increased pollution is the significant decrease in lake clarity that has occurred, with depth clarity dropping from 120 feet in the 1960s to only 70 feet today.[4]

Concern for the environment in and around Lake Tahoe led to approval of a bi-state State compact between California and Nevada to create a regional planning agency to oversee development around Lake Tahoe. The U.S. Congress ratified this agreement in 1969, creating the Tahoe Regional Planning Agency (TRPA). This legislation was later amended in 1980, authorizing TRPA to establish environmental quality thresholds and to enforce rules necessary to meet these thresholds. This resulted in a series of TRPA actions that produced an effective no-growth region in which new development is forbidden and redevelopment of existing properties requires mitigation steps designed to offset potential environmental impacts resulting from the increased tourism associated with redevelopment.

Increasing congestion, continued pollution, and no-development regulations in a region with high growth potential established the atmosphere that led to the proposal for a coordinated transit system (CTS). As proposed, the CTS could provide the means to reduce congestion, protect the environment, and earn mitigation credits for redevelopment by decreasing pollution-causing traffic through the increased use of transit. Earning mitigation credits was especially attractive to many players. For example, the City of South Lake Tahoe was considering several utility projects and a convention center, the Heavenly ski resort had already planned many expansion projects, and several casinos in the area wanted to earn credits for future expansion. Each of these redevelopment projects required environmental mitigation.

While concern for traffic problems and the environment and interest in earning mitigation credits provided the initial impetus for CTS, the advantages of a coordinated transit system were a powerful draw that encouraged other area organizations that provided transit services to join the project. For example, it was envisioned that casino shuttle vans used primarily at night to transport casino patrons to and from lodging could be used during the day to provide demand-response service for residents and

[4] "Application for Participation in the FY00 ITS Integration Component of the ITS Deployment Program," published by the Tahoe Regional Planning Agency (TRPA), March 7, 2000.

tourists in the city. Ideally, a fully deployed CTS would allow South Shore visitors to leave the driving and parking hassles behind and rely on this new coordinated transit system to meet all of their transportation needs.

Figure 2-1. View of South Shore Lake Tahoe Area.

As proposed, CTS would eventually combine the existing transportation resources of public and private entities to provide more effective and cost-efficient services to both residents and visitors. With this vision in mind, five public-sector and six[5] private-sector stakeholders joined together to generate plans for the CTS project (see Table 2-1 below).

Table 2-1. CTS Public and Private Stakeholders

Public Stakeholders	Private Stakeholders
Tahoe Regional Planning Agency	Caesars Hotel and Casino
Tahoe Transportation District	Harrah's Hotel and Casino
City of South Lake Tahoe	Horizon Hotel and Casino
El Dorado County	Harveys Hotel and Casino
Douglas County	Lakeside Inn and Casino
	Heavenly Valley Ski Resort

[5] Harrah's / Harvey's and Caesar's / Horizon have since merged operations.

2.2 DESCRIPTION OF THE CTS PROJECT

The stakeholders recognized the need to address large summer seasonal peaks in transportation demand driven primarily by tourists.[6] This called for a comprehensive transit system that would provide the convenient access to transit services necessary to appeal to tourists. The original plan for the CTS project included:

- A shared pool or fleet of transit vehicles that could be switched among public and private sector resources to provide transit services as needed.
- All vehicles equipped with a common set of tools, including automated vehicle location (AVL), mobile data terminals (MDT), and radio data and voice communication equipment.
- A shared computer-aided dispatch (CAD) center to manage fleet operations.
- An automated ride-request system to automate fleet dispatching operations, including strategically located kiosks throughout South Lake Tahoe to facilitate and increase tourist use of the transit system.
- Advanced traveler information systems (ATIS) to provide real-time traffic and transit information to the public.

The CTS project was intended to coordinate the existing transit services available in portions of Douglas County in Nevada and in El Dorado County in California (see Figure 2-2). This area includes most of the south shore region of Lake Tahoe, including the tourist area around the city of South Lake Tahoe, California.

The CTS project represented the first deployment of transit ITS technologies in the Lake Tahoe region. Spanning the jurisdictions of two counties in two states as well as one city, and incorporating the private transit resources of five casinos and one ski resort, the CTS aimed to serve the operational and market objectives of both the public and private sectors through the centralized operation of a fleet of 42 vehicles.

Fixed route, flex-route, and demand-response operations were to be blended into one system to provide a fully integrated transit system to maximize cost and operating efficiencies. Transit services offered by the private and public participants were to be merged into a centrally-dispatched operation that would use intelligent transportation system (ITS) technologies to improve transit efficiency and to create a more visitor-friendly transit system.

[6] Estimates suggest that tourists generate about 60 percent of the transportation demand in the South Shore area, yet only 10 percent of area transit riders are tourists. Consequently, the tourist sector, an important discretionary rider population, must be a primary target of the transit system to achieve any significant reduction in current vehicular traffic levels. *Application for Participation in the FY00 ITS Integration Component of the ITS Deployment Program*, published by the Tahoe Regional Planning Agency (TRPA), March 7, 2000.

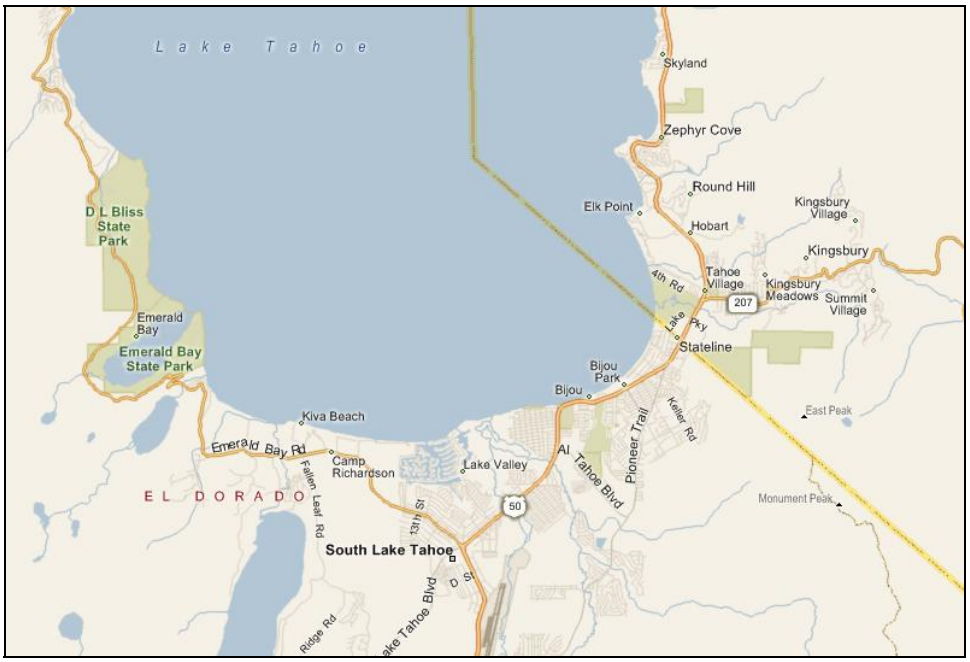


Figure 2-2. Geographic Scope of the CTS Project.

2.2.1 Institutional Scope

The institutional scope of the CTS project is large and complex, encompassing public and private stakeholders and government entities from one city and two counties in two States. The project stakeholders represent public planning organizations (TRPA and the Tahoe Transportation District [TTD], the transportation arm of TRPA), public transit providers (City of South Lake Tahoe, El Dorado County, and Douglas County), and private tourist destinations that provide transit services including five casinos (Caesars, Harrah's, Horizon, Harveys, and Lakeside Inn), and one ski resort (Heavenly). Each of these organizations was active in planning the CTS project, and each of the transit providers contributed funding and/or vehicles to support the project.

The CTS project plan included the creation of a management company (the CTS MCO Board) with a board of directors composed of project stakeholders responsible for deciding CTS policies. The board of directors included representatives from each of the following organizations:

- Lakeside Inn and Casino.
- City of South Lake Tahoe.
- El Dorado County.
- Douglas County.
- Tahoe Regional Planning Agency (TRPA).
- Tahoe Transportation District (TTD).
- Harveys Hotel Casino.

- Heavenly Ski Resort.
- Caesars Lake Tahoe.

The CTS MCO \board continues to meet monthly to discuss ongoing issues with the service, whether it be related to operations or marketing.

TRPA, a bi-state planning agency, was responsible for funding management, grant administration, contracting, and grant compliance. The South Shore Transportation Management Association (SS/TMA), a group funded by the California Department of Transportation (Caltrans) to help coordinate transportation activities in the South Shore basin, was originally responsible for project management during CTS implementation, but this role was later assumed by TRPA.

Funding for the CTS project came from a variety of sources. Capital funding for development of the CTS system was provided by two Federal grants (one from the Environmental Protection Agency [EPA] and one from the Federal Transit Administration [FTA]) totaling about $2.5 million, local project mitigation funds totaling about $1.2 million, earmark funding of about $300,000 with a local matching amount of $300,000, and other local funds of about $70,000. Capital funding for the new transit center came from designated California Proposition 116 funds and totaled to about $2 million. As part of their contribution to the CTS project, the private stakeholders provided vehicles for CTS service.

Operational funding comes primarily from the sources that support existing operations, such as private-sector contributions, State and local operating subsidies, and fare box revenues. In addition, the sale of advertising space on the information kiosks provides CTS with an additional source of revenue.

2.2.2 Transit Systems Involved

The transit services included in the coordinated transit system project are as follows:

- **Casino Demand-Response Service.** The BlueGO Casino Shuttle is a demand-response service that transports patrons to and from casinos in South Lake Tahoe to any destination other than a private residence. Service is provided daily between the hours of 8:30 a.m. and 1:30 a.m., and the fare is $1.00 per one-way trip. The shuttle serves five casinos: Harveys, Harrah's, Caesars, Horizon, and Lakeside Inn. Prior to CTS, Caesars, Harveys, and Harrah's each operated their own dedicated shuttle vans that were collectively referred to under the umbrella name Park-n-Roll. These individual shuttle services were offered to casino patrons at no charge. Figure 2-3 shows one of Harrah's Park-n-Roll shuttle vans that operated prior to CTS as well as one of the BlueGO Casino Shuttles that operates now.

Figure 2-3. Harrah's Park-n-Roll Shuttle and BlueGO Casino Shuttle.

- **Demand-Response Service within the City of South Lake Tahoe and El Dorado County.** The BlueGO Door-to-Door service (formerly known as BusPlus) provides demand-response service to the South Lake Tahoe area. The costs of this service are shared between the City of South Lake Tahoe and El Dorado County. Service is provided within the city limits of South Lake Tahoe on a 24-hour-a-day basis as well as to and from the town of Meyers and within El Dorado County on a daily basis from 7:00 a.m. to 6:30 p.m. The fare for a one-way trip within the city or county limits is $3.00 ($1.00 for registered elderly, disabled, or low-income individuals). The fare for a trip across city / county limits is $5.00. A 10-ride punch card can be purchased for $25.00.
- **Fixed Route Transit Service.** The BlueGO Fixed Route service (formerly known as the South Tahoe Area Ground Express, or STAGE) operates four routes that range from the casino district at the State line west through nearby lodging areas and along US Highway 50 (US 50) to the shopping area at the "Y," where US 50 and State Route 89 intersect. All four routes operate on hourly headways. Approximately 80 percent of the BlueGO Fixed Route service riders are area residents. The fare structure for the BlueGO Fixed Route is provided in Table 2-2.

Table 2-2. Fare Structure for BlueGO Fixed Route, Nifty 50 Trolley, and Douglas County Flex Route as of February 2006

Fare Type	Fare
All day ride	$3.00
One-way ride	$1.75
All day ride for special needs and seniors (age 62 and over)	$1.50
One-way ride for special needs and seniors (age 62 and over)	$0.50
10-ride punch pass	$15.00
Monthly pass	$50.00

- **Tourist Shuttle.** During the summer months (mid-June through Labor Day), the Nifty 50 Trolley provides narrated fixed-route tours along two routes (prior to spring 2005 this service was provided on three routes). Due to the nature of this service, it is primarily used by tourists.[7] The fare structure for the Nifty 50 Trolley is the same as for the BlueGO Fixed Route (shown previously in Figure 2-4). A photograph of the Nifty 50 Trolley is shown in Figure 2-4.[8]

Figure 2-4. Nifty 50 Trolley.

- **Douglas County Flex-Route Service.** Flex-route service is provided on one route in Douglas County (this service was previously known as *Douglas County BusPlus*). The service operates on hourly headways and buses have the ability to deviate within one-half mile of the route to pick up and drop off passengers for an additional fee. This service was previously operated only from autumn through spring each year, but as of October 2004 it is now offered year-round. This service follows the same fare structure as the BlueGO Fixed Route service (shown previously in Table 2-2).
- **Heavenly Ski Shuttle Service.** During the ski season, the Heavenly Ski Resort offers free shuttle service on five routes in South Lake Tahoe. All five routes originate at the Transit Center located at the base of the Gondola near the California-Nevada State line. The shuttle serves most major lodging facilities as well as all of the Heavenly Lake Tahoe base lodges in both California and Nevada.

Area Transit Management (ATM), a private company that previously operated STAGE, BusPlus, the Nifty 50 Trolley, and the ski resort shuttles, was contracted to operate the overall CTS service. All transit services are operated out of ATM's centralized dispatch center.

[7] "Application for Participation in the FY00 ITS Integration Component of the ITS Deployment Program," published by the Tahoe Regional Planning Agency (TRPA), March 7, 2000.

[8] Photo courtesy of Tahoe's Best. Retrieved on November 23, 2005 from http://www.tahoesbest.com/Transportation/nifty_fifty_trolley.htm

2.2.3 Branding the New Coordinated Transit System

Shortly after deployment of the new coordinated transit system, the stakeholders established a marketing subcommittee tasked with branding the services with a new name. The goal was to provide name recognition and stability to the services by making it clear to customers that there is one coordinated transit system. The marketing subcommittee decided on the name "BlueGO" along with the slogan, "Tahoe's Smooth Movin' Shuttle!" The logo and slogan are shown in Figure 2-5 and the logo can be seen on a casino shuttle in Figure 2-6.

Figure 2-5. CTS "BlueGO" Logo and Slogan.

Figure 2-6. Casino Shuttle Showing "BlueGO" Logo.

2.2.4 ITS Technologies Involved

The CTS project scope included implementation of a variety of ITS technologies as depicted in Figure 2-7. The "CAD-equipped dispatch center" is housed at ATM's offices in South Lake Tahoe. The original CTS concept included plans for an administration building for the coordinated transit system that would operate out of a

transit center downtown. Although the building is now complete, there is not enough funding for the administration. For now the transit center has been turned into a Visitors' Center, and much of the space is being leased to Heavenly. The administration is currently being run as an adjunct duty of ATM at their existing location.

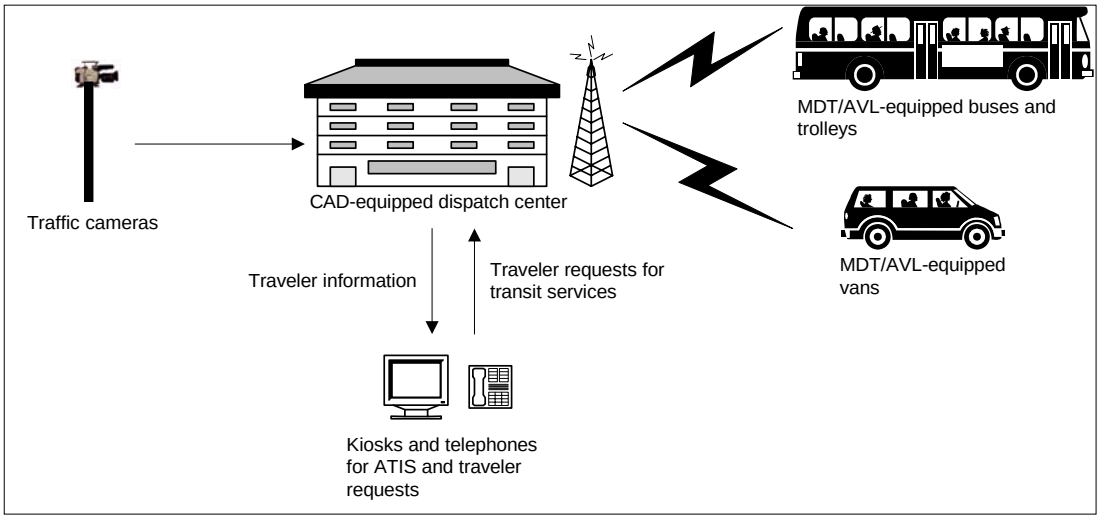


Figure 2-7. The South Shore Coordinated Transit System.

The specific technologies that were implemented as part of the CTS project are described below.

- **Automated Vehicle Location (AVL).** Nearly all of the vehicles in the coordinated fleet are equipped with a GPS-based vehicle location system. This allows dispatchers to track the location and speed of each vehicle in real-time. As shown in Figure 2-8, the system shows the location of each bus (labeled with their identification number), and automatically flags the bus with a color denoting whether it is running *early* (yellow), *on-time* (black), or *late* (red).
- **Computer-Aided Dispatch (CAD).** A CAD system provides real-time system performance monitoring and automated trip scheduling / dispatching for demand-response services in South Lake Tahoe. Upon receipt of a trip request (either directly through a kiosk request, or manually by a dispatcher taking a request by phone), the system identifies the best route and bus assignment for a requested trip (based on the trip assignments for each of the buses at of the time of the trip request), computes the trip fare, notifies the patron of the fare and expected pick-up time (either directly via kiosk, or through the dispatcher if by phone), and dispatches a demand-response vehicle to accommodate the trip.
- **Mobile Data Terminals (MDTs).** All casino shuttle and door-to-door vehicles are equipped with MDTs (shown in Figure 2-9 and Figure 2-10). The MDTs provide drivers with their pick-up/drop-off sequence for the shift (this information is automatically updated as changes are processed by the CAD system). The units also provide the driver with driving directions where needed and facilitate electronic collection of passenger ridership data (each time the driver stops for a pick-up, the MDT prompts the driver to input the number of passengers boarding and alighting).

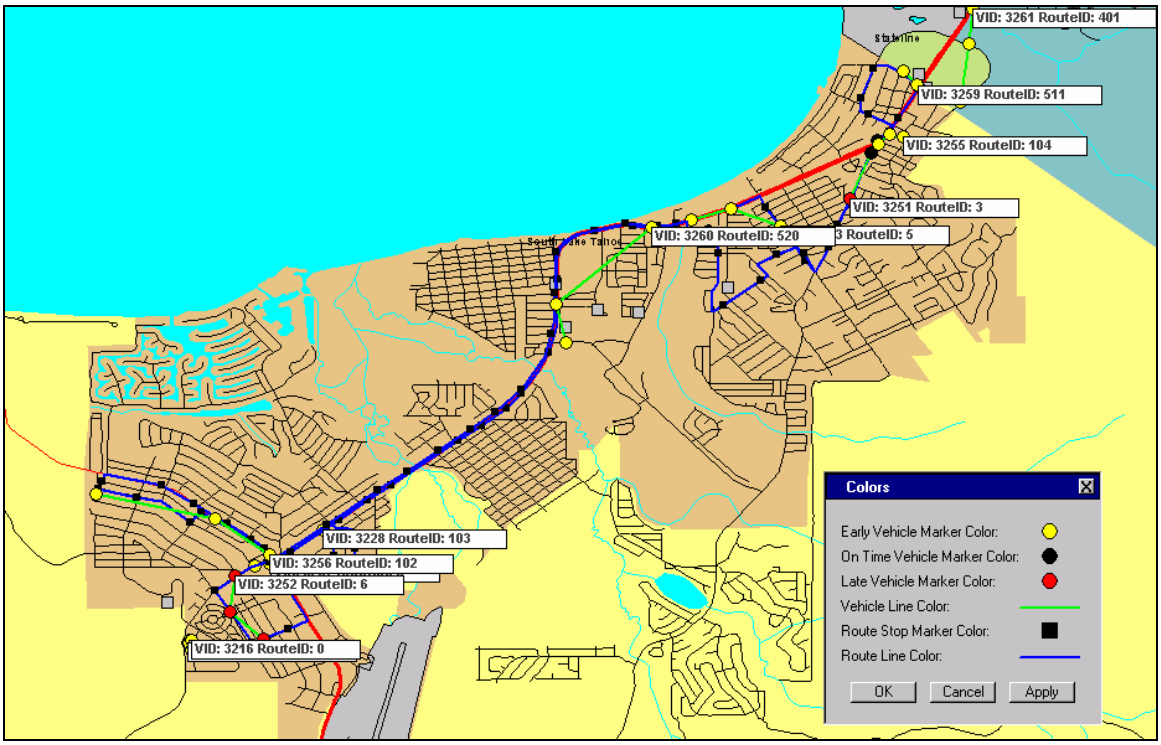


Figure 2-8. Screenshot of Dispatcher Interface with AVL System

Figure 2-9. Mobile Data Terminal (MDT) Selected for CTS Project.

Lastly, the MDTs support data communication between the drivers and dispatchers. Drivers and dispatchers have the ability to send text messages to each other, and dispatchers have the ability to send canned messages to all of the drivers at once.

Figure 2-10. MDT on a BlueGO Casino Shuttle.

- **Automatic Passenger Counters (APC).** A limited number of BlueGO Fixed Route buses have been equipped with automated passenger counters, but as of publication of this report there is not yet enough data for the transit operator to effectively make use of the data to identify patterns in boarding/alighting activities and to make changes to routes.
- **Trip Reservation / Information Kiosks.** Kiosks at key locations in the South Shore area support trip scheduling and dispatch services, provide transit and traveler information to patrons (e.g., traffic delays, weather, traffic surveillance camera feeds, information on local events and attractions), and support advertising. As of February 2006, 23 kiosks have been installed at various locations throughout South Lake Tahoe (note that they are all located indoors and within view of hotel or casino employees). The kiosks have a touch screen interface that allows riders to request a trip through a simple series of steps (see Figure 2-11). As shown in Figure 2-12, a telephone is attached to each kiosk to provide a direct line to dispatch.

Figure 2-11. Screenshot of Touch-Screen Main Menu on CTS Kiosks.

Figure 2-12. Patron Using a CTS Kiosk to Book a Trip on the Casino Shuttle.

A complete list of the current kiosk locations is provided in Table 2-3 below.

Table 2-3. Kiosk Locations as of December 2005

Caesars Tahoe	Lakeshore Lodge & Spa
Camp Richardson Resort	Lakeside Inn & Casino
Embassy Suites	Rite Aid
Embassy Vacation Resort	Royal Valhalla
Forest Suites	Stateline Transit
Harrah's Lake Tahoe	Station House Inn
Harveys Casino Resort	Super 8 Motel
Heavenly – Base Lodge	Tahoe Beach & Ski
Horizon Casino Resort	Tahoe Regional Planning Agency
Inn by the Lake	Tahoe Seasons Resort
Lake Tahoe Community College	Timber Cove
Lakeland Village	

- **Interactive Voice Response (IVR) System for Trip Booking by Telephone.** An IVR system was planned to provide customers with access to trip scheduling and dispatching services by phone. The system would identify which property a patron was calling from by connecting to a database of hotel phone numbers and would then automatically dispatch a pick-up to that location using the CAD system. This IVR system was in place for a short time on both of the demand-response services (the casino shuttle and the door-to-door), but was soon pulled from operation due to technical difficulties that will be described in Section 6.2.2. More recently there has been some discussion of reinstating the weather/traffic information portion of the IVR system even if it is without automated trip reservation capabilities since dispatchers receive many calls with requests for information about current traffic or weather conditions. Reinstating the automated system would reduce these calls, thereby increasing the time the dispatcher has available to take trip-booking calls and to communicate with drivers.
- **Traffic Surveillance Cameras.** Two traffic surveillance cameras provide real-time views of traffic conditions on US 50 in South Lake Tahoe. Both are accessible online at the links provided below and from the kiosks (as shown in Figure 2-13). The stakeholders have been working with Caltrans to install additional cameras around the Tahoe Basin and additional cameras are expected to be online by mid-2006.
    - Meyers and Highway 50
      http://video.dot.ca.gov/asx/50_meyers.asx
    - Ski Run and Highway 50
      http://video.dot.ca.gov/asx/50-ski-run.asx

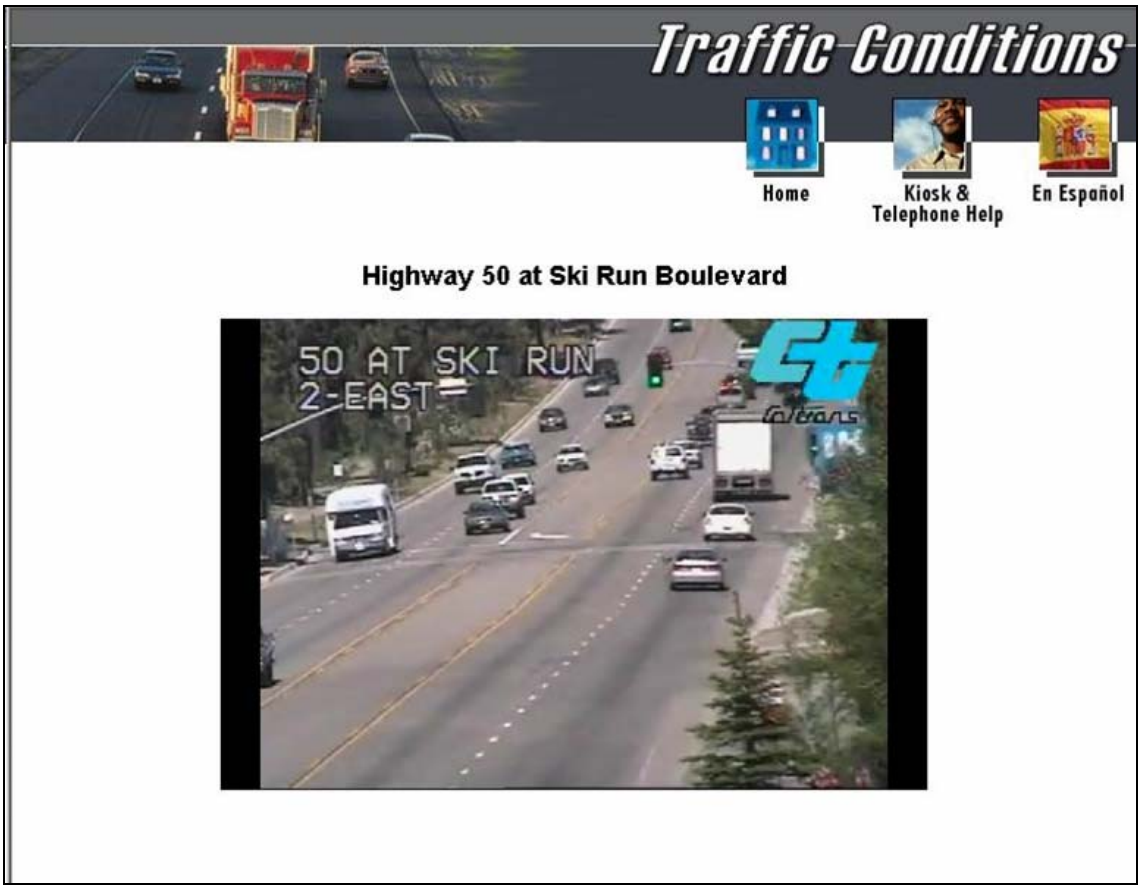


Figure 2-13. Screenshot of Traffic Camera View from Kiosk.

3 EVALUATION OVERVIEW

The national evaluation of the CTS project involved two major components. The first, and most extensive, is a *System Impact Study* designed to measure the effect of the new technology on the transportation system and the people who use it. The second component is an *Institutional Issues Review* designed to document the organizational and institutional challenges that the stakeholders encountered during development, deployment, and operation of the coordinated transit system. Lessons learned in deploying and operating the technologies and the system were also gathered from the stakeholders throughout the course of the evaluation.

3.1 SYSTEM IMPACT STUDY

The purpose of this system impact study was to assess the overall impacts of the combination of technologies being deployed as part of the CTS project. The specific evaluation activities to be conducted were documented in the Tahoe CTS Evaluation Plan[9] prepared by the evaluation team in July 2002. The evaluation plan identified evaluation objectives and associated hypotheses that were directly linked to the project goals set forth by the stakeholders prior to deployment of the CTS. The overall project goals identified by the stakeholders were as follows:

- Increase transit system efficiency.
- Increase transit ridership, particularly among the visitor population.
- Reduce traffic congestion.
- Equitably distribute customers to private sector stakeholder facilities.
- Improve customer satisfaction with transit services on the part of visitors to the area as well as residents who rely on local transit services.

With these goals in mind, the evaluation team identified five evaluation objectives[10] and six corresponding hypotheses.

Table 3-1 presents these evaluation objectives and hypotheses, along with a summary of the measures of effectiveness (MOE) and the associated data sources or data collection activities used to obtain information/data for each MOE.

[9] Tahoe Coordinated Transit System Evaluation Plan, July 5, 2002. Prepared for the United States Department of Transportation, ITS Joint Program Office.

[10] It should be noted that the evaluation team originally identified one additional goal: to assess the effectiveness of the first-drop algorithm. However, the team was unable to assess the first-drop algorithm as the stakeholders' interest in this measure waned over the course of the evaluation and the data that would be required for this type of assessment was not being collected and archived. See Section 5.2.3 for further information.

Table 3-1. Hypotheses, MOEs, and Evaluation Activities Associated with the Systems Impact Study Portion of the Evaluation

Evaluation Objective	Hypothesis	MOE	Data Source / Analysis
Assess the impact of CTS on transit ridership.	CTS will result in increased transit ridership.	Ridership.	Before/after analysis of standard ridership reports.
	CTS will result in increased use of transit by visitors.	Ridership on visitor-oriented transit services.	Before/after analysis of standard ridership reports.
Assess the impact of CTS on traffic congestion.	CTS will result in reduced traffic volumes.	Traffic volumes on segments of US 50 relative to visitor activity.	Before/after analysis of traffic counts and visitor activity estimates.
Assess the impact of CTS on transit system efficiency.	With CTS, transit services will operate with greater efficiency than the existing transit system.	Number of passengers carried relative to service provided.	Before/after analysis of standard ridership reports.
		Transit operating costs relative to service provided.	Before/after analysis of standard operating performance reports.
Assess transit operator perceptions of the system and the technologies.	CTS will benefit transit operators.	Transit operator perceptions of CTS benefits.	Analysis of post-implementation transit operator interviews.
Assess the impact of CTS on customer satisfaction with transit services in South Lake Tahoe.	With CTS, transit riders will be more satisfied with available transit services.	Passenger perceptions of reliability, wait time, and travel time.	Analysis of before/after passenger surveys.

3.2 INSTITUTIONAL ISSUES REVIEW

The review of institutional issues addressed the organizational arrangements and the public-private partnerships that were developed during this project and documented the ITS deployment process from an institutional viewpoint. Institutional coordination and cooperation between government and private interests were vital to the success of the project as the CTS project brought together 11 project stakeholders from the public and private sectors.

The evaluation team had several objectives for the institutional issues review:

- Assess the impact of the institutional environment on the development, implementation, and operation of CTS services.
- Document the progress of the project concerning the challenges faced by the CTS MCO Board during the initial phases of implementation.
- Document lessons learned from stakeholders concerning the application of ITS technology to public transit services.

4 FINDINGS FROM SYSTEM IMPACT STUDY

This section provides additional details on the data collection activities undertaken by the evaluation team to gather the data needed to accomplish each of the evaluation objectives associated with the system impact study. This section also provides the results of the Phase II and III data collection activities. As described in Chapter 3, Evaluation Overview, the data collected and analyzed included transit ridership, traffic volumes, efficiency of transit operations, operator perception of the technologies, and customer satisfaction with the transit service and the technologies.

It should be noted that the evaluation plan established the activities that the team set out to accomplish at the start of the evaluation; however, some of these activities changed as a result of changes to the CTS project that occurred during the course of the evaluation. It should also be noted that while some evaluation activities had a baseline (or "before") data collection component, others had only a post-deployment (or "after") data collection component. Additionally, some of the baseline evaluation activities conducted by the evaluation team were not conducted post-deployment as the project had changed such that it no longer made sense to collect these data post-deployment.

This section reports on results of before and after comparisons of data; as such, any data that were collected only in the "before" case are not included here. A detailed summary of all baseline data that the evaluation team collected can be found in the Phase II Evaluation Report.[11]

4.1 BACKGROUND

Before documenting the results of the CTS project's influence on ridership, traffic congestion, and customer satisfaction, it is important to provide context for the implementation of ITS technologies in the CTS project, specifically with regard to the casino shuttle. An important goal that the stakeholders had for the CTS project was to reduce vehicle miles of travel (VMT) in the Lake Tahoe area by increasing transit ridership. The size of the visitor population has a significant effect on the ability of CTS to reduce VMT. Figure 4-1 identifies some of the major influences on casino shuttle ridership, and therefore VMT, in the Lake Tahoe area. The figure emphasizes the way in which the technology implemented via CTS can influence ridership, VMT, and ultimately the livability of the area from mobility and environmental perspectives.

It is important to note that this is not a complete picture of variables that influence transit in the Lake Tahoe area. The boxes in blue represent those elements that the evaluation team is able to measure, either directly or through a surrogate measure: surveys provide information on *service quality;* room-nights sold data approximate the *number of visitors; ridership* data is available from the operating contractor ATM; and traffic counts provide a surrogate measure of *VMT*. The boxes in green represent the aspects of the CTS system that the technology can directly affect. The visiting population, marketing for the services, and fares all significantly influence ridership.

[11] *Tahoe Coordinated Transit System Final Phase II Report*, February 3, 2003. Prepared for the USDOT ITS Joint Program Office.

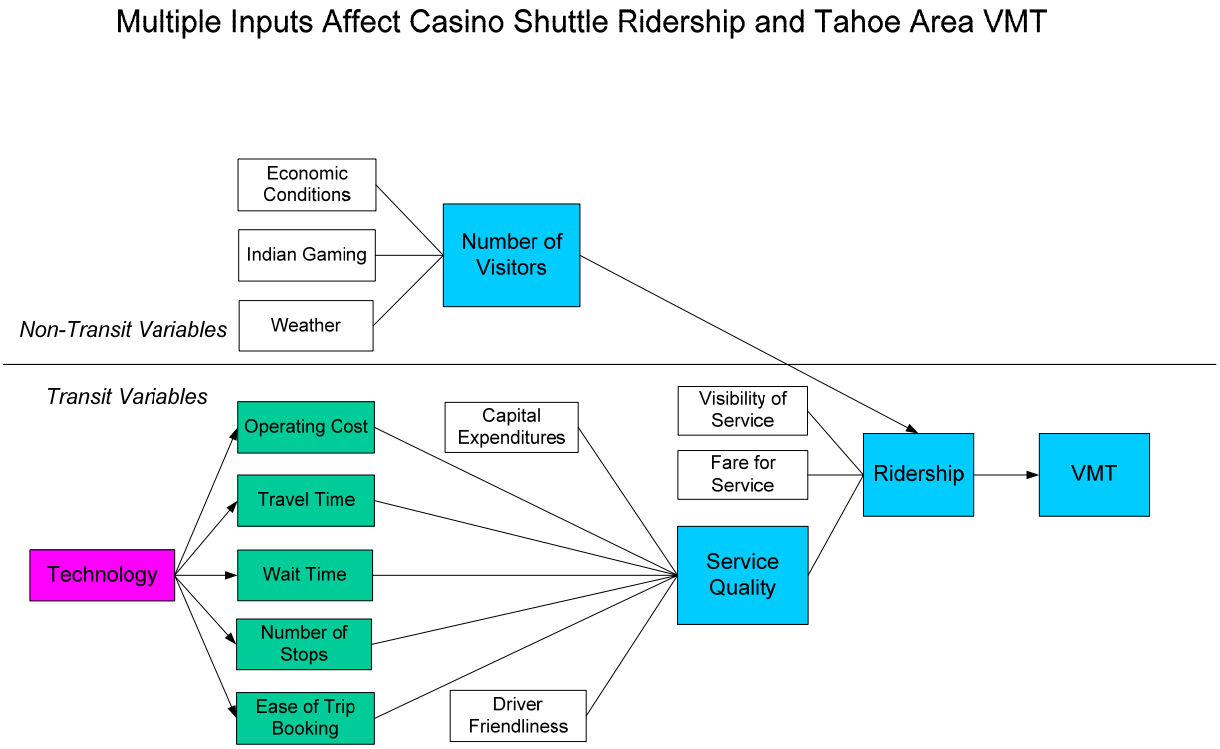


Figure 4-1. Variables Affecting CTS Ridership and VMT in South Lake Tahoe.

The principal lesson of this diagram is that although technology can have an impact on ridership and VMT, there are other factors that also affect these measures. It is within this context that ridership on the casino shuttle, customer satisfaction, and traffic congestion in South Lake Tahoe can be discussed.

4.2 ANALYSIS OF TRANSIT RIDERSHIP

It was hypothesized that CTS would result in an increase in transit ridership as operations improve following the addition of transit ITS technologies. This section outlines the data collection approach and findings associated with the transit ridership analysis.

The potential to increase ridership provided significant motivation for the CTS project. Ridership is an important performance measure of the success of the project for a variety of reasons. Reducing the environmental effects of automobile use is an important benefit of the project for the stakeholders involved, and ridership data can provide an indication of the extent to which the CTS project has been successful in reducing vehicle trips in the Tahoe Basin. The private partners have a financial stake in the project beyond providing the vehicles and a portion of the operating funding; casino property revenue is highly correlated with the number of people that enter their facility, meaning that ridership on the casino shuttle is of financial importance for those partners.

The Lake Tahoe economy depends heavily on tourism as a driver; consequently, the number of visitors determines the number of potential riders on the casino shuttle.

Because of this strong linkage, measures of tourism in the South Lake Tahoe area are included in this section alongside ridership data to provide the proper context with which to study ridership trends on the casino shuttle. These measures include *room-nights sold* in the City of South Lake Tahoe and *gaming revenue* for the casino properties in Stateline, Nevada.

4.2.1 Data Collection Approach

In order to assess transit ridership before and after CTS, the evaluation team obtained transit ridership data from ATM for the BlueGO Casino Shuttle and for the BlueGO Door-to-Door service. The team also obtained *room-nights sold* data and *gaming revenue* from the Lake Tahoe Visitor's Authority. The team obtained ridership data for the door-to-door service from January 2002 through September 2005 and ridership data for the casino shuttle dating back to the inception of consolidation of the services in October 2003 along with a few key data points from the summer of 2002.[12]

It should be noted that the evaluation team originally planned to also study ridership on the BlueGO Fixed Route and the Nifty 50 Trolley in anticipation of deployment of the various technologies on these services. However, the ridership study was limited to the demand-response services as the fixed-route services were not significantly impacted by the consolidation of the services or by the addition of technologies such that there would be an expectation of an affect on ridership.

4.2.2 Summary of Findings – BlueGO Casino Shuttle Ridership

Figure 4-2 below presents monthly passenger trips since the inception of the consolidated casino shuttle service. The data display a seasonal pattern with summer and winter peak periods. The summer peak tends to be slightly larger than the winter peak, which is consistent with the other tourism data presented in this section.

In 2002, prior to CTS, ridership on the independent casino shuttles during the peak months of July and August was approximately 35,000 each month. Although ridership data for the independent casino shuttles cannot be directly compared with the BlueGO Casino Shuttle service ridership due to the differences in data collection procedures before and after, this indicates that there was about a 40 percent reduction in ridership from 2002 to 2003. However, this decrease cannot necessarily be attributed to the consolidation of the services or to the addition of technologies. There were accompanying changes to the "brand" of the service and to the cost of the service (shuttles that were previously free now cost a $1.00 fare per one-way trip) which likely affected the ridership, and it will take some time for the service to recover from these changes.

Since the implementation of the MDTs, CAD, and kiosks in October 2003, ridership on the casino shuttle has been increasing, although it is not up to the level of ridership that was estimated before CTS. The casino shuttle recorded 22,537 passenger trips in August 2005, a 10.3 percent increase over the summer peak ridership of 20,426

[12] It is difficult to obtain an accurate picture of the pre-CTS ridership on the casino shuttle as ridership on the casino property shuttles prior to CTS was recorded manually by drivers of the various systems and the level of accuracy across the various services varied. As a result, these data are presented here, but the evaluation team has not attempted to make any strong conclusions using these data.

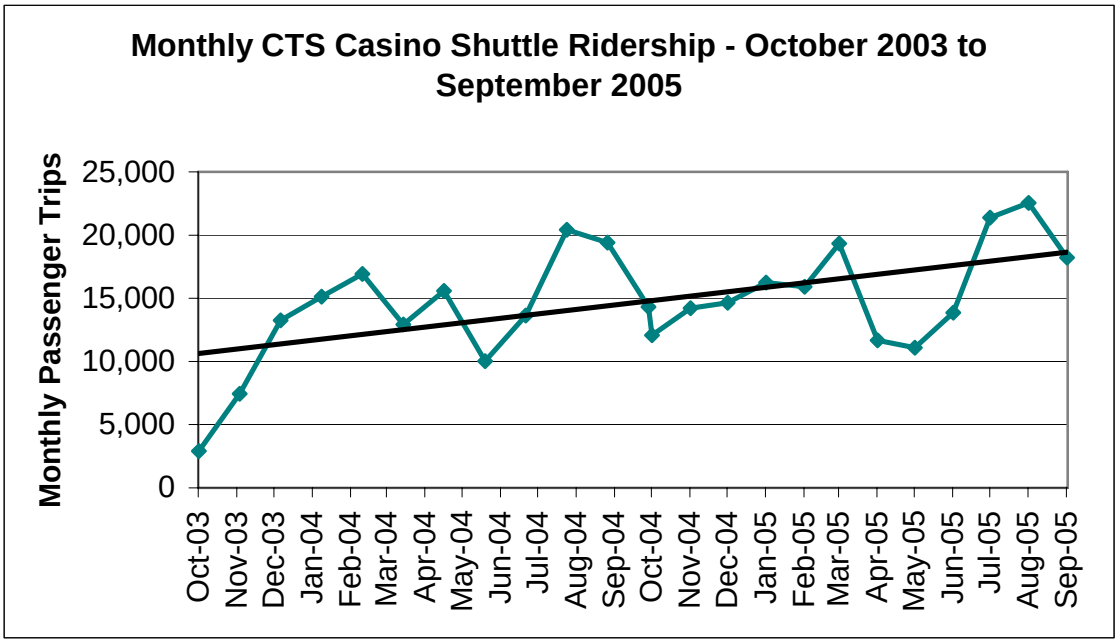


Figure 4-2. Monthly CTS Casino Shuttle Ridership since Inception in October 2003.

recorded in July 2004. The winter peak ridership recorded in March 2005 of 19,342 passenger trips reflects a 14.3 percent increase over the winter peak of 16,917 passenger trips in February 2004.

4.2.2.1 The Relationship between Tourism and Casino Ridership

The BlueGO Casino Shuttle is designed to carry passengers from hotel properties in the South Lake Tahoe area to the casino properties in Stateline, NV. Therefore, the number of visitors in the area significantly affects ridership on the casino shuttle, as the visitor population represents the pool of potential riders on the system.

Three measures of tourism are presented in this section to approximate seasonal changes and trends in visitation in the South Lake Tahoe area. Hotel room-nights sold, traffic counts, and gambling revenue data will all be presented for the area, and these data are analyzed with respect to the casino shuttle ridership data in the following sections.

Room-Nights Sold

A count of the number of hotel rooms sold in the area provides an indication of the trends in visitation over time. There are several caveats to note concerning the room-nights sold data in this report. First, the calculation of room-nights comes from room tax collections by the various municipalities in the region. While not an actual count of room-nights sold, this approximation is the best data available. Second, the data presented here only includes California hotels. Nevada data is available, but it is less valuable for assessing the pool of potential casino shuttle riders. The majority of the room-nights sold in Nevada come from the casino properties themselves, and the visitors staying at the casino hotels have little need to ride the casino shuttle since the service is designed to move people to the gaming area. In fact, all of the BlueGO

kiosks located at hotels are in South Lake Tahoe, CA, with the exception of the kiosks at the casino properties. Third, this data does not include visitors to time-share properties in the South Lake Tahoe area, meaning this data could be underestimating the actual number of visitors staying in Lake Tahoe area lodging, and therefore underestimating the potential ridership pool for the casino shuttle.

Figure 4-3 presents monthly room-nights sold data in South Lake Tahoe, CA, from January 2000 to April 2005 (the most recent month of data released by the city).[13]

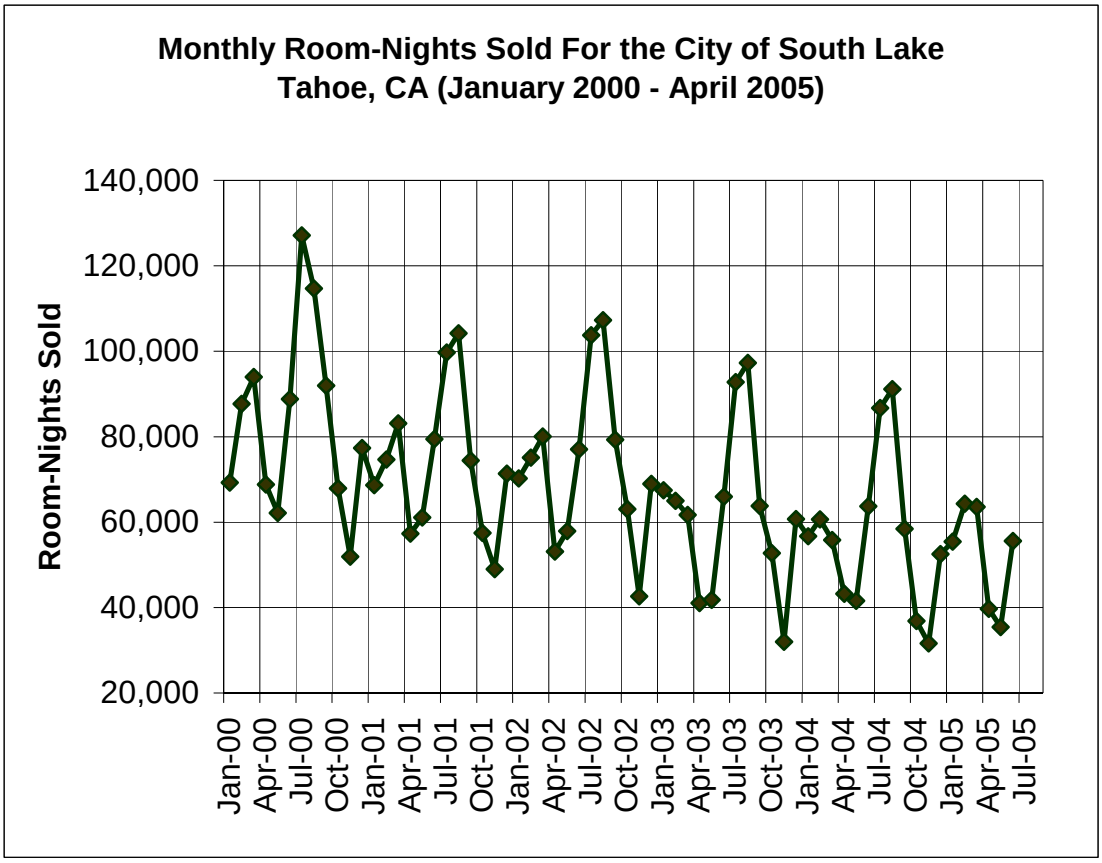


Figure 4-3. Monthly Room-Nights Sold For South Lake Tahoe: January 2000 - April 2005.

The data for room-nights show a clear downward trend over the last 5 years. The City of South Lake Tahoe recorded a peak value of 127,089 room-nights sold in July of 2000. The peak value in 2004 was 91,098 room-nights, a decline of 28.3 percent from the 2000 peak value. The data's seasonal movements show winter peak periods as well, and the winter peak values confirm the negative trend observed in the summer peak values. The winter peak observed in February 2005 of 64,290 room-nights represents a 31.6 percent decline from the winter peak of 93,936 in March 2000.

The seasonal movements of the room-nights sold data help explain the similar trends in the casino shuttle ridership data. Figure 4-4 compares the casino shuttle ridership data since the inception of CTS with the room-nights sold data just presented in Figure 4-3.

[13] Data received from the Lake Tahoe Visitors Authority.

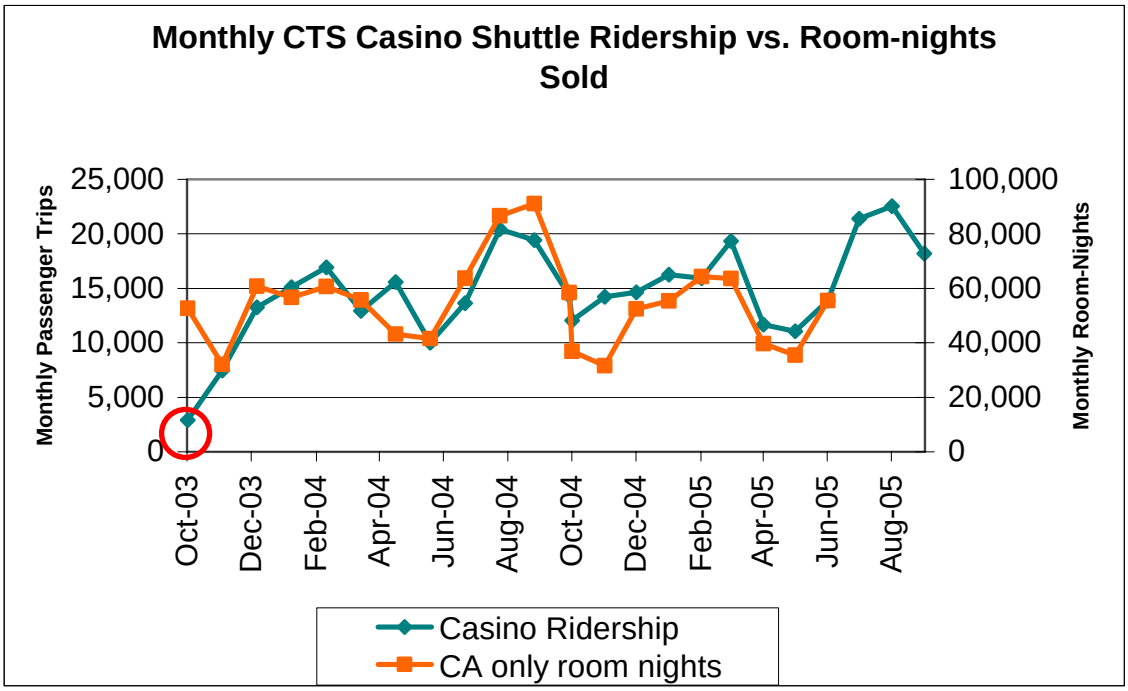


Figure 4-4. Monthly Room-Nights Sold Data in South Lake Tahoe: January 2000 - April 2005.

It can be seen that there is clear correlation between the two data sets. The initial value for October 2003 (circled in red) is considered an outlier data point because of the fare increase, changes in service, and problems with the kiosk interface during the first month after deployment. After removing that value, the correlation coefficient for these two data sets is 0.80, meaning significant positive correlation. This correlation implies, as expected, a dependence on the visiting public for casino shuttle rides. The fact that room-nights have stabilized over the past 2 years is a positive sign for the pool of potential riders of the casino shuttle. Due to the fact that ridership on the casino shuttle tracks so closely with room-nights sold, it does not appear that the consolidation of the services and the addition of the ITS technologies has resulted in an increase in ridership on the casino shuttle.

Gaming Revenue and Indian Gaming Locations

Gaming revenue also presents a surrogate measure of visitation to the Lake Tahoe area, and gaming revenue for the casino properties has been relatively steady over the past 5 years. Figure 4-5 presents monthly gaming revenue from the Stateline, NV, casinos from January 2000 to August 2005.[14]

[14] Data received from the Lake Tahoe Visitors Authority.

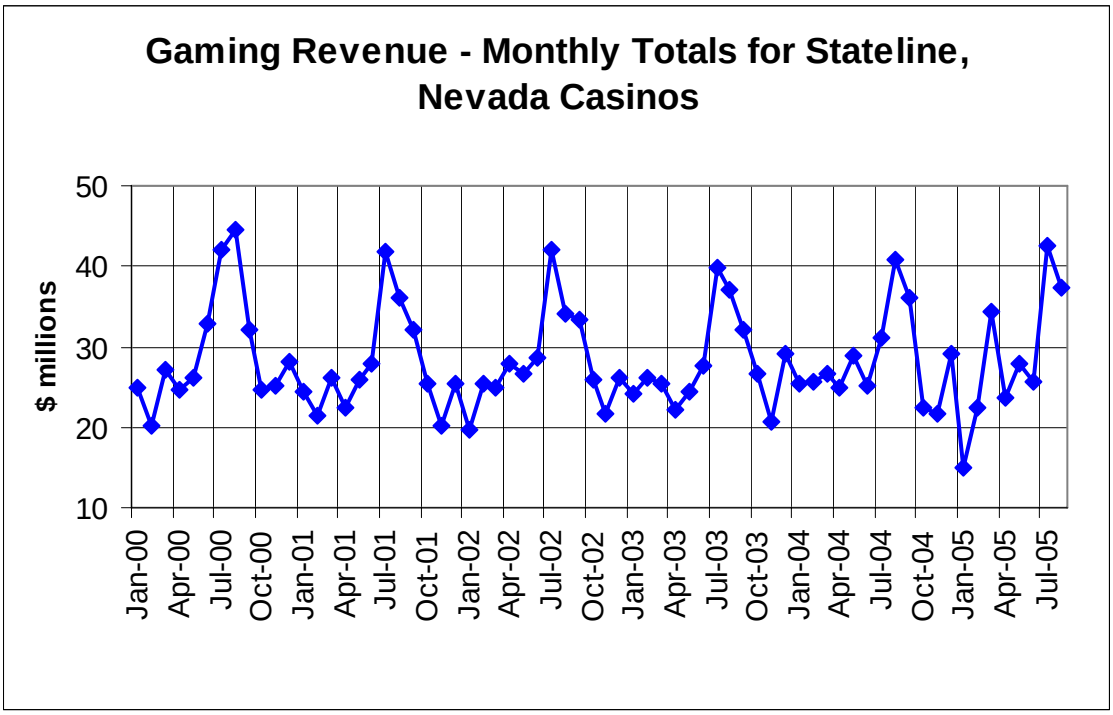


Figure 4-5. Monthly Gaming Revenue for Casinos in Stateline, NV.

The summer peak value of $42.5 million in July 2005 is 4.4 percent less than the summer peak value of $44.5 million in August 2000. Overall, the seasonal pattern remains quite similar over the 5-year period. As a positive sign for winter visitation, the highest winter time value was recorded in March 2005 at $34.3 million. This data further demonstrates the seasonal pattern of visitation statistics for the area.

Holistic Comparison of Tourism Data

Table 4-1 presents pair-wise correlations among the room-nights, gaming revenue, and traffic volume data (traffic data analysis is presented in Section 4.3).

Table 4-1. Correlation Matrix for Tourism Variables

	Gaming Revenue	Room-Nights	NV Traffic	CA Traffic
Gaming Revenue	1.000			
Room-Nights	0.696	1.000		
NV Traffic	0.798	0.660	1.000	
CA Traffic	0.853	0.768	0.948	1.000

Although when presented graphically these data could be described as “noisy,” there are a clear set of patterns that emerge. First, the three types of data clearly move together in a seasonal pattern. The table indicates significant positive correlation among the pair-wise comparisons of the tourism variables. This correlation explains

the seasonal pattern observed in the casino shuttle ridership data, and it offers further evidence that ridership on the shuttle is tied to the number of visitors in the area. The casino shuttle has shown a positive growth trend in ridership over the past 2 years, and it is important to qualify this trend by highlighting the significant effect the number of visitors has on casino shuttle ridership. Future positive or negative swings in visitation to the Lake Tahoe area will likely affect casino shuttle ridership significantly.

4.2.3 Summary of Findings - BlueGO Door-to-Door Ridership

A significant difference between the casino shuttle and door-to-door services is the lack of influence of visitors on door-to-door ridership. Although the door-to-door service is open to the general public, seasonal trends in visitation have very little affect on ridership for the service. Figure 4-6 presents monthly ridership data from the door-to-door service dating to January 2002.

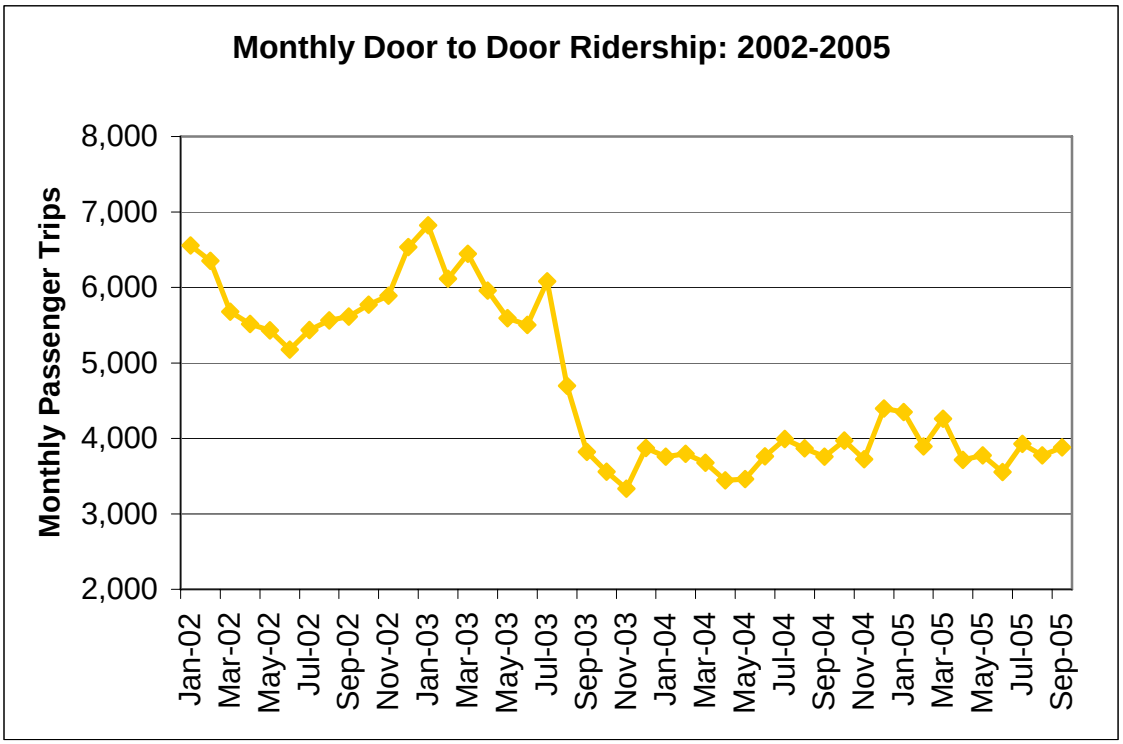


Figure 4-6. Door-to-Door Ridership: 2002-2005.

The door-to-door ridership was significantly negatively impacted by some of the technological changes implemented with the CTS project. Passenger trips for the door-to-door service declined by 45 percent from July 2003 to November 2003. This time period coincides with the initial rollout of the kiosks and phone system that were initially planned for use on the door-to-door service. A significant portion of the ridership decline was due to problems with the newly installed automated phone reservation system. The system did not function properly, and many riders had difficulty scheduling trips (see Section 6.2.2 for further details).

Since that initial significant drop in ridership, the door-to-door service has shown a steady pattern of growth as shown in Figure 4-7, which presents monthly passenger trips for the door-to-door service from the deployment of the CTS technology in October 2003 to September 2005. There is no clear pattern, although movements of the graph indicate that ridership increases in the winter months slightly and declines slightly in the summer months.

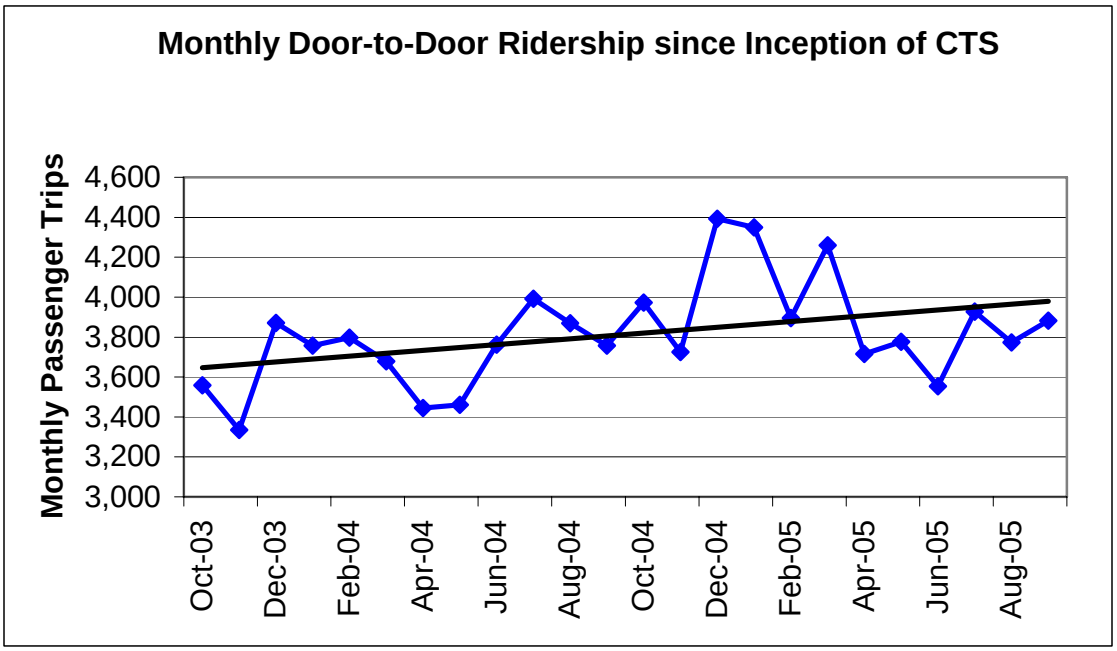


Figure 4-7. Monthly Door-to-Door Ridership since Inception of CTS.

From October 2003 to September 2005, the door-to-door service saw a 9.1 percent increase in passenger trips. The increase is 23.5 percent from October 2003 to December 2004, when the peak value of 4,393 passenger trips was recorded. While the door-to-door service has not approached pre-CTS levels of ridership, the service is showing a positive trend over the past 2 years.

4.3 ANALYSIS OF TRAFFIC VOLUMES

It was hypothesized that CTS would result in reduced traffic volumes in South Lake Tahoe as transit ridership on the various CTS services increases. The stakeholders' hope was that more visitors to South Lake Tahoe will leave their cars at home. This section outlines the data collection approach and presents the results of the traffic data analysis.

4.3.1 Data Collection Approach

The availability of automatically collected traffic volume data in both California and Nevada provided a mechanism by which to analyze the traffic impacts of the new system relative to measures of visitor volume. An extensive set of permanently installed automatic traffic counters operated by Caltrans and Nevada DOT is the source of average annual daily traffic volumes for the evaluation.

US Route 50 is the major arterial highway through the South Tahoe Shore area, including the cities of South Lake Tahoe, CA, and Stateline, NV. Data from continuous count stations (i.e., 365 days a year) in both cities were obtained from the respective State Departments of Transportation. The California Department of Transportation (Caltrans) has a continuous counting station in the City of South Lake Tahoe located on US Route 50 at Park Avenue. The Nevada Department of Transportation also has a continuous counting station along US Route 50 in Stateline, NV, less that 1 mile from the Caltrans location.

The purpose of this data collection is twofold: traffic counts provide insight into the effect CTS ridership has had on VMT and offer another view of visitor trends in the area (as discussed in Table 4-1).

4.3.2 Summary of Findings

Figure 4-8 shows monthly average daily traffic (ADT) from January 2000 to September 2005. There are some data points missing from both counter locations due to times when the counters were inoperable.

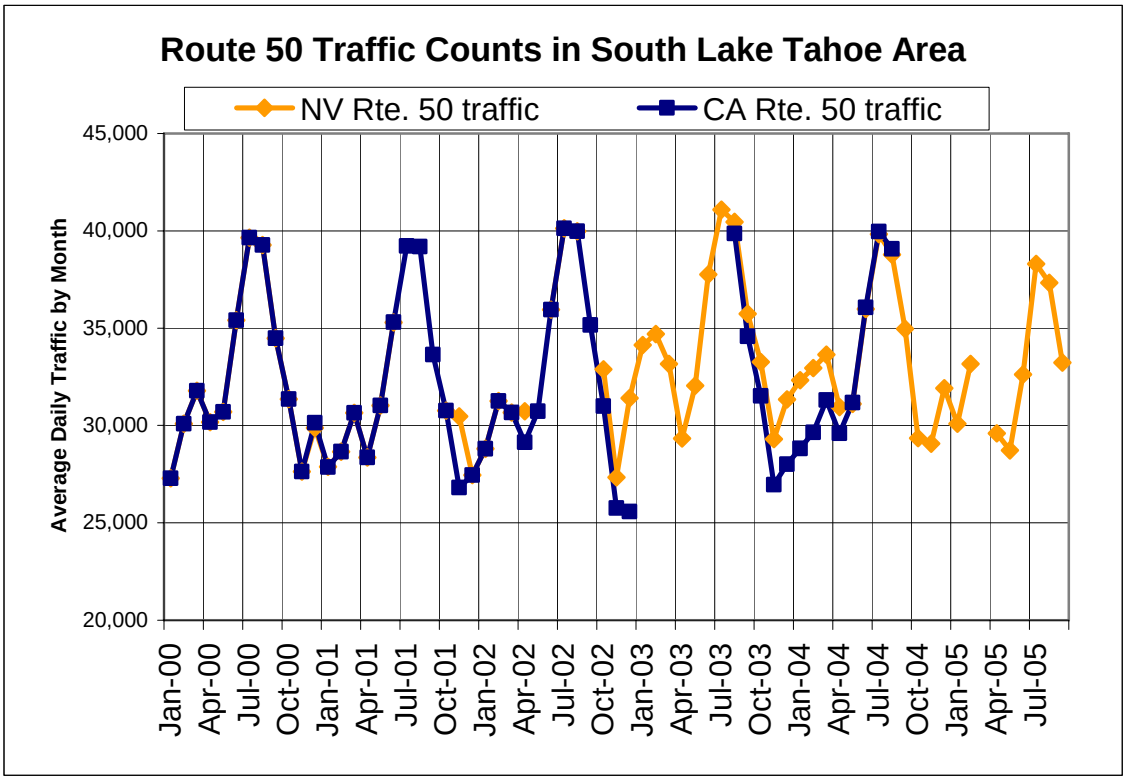


Figure 4-8. Monthly Route 50 Traffic Counts in South Lake Tahoe Area, January 2000 – September 2005.

Similar to the room-nights sold data, a seasonal pattern emerges from the data, with the summer months of July and August being peak times. Figure 4-9 provides a comparison of these summer and winter peak seasons for the traffic volume data in the Lake Tahoe area. The winter peak season is defined as January through March, and

the summer peak season is defined as June through August. The columns in the figure represent the 3 month total of ADT for the period.

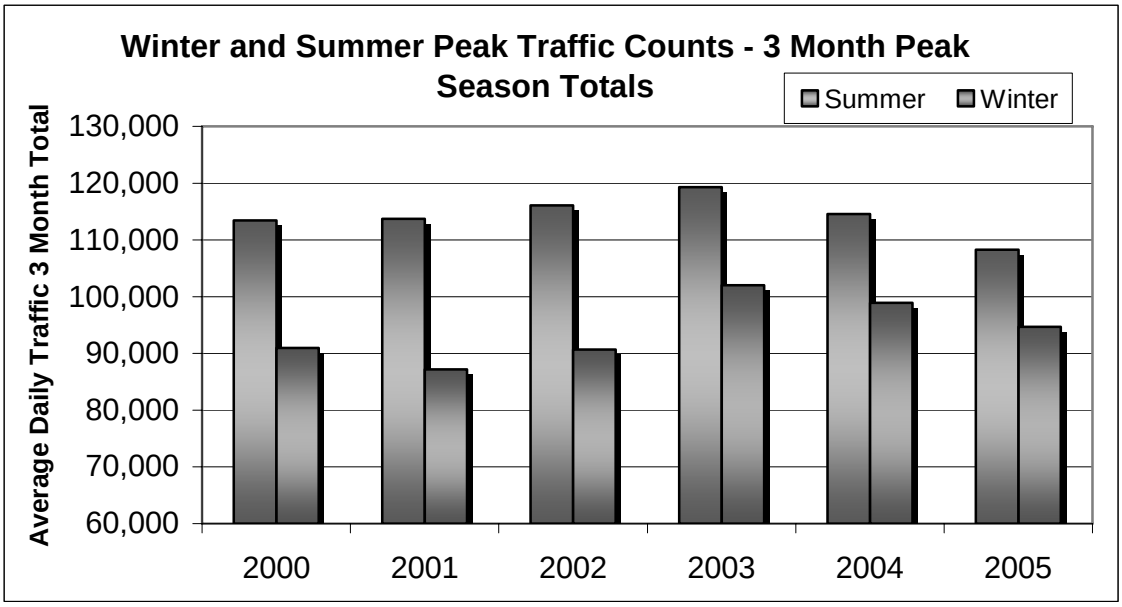


Figure 4-9. Three-Month Winter and Summer Peak Period Traffic Counts (2000-2005).

Surprisingly, traffic volumes do not show the significant seasonal variance seen in the room-nights sold data, and there are several possible explanations for this discrepancy. The most likely explanation is a reduction in the duration of visits (i.e., the number of people traveling to the Lake Tahoe area has not changed, but their hotel stays are shorter or non-existent in the case of a day trip by car). A less likely scenario involves fewer visitors flying to Reno or Sacramento and traveling to the area via mass transit.

The winter peak season traffic volumes show more variation from year to year than the summer peak seasons. Figure 4-9 shows some positive signs that CTS is reducing vehicle trips over the past 2 years. The 2005 summer peak total of 108,252 is down 10.2 percent from the 2003 value of 119,288. Similarly, the 2005 winter peak total of 94,698 is down 7.7 percent from the 2003 value of 102,033. From 2004 to 2005, the summer peak season decreased by 5.9 percent and the winter peak season decreased by 4.5 percent. The casino shuttle had a 7.5 percent increase in ridership over that time period.

There are a number of factors that influence vehicle trips, especially in an area with a tourist-driven economy. But as transit ridership is improving, specifically on the casino shuttle, traffic counts in the Lake Tahoe area are decreasing. These data provide some indication that CTS has likely impacted VMT in the area and that the main periods of impact are during times of high tourist volume.

4.4 ANALYSIS OF EFFICIENCY OF TRANSIT OPERATIONS

It was hypothesized that transit operational efficiency in South Lake Tahoe would improve as a result of the consolidation of transit services and as a result of the addition of the ITS technologies. This section outlines the data collection approach taken to assess the impact of CTS in terms of operational efficiency gains and presents the results of the data analysis.

4.4.1 Data Collection Approach

Transit-related data collected includes *passenger trips*, *operating hours*, and *operating costs* for fixed-route and demand-response services. Since *passenger counts* is the only measure available for the privately operated casino shuttles, *passengers per operating hour* and *operating cost per hour* are calculated for all but the casino shuttle services. Prior to CTS all passenger count data were collected manually by way of driver tally sheets. Post-CTS, passenger count data are still recorded manually by drivers, but drivers use their MDTs instead of a tally sheet.

Operational cost data was provided by ATM. Information on other operational efficiencies was obtained from TRPA and other stakeholder interviews and correspondence.

4.4.2 Summary of Findings

4.4.2.1 Number of Vehicles Deployed for Casino Shuttle Service

As a result of the consolidation of the transit services and the addition of ITS technologies (MDTs and CAD), there has been a reduction in the number of vehicles necessary to provide the casino shuttle service. At the inception of the casino shuttle Service, the stakeholders believe that anywhere from five to eight buses were providing the on-demand casino shuttle service at any given time with wait times between 15 and 20 minutes during peak times. Due to the addition of the technology and the consolidation of the casino shuttle services, the current system provides the same level of service with only three to four buses. The reduction of the vehicles is an approximation of the operator; the number of buses deployed at any given time varies somewhat depending on the demand for the service. This reduction is a tangible benefit of the CTS project that should mean reduced operational costs, fuel consumption, and wear on CTS vehicles over time.

4.4.2.2 Vehicles Switching between Services

Another efficiency gain resulting from CTS is the ability of the operator to switch vehicles between the door-to-door and casino shuttle services on an impromptu basis. This capability allows the operator to align the number of vehicles dedicated to each service with demand for each service. While ATM indicates that this practice does not occur on a daily basis, it is beneficial from the operator's perspective because of the flexibility it provides for real-time operations. This ability reduces the impact of issues such as sudden, drastic changes in demand for services and vehicle breakdowns. An important goal of CTS was consolidating the services to improve efficiency, and this ability to switch vehicles between services is a tangible benefit of the project.

4.4.2.3 Operational Cost Data

Due to the lack of available data from the individual casino shuttles for a "before" comparison, data on operational costs and service levels are only provided for the door-to-door service. Operating costs are compared to passenger trips and vehicle service hours to assess the impact of CTS on operating efficiency.

Figure 4-10[15] compares annual operating costs for the door-to-door service to annual passenger trips for that service:[16]

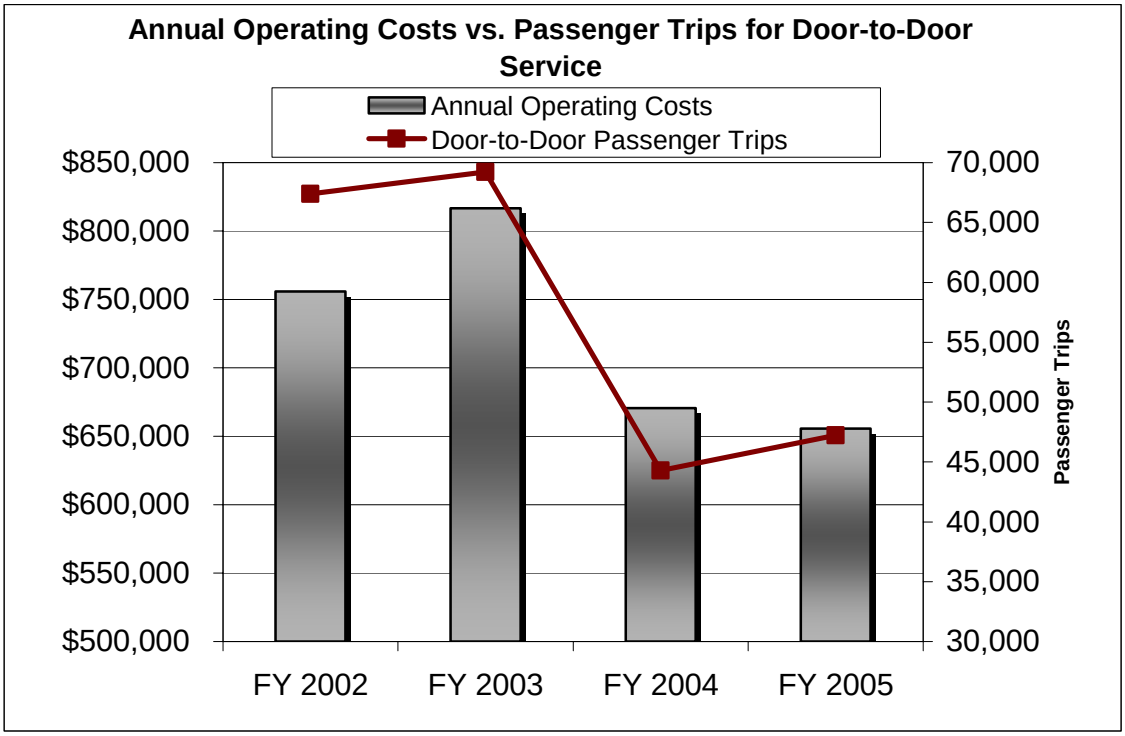


Figure 4-10. Annual Operating Costs vs. Passenger Trips for Door-to-Door Service (FY 2002–2005).

The number of passenger trips served decreased significantly from FY 2003 to FY 2004, and there was a corresponding decrease in annual operating costs. It is likely, however, that the significant decrease in both passenger trips and operating costs from 2003 to 2004 occurred for different reasons. ATM management explained that operating costs were decreased due to budget shortfalls in 2003. Passenger trips decreased due to significant issues with the phone reservation system when it was initially deployed in the fall of 2003 (the beginning of FY 2004). Therefore, the 17.9 percent decrease in operating cost from FY 2003 to FY 2004 cannot necessarily be attributed to increased efficiency from CTS. This decrease in operating costs has a direct correlation with the decrease in passenger trips over the same time period. From FY 2004 to FY2005, Figure 5-11 does show a slight decrease in operating costs

[15] Annual operating cost data provided by ATM.

[16] Note: the fiscal year for ATM is October 1st to September 30th; i.e., FY 2002 begins on October 1 of 2001 — all references to FY indicate this time period.

while passenger trips on the door-to-door service slightly increased. This indicates more passenger trips with a similar level of service, although the exact number of service hours for FY 2005 is not available. This small gain in efficiency for the door-to-door service is a positive sign, but the data is inconclusive in terms of showing whether the improvements employed in the CTS project had any significant effect on cost efficiency for the service.

The main driver of operational costs is the number of vehicle service hours recorded, and, intuitively, passenger trips decrease when the operator provides fewer service hours. Figure 4-11 compares the operational cost data just presented in Figure 4-10 to annual vehicle service hours for FY 2002 to FY 2005 (FY 2005 vehicle service hours data are not available).

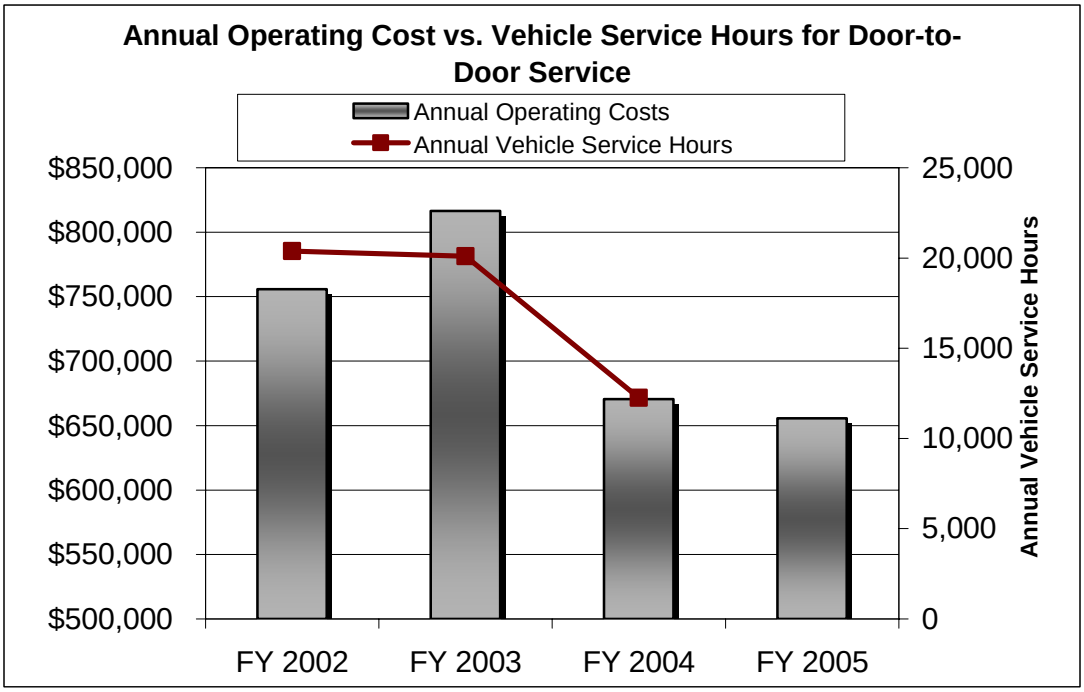


Figure 4-11. Annual Operating Cost vs. Vehicle Service Hours for Door-to-Door Service (FY 2002 – 2005)

There was a 39 percent decrease in annual vehicle service hours from FY 2003 to FY 2004. ATM management has indicated that this occurred mainly because of a service level adjustment in FY 2004 reacting to the significant decrease in demand for the service. The level of service within the City of South Lake Tahoe decreased from 36 vehicle-hours a day in FY 2003 to 12 vehicle-hours a day in FY 2004.[17] The similarity between cost values for FY 2004 and FY 2005 indicates that the door-to-door service recorded a comparable number of service hours in FY 2005 and FY 2004.

[17] "BlueGO Performance Review Study: Final Report," Tahoe Regional Planning Agency (2005). Prepared by LSC Transportation Consultants, Inc. Tahoe City, CA.

4.4.2.4 Operational Performance Data

Two measures are presented to assess operational performance: passenger trips per vehicle service hour and passenger trips per vehicle service mile.[18] Figures 4-12 and 4-13 present these two measures graphically by season for the door-to-door service from December 2000 to November 2004.

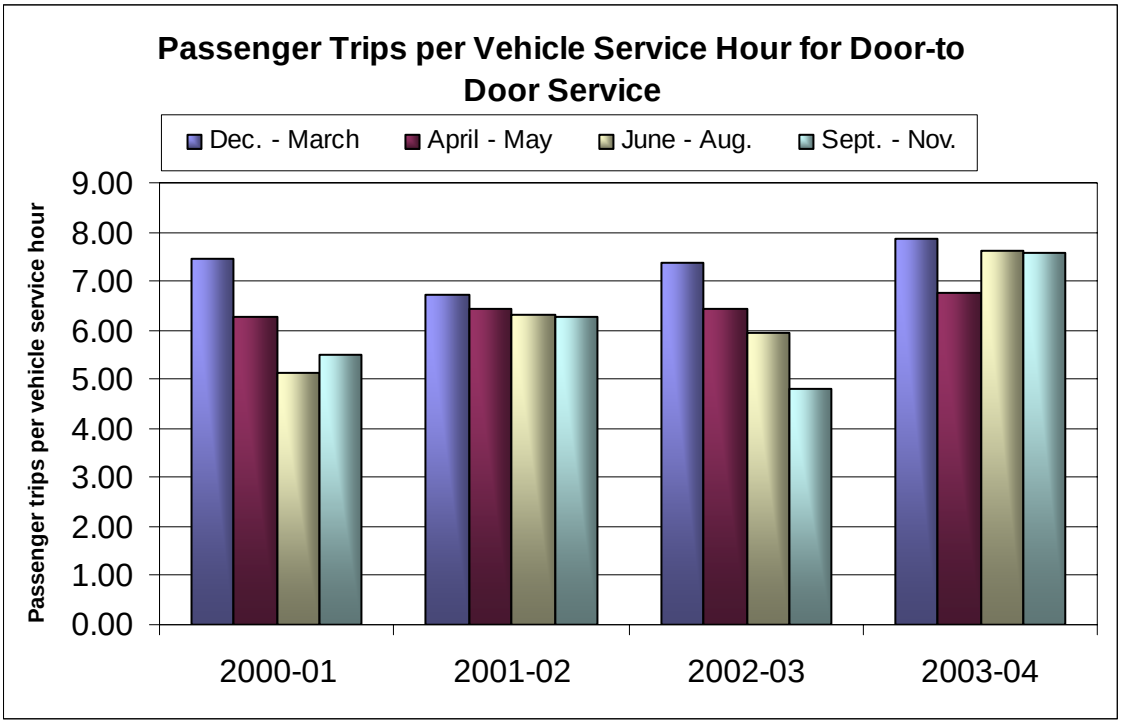


Figure 4-12. Passenger Trips per Hour of Vehicle Service for Door-to-Door Service.

Passenger trips per vehicle service hour have varied by season and by year. The winter season has been the highest of the four seasons in each of the 4 years studied. Figures 5-13 and 5-14 show that these two efficiency statistics are affected by the drop in ridership in FY 2003 that corresponded with the initial rollout of CTS technologies. This result is not surprising considering the decline in both vehicle service hours and passenger trips, and, in turn, vehicle service miles. The increase from 2002-03 to 2003-04 makes it appear promising that efficiency is improving. The average value for 2003-04 of 7.54 passenger trips per vehicle service hour represents a 20 percent increase over the 2002-03 average of 6.26. Due to the significant changes implemented by CTS that affected ridership, it is difficult to make conclusive statements about increases in efficiency; however, the data does suggest a positive trend after the initial drop in ridership in FY 2003. This improvement can likely be at least partially attributed to technological improvements implemented with the CTS project. Caveats to this assertion include resting the analysis on the time frame of only 1 year as well as the impact of the variety of factors that affect passenger trips.

[18] Data for these measures provided by "BlueGO Performance Review Study: Final Report." Prepared by LSC Transportation Consultants, Inc. Tahoe City, CA.

Conversely, it is clear that the traveling public needs time to adjust to changes in transit services, particularly when those changes include the addition of technology. It is also reasonable to expect lag time in creating efficiencies via the new technology while both the operator and the traveling public adjust to system changes.

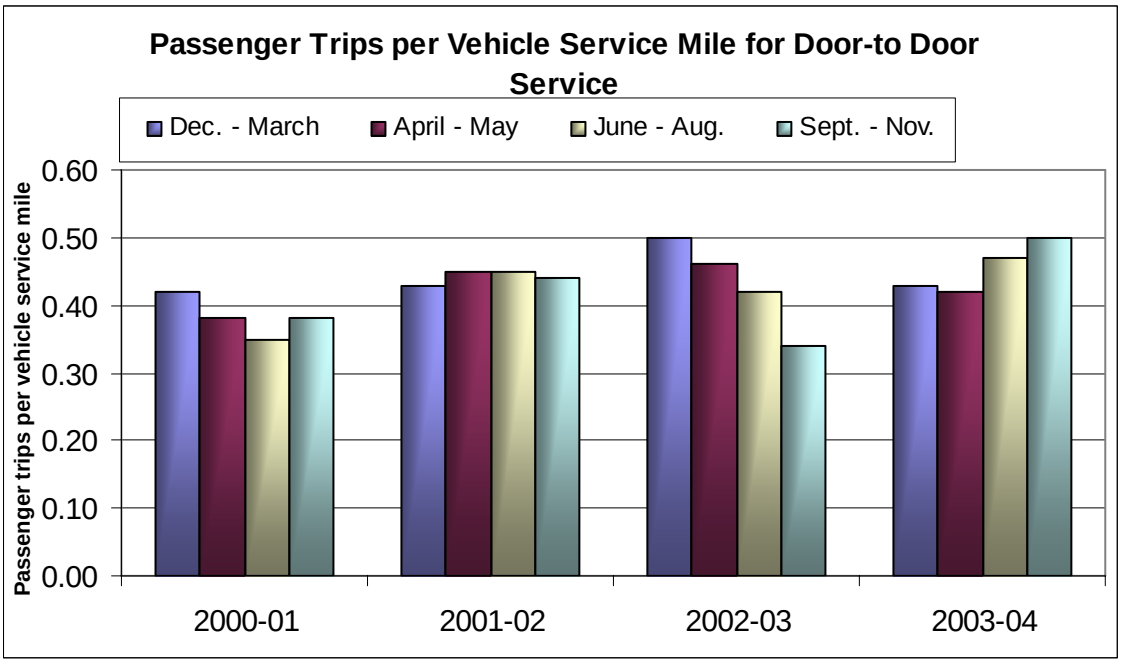


Figure 4-13. Passenger Trips per Vehicle Service Mile for Door-to-Door Service.

The passenger trips per vehicle service mile for the door-to-door service have been relatively stable over the 4 year period, with the exception of the decline in FY 2003 due to the drop in ridership. Because the door-to-door service is on demand, there is not a clear sense that a higher number passenger trips per mile of service is measuring "better" efficiency for that service. A higher value of this statistic would imply that more passengers are riding a vehicle simultaneously, which is one view of efficiency. However, because of the wide area of coverage for the service, multiple travelers on the same vehicle trip could mean a significantly lower level of service for passengers (i.e., as origins and destinations are farther apart, trips with multiple pick-ups and drop-offs are longer for passengers). Taking this into consideration, the fact that the door-to-door service is maintaining an acceptable level of efficiency reflects positively on the service and the changes implemented with CTS.

4.5 ANALYSIS OF OPERATOR PERCEPTION OF THE TECHNOLOGIES

One of the objectives of the evaluation was to determine the transit operators' perceptions of the system impacts. This section outlines the data collection approach taken to obtain transit operators' perceptions and presents the findings of the analysis.

4.5.1 Data Collection Approach

Although the evaluation team originally intended to obtain vehicle operator feedback either through focus groups or surveys, the team found that they were presented with an excellent opportunity to casually interview casino shuttle drivers while collecting the on-board passenger surveys. There was sufficient time to talk with drivers about the system during the "down-time" between pick-ups and drop-offs, and the evaluation team felt that this method of information-gathering was preferable as the drivers seemed very forthcoming, perhaps more so than if they had been asked the same questions during a formal interview, focus group, or survey. The evaluation team spoke with a total of 11 drivers (representing nearly all of the casino shuttle drivers) over the course of the four days of data collection in August 2004. Drivers were asked about how operations have changed as a result of the MDTs. Some drivers had formerly worked for the independent casino shuttles; these drivers were asked specifically about how operations have changed as a result of the consolidation. Drivers were also asked about their perceptions of efficiency gains as a result of the technology, and were asked about their perception of passengers' receptiveness to the change in service.

The evaluation team also talked informally with dispatchers and other transit managers throughout the evaluation to obtain their perceptions of the benefits and drawbacks of the technologies and the coordinated transit system.

4.5.2 Summary of Findings

The findings of the transit operator interviews are provided in Chapter 6 (Technology Lessons Learned).

4.6 ANALYSIS OF CUSTOMER SATISFACTION WITH TRANSIT SERVICE AND TECHNOLOGIES

It was hypothesized that the CTS project would lead to an improvement in customer satisfaction among riders due to increased operational efficiencies resulting from consolidation of transit services and addition of ITS technologies. This section outlines the data collection procedures undertaken to obtain customers' perceptions of transit service in South Lake Tahoe and presents the results of the customer satisfaction analysis.

4.6.1 Data Collection Approach

The evaluation team surveyed casino shuttle passengers before and after CTS deployment to obtain their perceptions of transit system efficiency and of other factors (e.g., reliability, wait time, and travel time) that would affect their satisfaction with the available transit services. The surveys asked respondents about the importance of, and their satisfaction with, various aspects of transit services in South Lake Tahoe. The surveys were designed to focus on those service elements that were expected to be most directly impacted by the CTS system implementation such as on-time performance, ease of requesting a ride, and availability of real-time status information.

The evaluation team collected baseline surveys in August 2002 and post-deployment surveys in August 2004 and March 2005. In the "before" case, passengers were

surveyed on-board fixed-route services (STAGE and Nifty 50 Trolley) and demand-response services (BusPlus and Park-n-Roll Casino Shuttles) in anticipation of deployment of the various technologies on these services. In the "after" case, however, passengers were only surveyed on-board BlueGO Casino Shuttles. This was because the other services were not impacted by any of the technologies that would either be apparent to passengers (e.g., kiosks, IVR) or have an affect on passengers' perceptions of the system.

The survey instruments used by the evaluation team for the results that are included in this report are provided in Appendix A. The survey instruments for surveys that were only collected in the baseline can be found in the Phase II Evaluation Report.[19]

The evaluation team worked with the project stakeholders to identify peak periods for data collection, and survey workers were assigned to each of the identified time periods. After being seated, boarded passengers were approached and asked if they would be willing to complete a short survey. Those who chose to participate returned the completed form to the survey worker before leaving the bus. Participants were not offered any incentives, and no category of respondent was targeted beyond the requirement that respondents be adults (18 years or older).

Although virtually all patrons asked to participate in the survey did so, the respondents were self-selected and therefore the results of the surveys, particularly the demographics, cannot be used to describe the population of riders as a whole.

4.6.2 Summary of Findings

A total of 211 passenger surveys were collected in the "before" case. The time periods and number of responses collected for each time period for the baseline data collection effort are shown in Table 4-2 below.

Table 4-2. Summary of "Before" Casino Shuttle Survey Data Collection and Responses

Service	Day	Date	Time	Collected Responses
Caesars Shuttle	Saturday	8/3/02	5 – 8 p.m.	58
Harrah's/Harveys Shuttle*	Monday	8/5/02	4 – 8 p.m.	104
	Tuesday	8/5/02	5 – 7 p.m.	49
Total				**211**

** Two time slots were allocated to Harrah's and Harveys as the two casinos merged just a few months prior to the baseline data collection.*

The evaluation team obtained 149 survey responses in August 2004 and 334 in March 2005 for a total of 483 "after" surveys. The data collection periods and number of surveys obtained are detailed in Table 4-3 below.

[19] *Tahoe Coordinated Transit System Final Phase II Report*, February 3, 2003. Prepared for the United States Department of Transportation ITS Joint Program Office.

Table 4-3. Summary of "After" Casino Shuttle Survey Data Collection and Responses

Location	Day	Date	Time	Collected Responses
BlueGO Casino Shuttle	Friday	8/13/04	1 – 9 p.m.	80
	Saturday	8/14/04	1 – 9 p.m.	55
	Sunday	8/15/04	11 a.m. – 2 p.m.	14
	Thursday	3/17/05	1 – 9 p.m.	104
	Friday	3/18/05	1 – 9 p.m.	107
	Saturday	3/19/05	1 – 9 p.m.	103
	Sunday	3/20/05	11 a.m. – 2 p.m.	20
Total				**483**

It should be noted that post-CTS surveys were collected in March 2005 only after the evaluation team obtained fewer surveys than anticipated during the planned data collection period (August 2004). The unexpected benefit to this was that the team had the opportunity to determine whether or not winter visitors had significantly different opinions about transit services when compared to summer visitors (for example, buses sometimes run slower during inclement weather, so it might be expected that winter visitors would have a less favorable opinion of the service). After comparing the responses from the two different data sets, however, the team found that the two groups did not vary significantly in their responses to most questions. The following sections present the findings of the survey analysis. For all questions, the August 2004 and March 2005 responses are combined to simplify the presentation of the results; however, for any questions that did reveal a difference between the two groups of visitors, that difference is noted and explained.

In general, customers appear to be as satisfied with the casino shuttle service as they were with the independent casino shuttles that operated pre-CTS. Customers are generally satisfied with the operation of the service (wait time, travel time, and number of stops to pick up and drop off other passengers) as well as with the cost of the service and the trip-booking technologies.

4.6.3 Detailed Findings

4.6.3.1 Respondent Demographics and Rider Characteristics

In terms of demographics, respondents were asked to provide their age and gender as well as to indicate whether they are residents or visitors to the area. Respondents were also requested to indicate their trip purpose and the extent of their experience with the casino shuttle. A comparison of the demographics of the baseline and post-CTS surveys are provided here.

As shown in Figure 4-14, the age distribution of the samples was similar before and after, with the primary difference being that the post-CTS respondents represented a slightly younger group of people. There was a smaller proportion of respondents in the "36-55" category (approximately 10 percent less) and a larger proportion of respondents in the "21-35" category (approximately 10 percent more). When

comparing August 2002 to August 2004, however, the age distribution of the respondents is nearly the same. This indicates that winter visitors as a whole are somewhat younger than summer visitors.

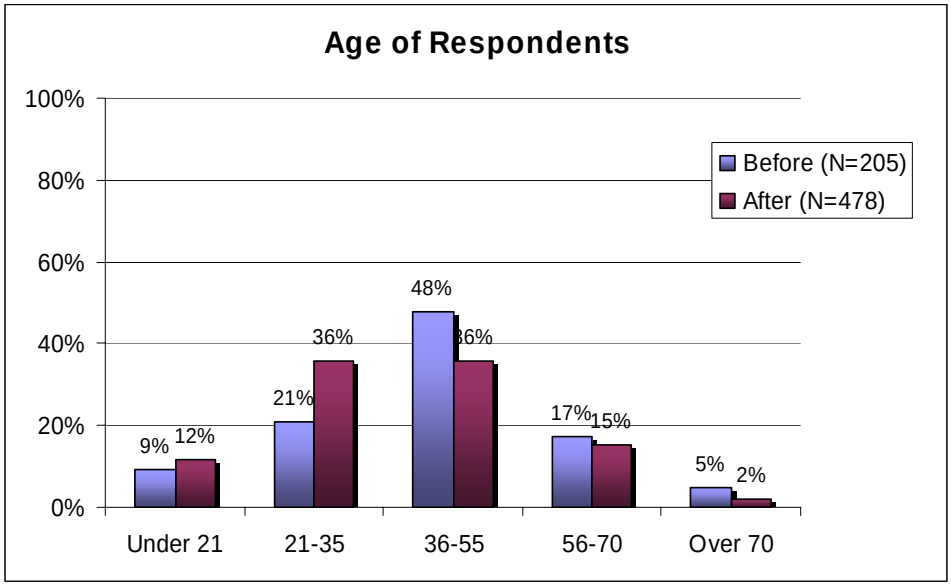


Figure 4-14. Age of Respondents (Before and After).

As shown in Figure 4-15, there was nearly a 50 / 50 gender split in respondents to the baseline and post-CTS surveys. It can be seen that there was a slightly higher percentage of females responding to the baseline survey; however, the interview team for the baseline surveys noted that in many cases, when couples were traveling together, only one individual responded to the questionnaire, and, more often than not, it was the female.

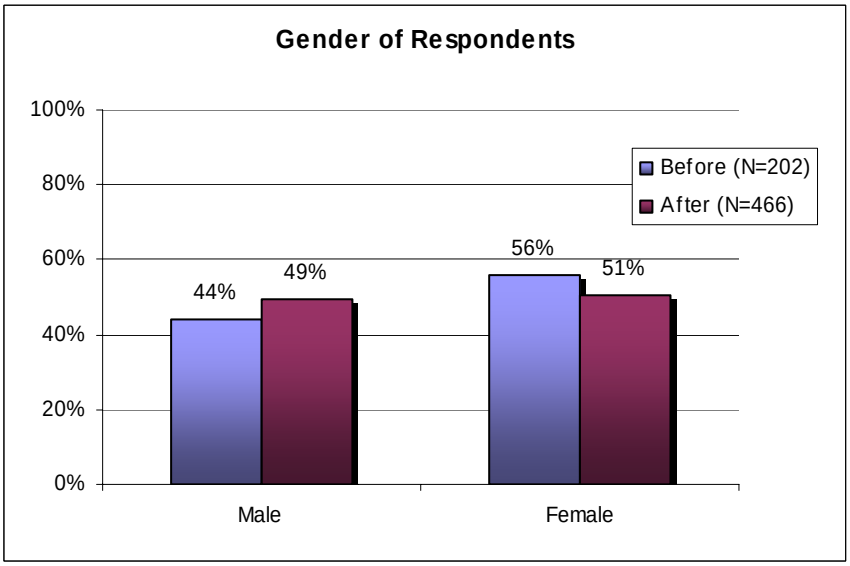


Figure 4-15. Gender of Respondents (Before and After).

In order to determine if respondents are residents or tourists, and in order to gauge the respondents' level of exposure to the casino shuttle and to the Tahoe area in general (because many tourists return on a very regular basis), respondents were asked: "Which of the following best describes the time you spend in South Lake Tahoe?"

Nearly all of the respondents were visitors to the area. As shown in Figure 4-16, approximately 97 percent of the baseline respondents and approximately 79 percent of the post-CTS respondents were visitors. At first glance, it appeared notable that there was a significant increase in those who reported that they were visiting South Lake Tahoe for the first time (from 18 to 32 percent). However, a closer look revealed that there was a greater number of the winter respondents (March 2005) who reported being "first-time visitors" (i.e., when comparing August 2002 and August 2004 respondents, the percent reporting that they were visiting for the first time was nearly identical). Therefore, although data is not available to substantiate this claim, it seems likely that the difference is due to the fact that there are more first-time visitors to South Lake Tahoe during the winter months.

Also of note is that there was an increase in the number of full-time residents on the service (13 percent of those surveyed post-CTS were full-time residents while only 2 percent were in the baseline). This is interesting as the casino shuttle does not serve residential areas of South Lake Tahoe. A possible explanation for the increase is that many transit-dependent residents prefer the casino shuttle over the door-to-door service due to the cost of the service ($1 per trip versus $3 per trip). These locals may have been less inclined to ride the independent casino shuttles that existed pre-CTS as many of these individuals are employed by the casinos and therefore may have viewed riding their free employer-operated shuttle as a clear misuse of the service.

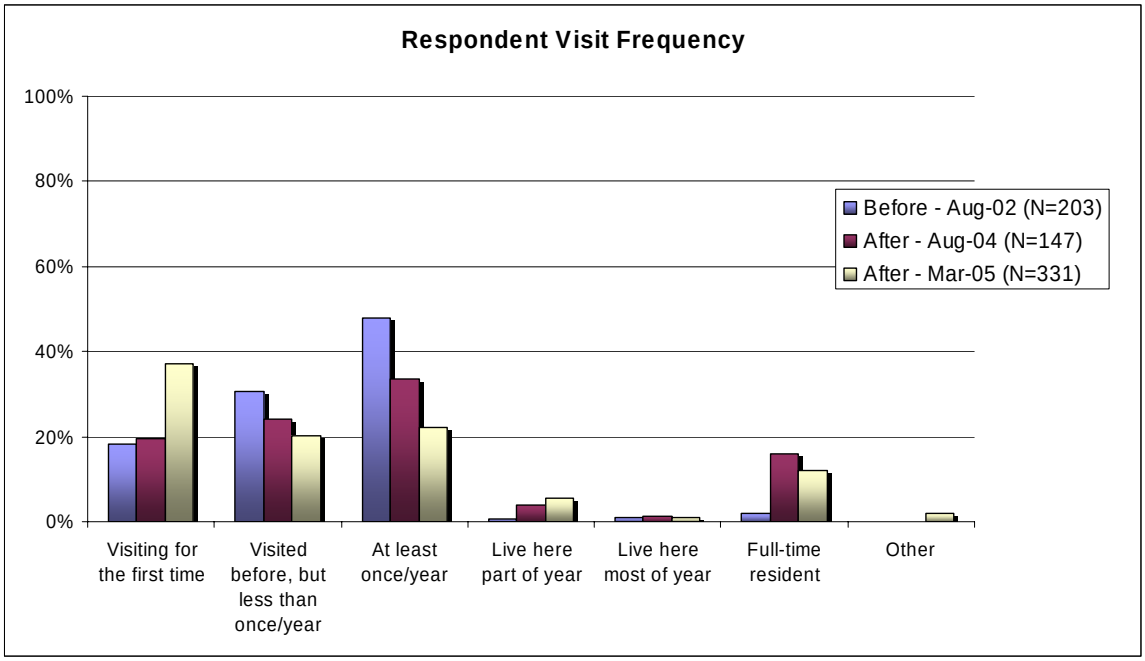
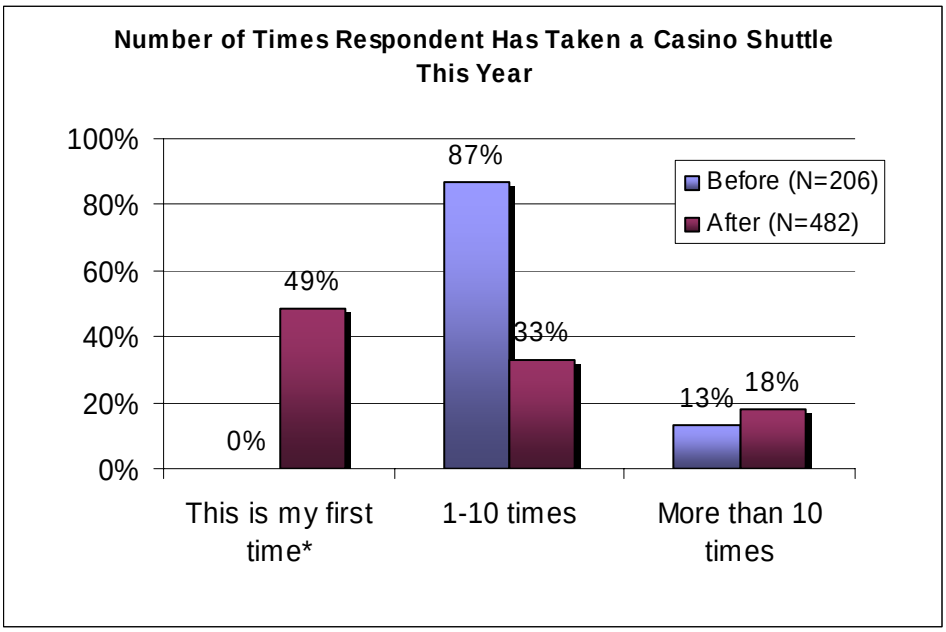


Figure 4-16. Respondent Visit Frequency (Before and After).

In order to gauge if riders were returning to the casino shuttle after trying the service for the first time, respondents were asked, "How many times would you estimate that you have taken a BlueGO Casino shuttle this year?" Respondents in the baseline were not given the choice "this is my first time," so it is likely that many of the respondents reporting '1-10 times' in the baseline were actually riding the service for the first time.



*Note that this response choice was not provided on the baseline survey.

Figure 4-17. Number of Times Respondents Have Taken a Casino Shuttle This Year (Before and After).

Respondents were also asked, "Do you currently have access to a personal automobile here in South Lake Tahoe?" As shown in Figure 4-18, the percent of respondents reporting that they have a car while in Tahoe dropped from 91 percent to 70 percent. When focusing on only the responses of visitors, the percent reporting that they have access to a car dropped from 91 percent[20] to 56 percent. When it came to this question, there was quite a difference between the August 2004 and March 2005 responses. While 91 percent of visitors reported having access to a car pre-CTS, this figure decreased to 80 percent of August respondents, and to only 46 percent of March respondents. This indicates that fewer winter visitors have access to a car while in Tahoe, which is logical in that the evaluation team heard from many riders that the inclement winter weather makes transit more appealing. With that said, the fact that the percent of respondents having access to a car dropped from 91 to 80 percent from August 2002 to August 2004 bodes well for the stakeholders' goal of increasing the number of visitors who leave their car at home.

[20] Note that this percent is the same as the previous baseline figure as residents were not asked this question on the baseline survey.

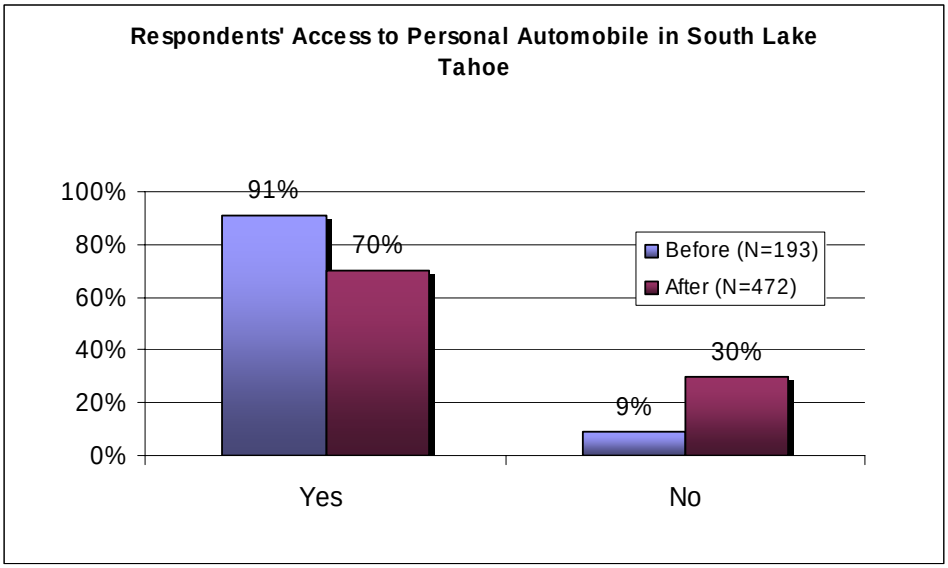


Figure 4-18. Reported Access to a Personal Automobile in South Lake Tahoe (Before and After).

4.6.3.2 Overall Impression of Transit Services in South Lake Tahoe

All survey respondents were asked to rate their "overall impression of transit services available in the South Lake Tahoe area." Although opinions did not change, there was not much room for improvement as most baseline respondents indicated a "positive" or "very positive" impression. Overall, a high percentage of baseline and post-CTS respondents (89 percent and 81 percent, respectively) indicated a "positive" or "very positive" impression.

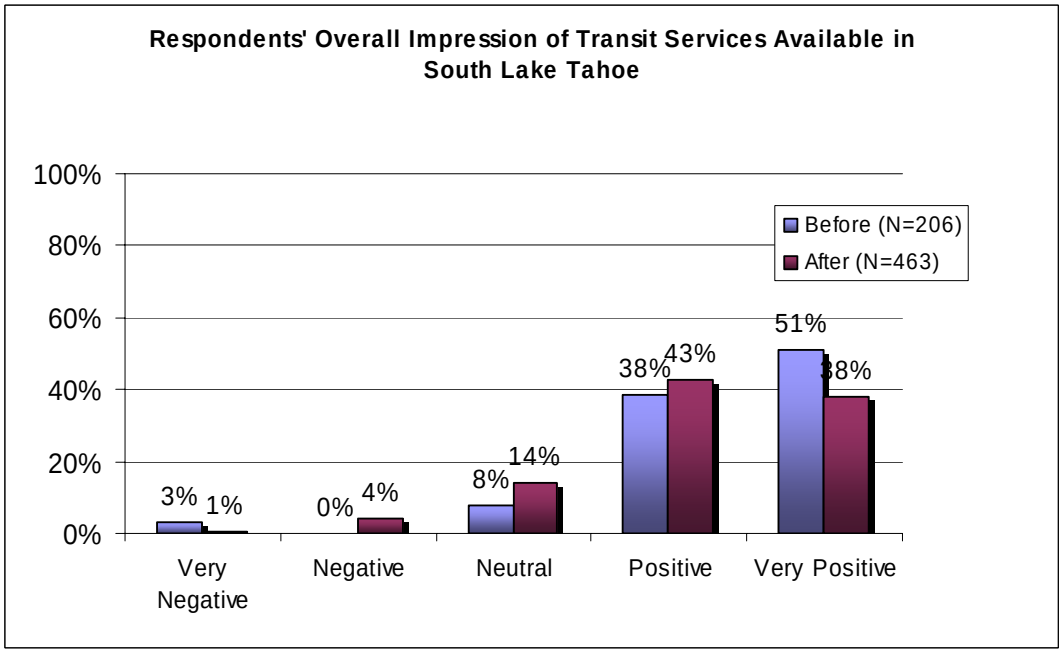


Figure 4-19. Reported Overall Impression of Transit Services Available in South Lake Tahoe (Before and After).

4.6.3.3 Customer Satisfaction with Technologies

On the post-CTS surveys, respondents were asked, “Have you ever used the phone in an attempt to schedule a trip on a BlueGO Casino shuttle?” and ”Have you ever used a touch-screen computer kiosk in an attempt to schedule a trip on a BlueGO Casino shuttle?” As shown in Figure 4-20, over half of the respondents (57 percent) indicated that they had used a phone to schedule a trip, while only 33 percent indicated that they had used a kiosk. Interestingly enough, out of the 476 respondents who answered both questions, 23 percent reported that they had used both a kiosk and a phone to reserve a trip. Surprisingly, age did not play a factor in phone and kiosk use (i.e., the age distribution among both those reporting having used a phone to reserve a trip and those reporting having used a kiosk to reserve a trip was very similar to the age distribution of the entire population surveyed).

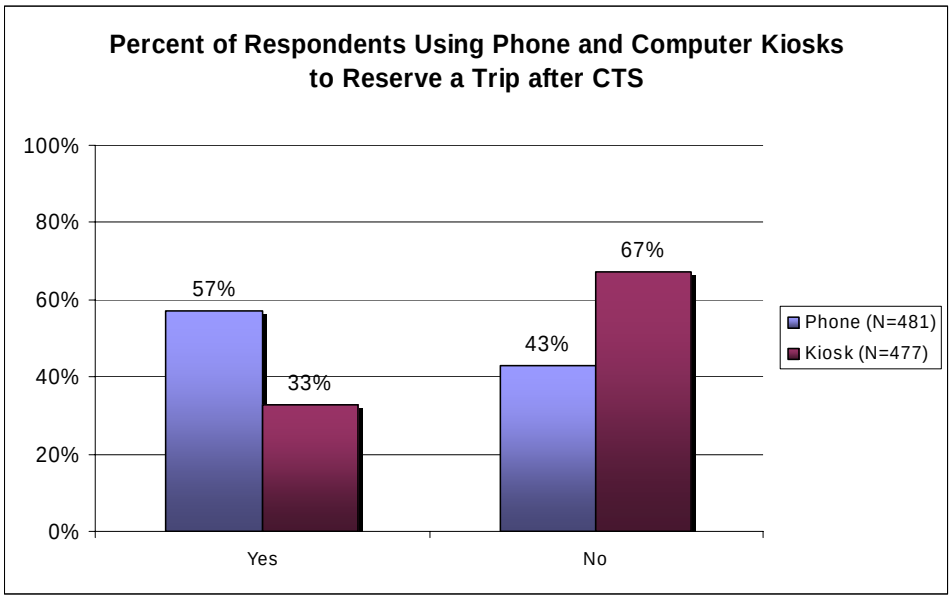


Figure 4-20. Percent of Respondents Using Phone and Computer Kiosks to Reserve a Trip (After).

Respondents were then asked to indicate why they had not used the phone or kiosk to reserve a trip. Surprisingly, approximately one-third of respondents (28 percent of those referring to the phone and 34 percent of those referring to the kiosk) stated that they were not aware of that option for trip-booking. While conducting the on-board surveys, the evaluation team noted that many riders never needed to request a trip as another rider had already done so, or as the shuttle was already waiting at their pick-up location when they arrived. Therefore, it was expected that many people would simply report that they did not need to request a trip. Although none did, it is possible that this was the case for some of the individuals who chose ‘other’ but did not provide a reason for not using the phone or kiosk. Of those who reported ‘other’ for why they did not use the kiosk, about one-third indicated that they saw the kiosk, but chose to use the phone instead.

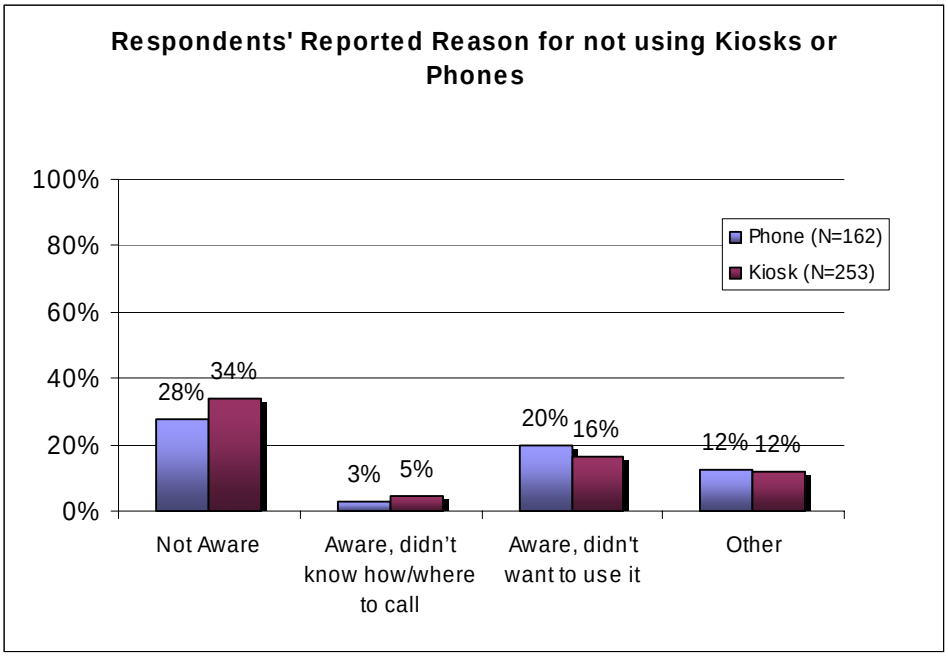


Figure 4-21. Reasons for Not Using Kiosks or Phones to Reserve a Trip (After).

Respondents who reported using the phone were asked, "Based on your experience reserving a trip by phone, how satisfied are you with… the ease of scheduling a trip by phone?" Similarly, respondents who reported using the kiosk were asked this question regarding the kiosk. A similar question was asked on the baseline survey and the results are provided in Figure 4-22 along with the responses to the question on the post-CTS survey.

The most notable change was that although almost no respondents to the baseline survey reported being "not satisfied" or "not at all satisfied" with the ease of scheduling a trip (only 2 percent), 13 percent responded this way to the post-CTS survey when asked about the ease of scheduling a trip by phone and 22 percent responded this way when asked about the ease of scheduling a trip using the kiosk. With that said, the overwhelming majority reported being "satisfied" or "very satisfied" with the ease of scheduling a trip post-CTS (78 percent for those booking by phone and 67 percent for those booking via a kiosk).

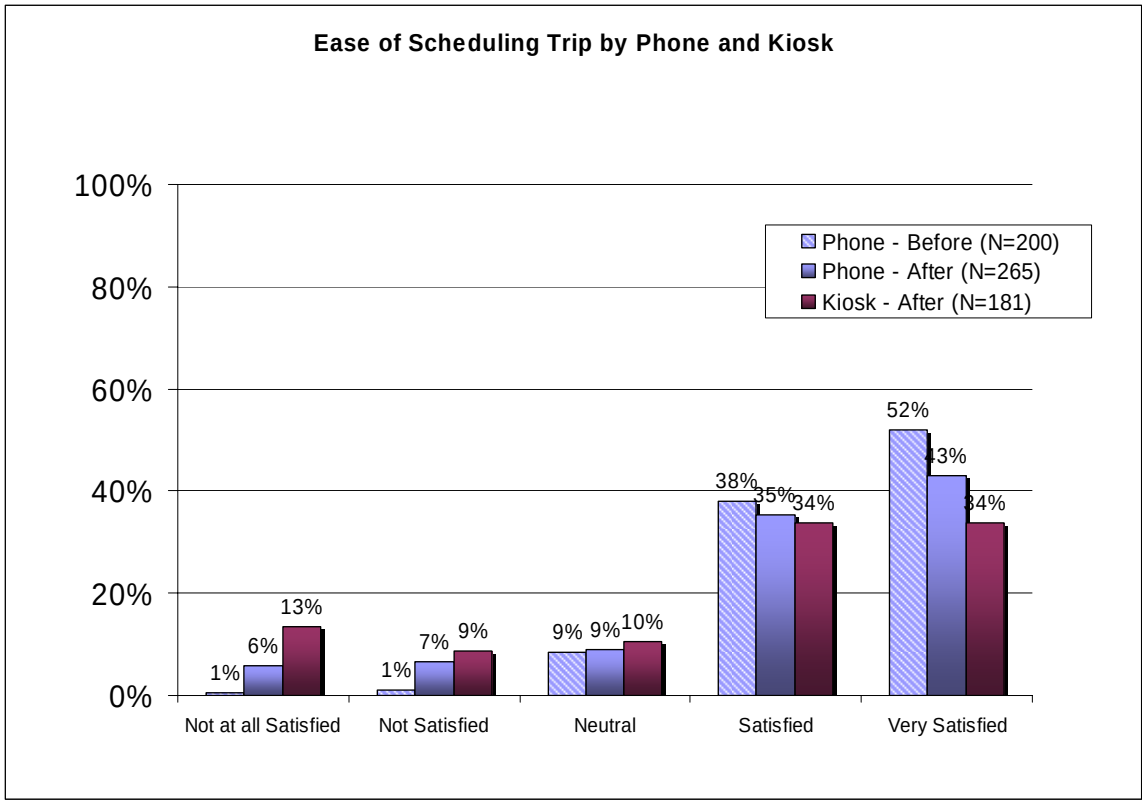


Figure 4-22. Reported Ease of Scheduling a Trip by Phone and Kiosk (After).

Respondents were then asked about their satisfaction with, "… the information received about expected wait time" from the phone and kiosk. As shown in Figure 4-23, respondents had mixed feelings about this, and the opinions do not vary much between phone and kiosk. This is somewhat logical since the wait-time information provided to the patron is generated from the CAD system in either case; however, those patrons using the phone would have talked with a dispatcher who could have provided additional qualitative information about the current traffic conditions or about how busy they are at the moment. Therefore it is not surprising that respondents getting their information over the phone were somewhat more satisfied with the information they received about the wait time as compared with those who received their information via a kiosk (72 percent receiving information by phone were "satisfied" or "very satisfied," while only 62 percent receiving information through the kiosk were "satisfied" or "very satisfied").

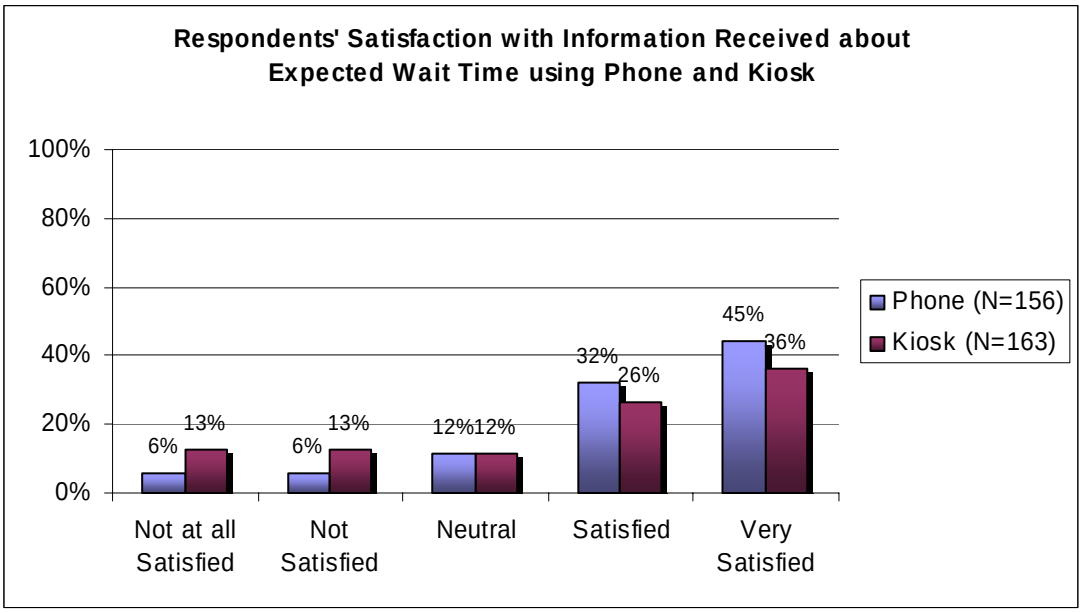


Figure 4-23. Reported Satisfaction with Information Received about Expected Wait Time Received from Phone and Kiosk.

4.6.3.4 Customer Satisfaction with Casino Shuttle Service

Respondents on the post-CTS survey were asked to rate, on a scale of 1 to 5, in general, how satisfied they are with several aspects of the BlueGO Casino Shuttle service. First, respondents were asked if they were satisfied with the availability of information about the service. A similar question was asked on the baseline survey and a comparison is provided in Figure 4-24. The biggest shift that occurred was that less people reported being “very satisfied” with the availability of information and more people reported being ”neutral.”

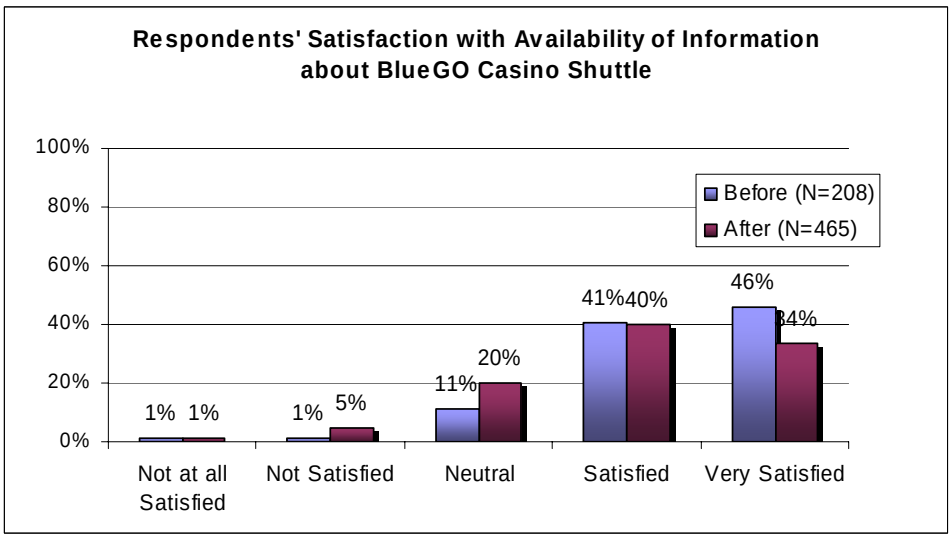


Figure 4-24. Reported Satisfaction with Availability of Information about BlueGO Casino Shuttle.

Similarly, respondents were asked to rate how satisfied they are with the number of stops to pick up and drop off other passengers during the trip. A similar question was asked on the baseline survey and a comparison is provided in Figure 4-25 below. The responses were almost identical between before and after with the majority of respondents reporting that they are either “satisfied” or ”very satisfied” (83 percent of the baseline respondents and 80 percent of the post-CTS respondents). This reflects positively on the combined services as the shuttle now serves multiple casinos and the number of stops could conceivably be the most significant complaint among riders.

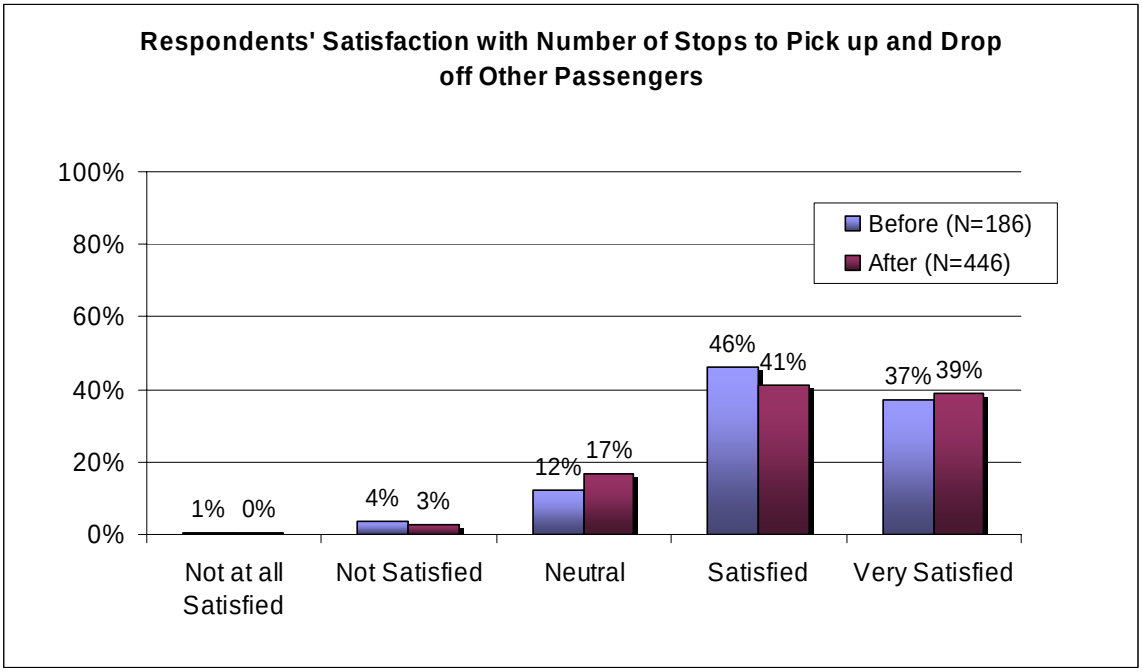


Figure 4-25. Reported Satisfaction with Number of Stops to Pick Up and Drop Off Other Passengers.

Respondents were then asked to rate their level of satisfaction with various aspects of the BlueGo Casino Shuttle service including the *time spent waiting for a shuttle*, the *cost of the trip*, the *total travel time*, and the *overall service*. As can be seen in Figure 4-26, respondents reported a high level of satisfaction with all of these aspects of the service. *Time spent waiting for a shuttle* is the one aspect where respondents showed some dissatisfaction (9 percent reported being either ”not satisfied” or ”not at all satisfied” with the wait time). Considering the fact that the service now costs $1 per trip (and was previously free), some of the project stakeholders were concerned that riders would not be satisfied with the cost of the service. However, surprisingly enough, cost came out as the factor for which respondents reported the highest level of satisfaction (59 percent reported being “very satisfied”).

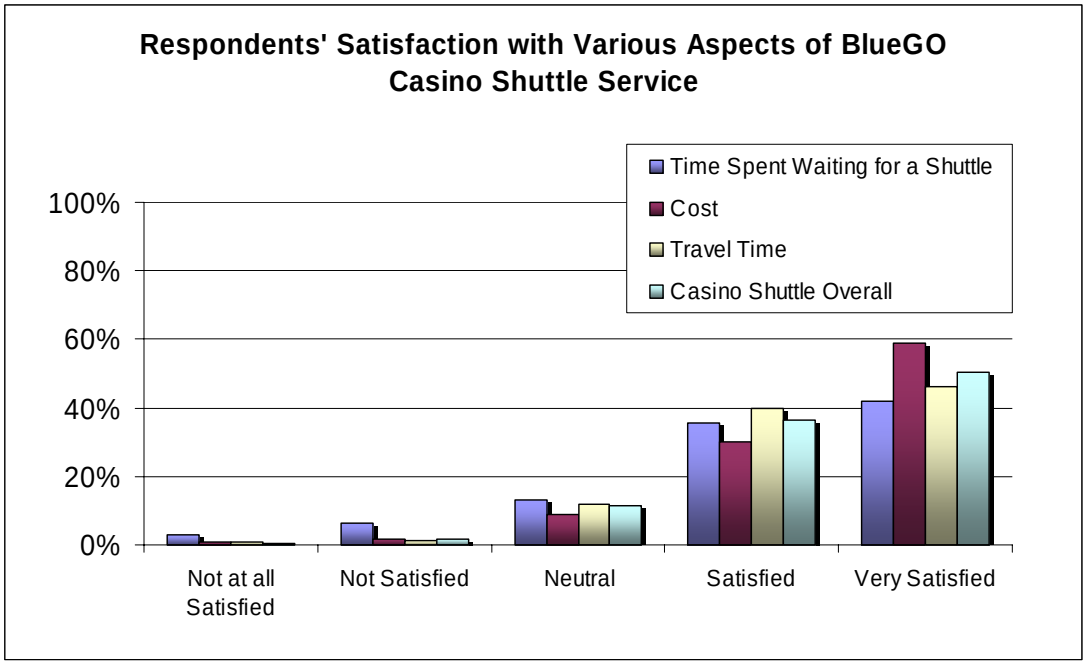


Figure 4-26. Reported Satisfaction with Various Aspects of BlueGO Casino Shuttle Service.

Respondents were also asked, "How much time did you spend waiting for THIS shuttle as compared to how long you expected to wait?" As shown in Figure 4-27, there was quite a bit of variability in the responses to this question. This is not surprising considering that the wait-time does vary quite a bit depending on the time of day and the weather conditions. Just over half of respondents (58 percent) reported being that the wait time was "significantly less time" or "somewhat less time" than expected, and about one-fourth (28 percent) reported that the wait time was what they expected. Interestingly enough, 37 percent of those who reported that the wait time was what they expected were using the service for the first time.

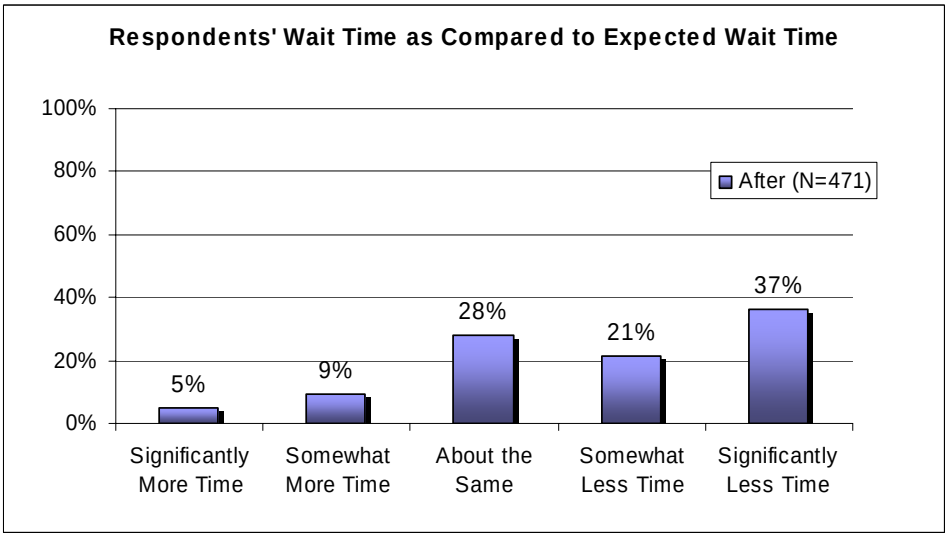


Figure 4-27. Actual Wait Time as Compared to Expected Wait Time.

4.6.3.5 Comparison of BlueGO Casino Shuttle to Individual Park-n-Roll Shuttles

Respondents were asked if they had used any of the individual casino shuttles (Park-n-Roll) before the services were merged. The question read, "Several casinos in South Lake Tahoe (e.g., Caesars, Harrah's, Harveys) used to provide their own independent shuttle services. In October of 2003, these shuttle services were merged into the BlueGO Casino shuttle service. Did you use any of the individual casino shuttles before the services were merged?" Sixty-five percent of respondents indicated that they had used one of the individual casino shuttles.

These respondents were subsequently asked, "Overall, how would you rate the BlueGO Casino shuttle service as compared to the individual casino shuttle services?" As shown in Figure 4-28, the majority of respondents felt that the service was at least as good as the previous service (85 to 88 percent of respondents reported that the service was "about the same as before" or better).

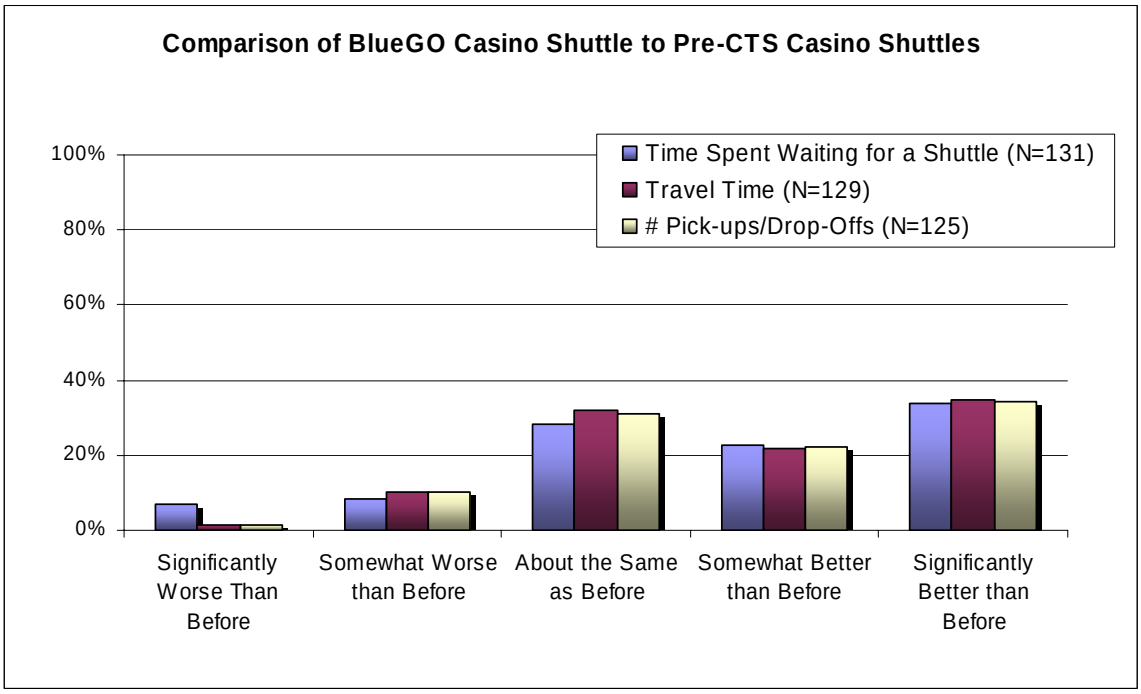
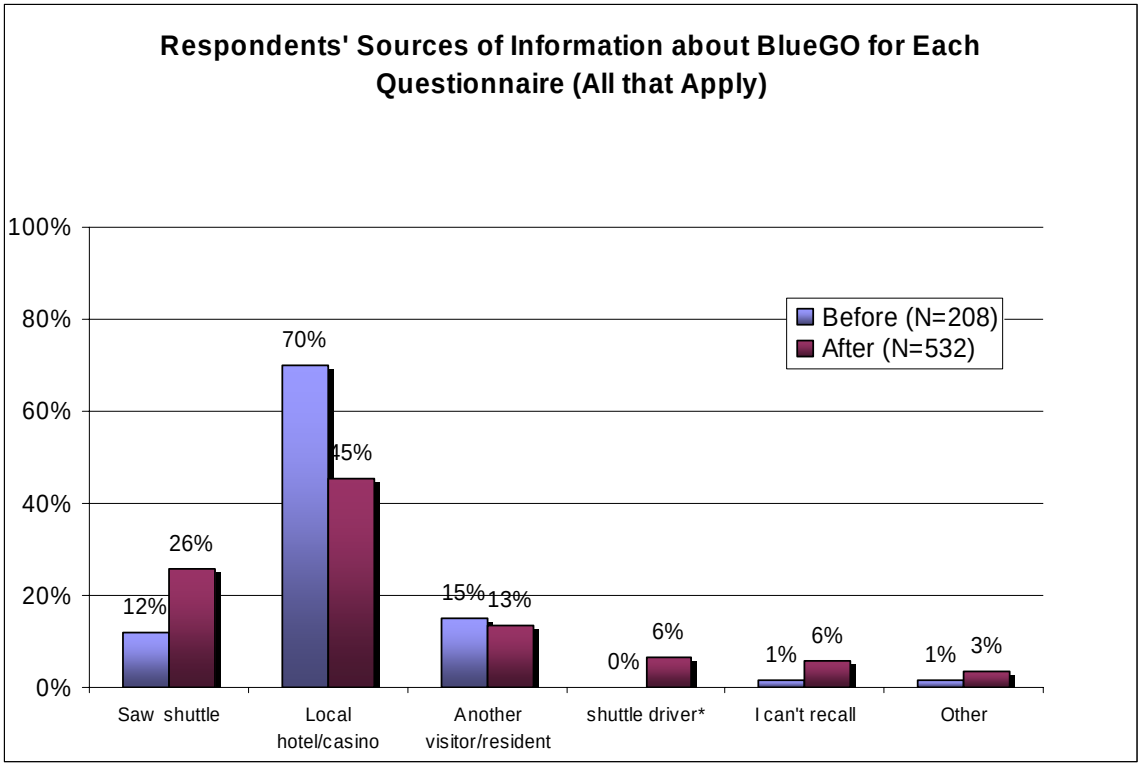


Figure 4-28. How BlueGo Casino Shuttle Compares to Pre-CTS Casino Shuttle Services.

4.6.3.6 Transit System Awareness

Respondents were asked, "What were your sources of information about the BlueGO Casino shuttle service before using it for the first time?" A similar question was asked on the baseline survey, and 70 percent of respondents reported finding out about the service from a hotel or casino. This is critical as it points to the fact that in such a tourist-driven area as South Lake Tahoe, the hotel staff can really play a key role in helping inform visitors about the service (or conversely, in discouraging visitors from using the service). On the post-CTS survey, this number dropped to only 45 percent of respondents reporting having learned about the service from a local hotel or casino. Twenty-six percent of respondents reported simply seeing a shuttle, and 13 percent reported asking a driver about the service. The fact that over one-quarter of the respondents reported seeing a shuttle post-CTS (as compared with only 12 percent before), can likely be attributed to the BlueGO "brand" (i.e., even if there were the same number of shuttles circulating pre-CTS, each shuttle would have had a different brand so customers may not have recognized them as easily or they may have seen a shuttle bus for a particular casino that they are not interested in visiting, whereas now they would see a generic "BlueGO" shuttle).



* "Shuttle driver" was not a response choice provided on the baseline survey. The evaluation team added this response choice on the post-CTS survey as drivers reported that patrons often ask them about the service when they are at a casino picking up or dropping off riders.

Figure 4-29. How Respondents First Learned about Casino Shuttle (Before and After).

5 FINDINGS FROM INSTITUTIONAL ISSUES REVIEW

The CTS project has a long history. Although discussions among numerous private and public sector stakeholders in the Lake Tahoe area have been ongoing for more than 10 years, the more defined CTS project concept was conceived in 1994/95. Funding alternatives were explored in 1996, resulting in the two Federal grants that formed the bulk of the capital funding for the CTS project. Stakeholder discussions to define the CTS Operating Plan began in earnest in 1996, resulting in publication of that plan and signing of a CTS Participation Agreement in 1998. It took another year to select and negotiate with a lead systems integrator who was engaged in that role in July 1999. At that time, the project schedule called for a two-phase development process, with Phase I (system design and planning) to be completed by April 2000, and Phase II (system implementation) to be completed by April 2001.

The project experienced a change in systems integrator in 2002, and around that time day-to-day CTS project management responsibilities moved from the South Shore Transportation Management Association to the Tahoe Regional Planning Agency. Another significant change occurred in October 2002 when the Lake Tahoe Gaming Alliance withdrew from its lead role in the project. The Gaming Alliance representative had been a strong voice for maintaining the autonomy of the casino operations and, as a group, the stakeholders had been unable to come to an agreement to move ahead with implementation. It appears that this change in roles for one organization was pivotal in terms of getting the project implemented.

Between November 2002 and November 2003, the CTS Management Company (MCO) Board was organized. This board consists of individuals representing the various public and private stakeholders. The purpose of the board was to provide oversight with management authority by committee to make decisions on various aspects of the ongoing CTS implementation process. Although the original plans called for an Executive Director to facilitate this function, there was not enough available funding to allow for this convention. One of the private sector stakeholders, a property owner, was elected to act as the CTS MCO Board Chairperson to provide general oversight in assisting the Board's action as a whole.

5.1 APPROACH

The evaluation team conducted three sets of formal interviews with project stakeholders throughout the course of the evaluation. The team conducted the first round of interviews in person in May 2002 in conjunction with evaluation plan coordination meetings between the evaluation team and the CTS project stakeholders. The goal of this first set of interviews was to identify any significant institutional issues and lessons learned over the course of the planning of CTS. These discussions identified several institutional challenges facing the project stakeholders and were documented in the Phase II Evaluation Report.[21]

[21] *Tahoe Coordinated Transit System Final Phase II Report*, February 3, 2003. Prepared for the U.S. Department of Transportation ITS Joint Program Office.

The evaluation team interviewed representatives of the following stakeholders individually on May 8 and 9, 2002:

- The Lake Tahoe Gaming Alliance.
- Douglas County.
- Area Transit Management, Inc. (ATM).
- Heavenly Ski Resort.

The discussion guide for these pre-deployment interviews included the following questions:

- What motivated your organization to become involved in the CTS project?
- What aspects of the project will influence your organization's continued involvement in CTS?
- What are your attitudes about the “first-drop algorithm”?
- At this stage of the project, what "lessons learned" can you offer to help in future projects of this nature?

Additionally, on May 9, 2002, four stakeholder representatives met as a group with the evaluation team to discuss the evaluation and lessons learned to date. This group included the following stakeholders:

- Tahoe Regional Planning Agency (TRPA).
- Tahoe Transportation District (TTD).
- Area Transit Management, Inc. (ATM).
- South Shore Transportation Management Association (SSTMA).

Not all stakeholders invited to discuss institutional issues were available to participate. Therefore the results of these interviews, again, although of great interest to the evaluation team, cannot be said to represent the opinions of the stakeholder population as a whole.

In February 2004, the evaluation team conducted a second round of interviews with project stakeholders, this time with select public and private sector members of the CTS MCO Board,[22] representatives from TRPA, and representatives from ATM. The goal of this second round of interviews was to capture the public and private stakeholders’ initial reactions to the preliminary project deployment, which had occurred a few months before, in October 2003.

For the second round of interviews, the evaluation team used the following questions to guide the interview:

- What has been your organization’s role in the planning, design, and implementation of the CTS?

[22] The Evaluation Team interviewed CTS MCO Board Members that were identified and recommended by TRPA.

- What has been your personal role in the project? At what point in the process did you personally become involved with the project?
- What has been your organization's objective in participating in the CTS project?
- What specific benefits did your organization expect when it decided to participate in the Project? Have those expectations of benefits changed since the project started?
- What would constitute a "success" from your organization's point of view?
- Using a scale of 1 (poor) to 5 (excellent), how would you rate the success of this project as a whole at this point in time?
- What have been the most significant challenges associated with the planning and implementation of CTS? Which impacted the project the most?
- What aspects of the planning and implementation of CTS worked well? What aspects didn't?
- Now that CTS is operational, how well does it match up to the original vision?
- What advice would you pass on to others wanting to implement a similar system?
- Are there any other "lessons learned" you would like to share?

In October 2005 the evaluation team conducted a final round of interviews with the same group interviewed 20 months prior in order to document how each of the previously identified challenges were overcome and to identify any other lessons learned that the project stakeholders wanted to share. Several events occurred that warranted a final round of interviews before the completion of this evaluation. First, the complexity of the initial kiosk interface caused their usage to be significantly less than expected. Second, problems with the automated phone reservation system delayed and eventually prevented its implementation. Third, two separate casino property mergers changed the organization of the MCO Board stakeholders. The mergers also altered the merged casino properties' perceptions of their obligations to the effort. The second round of interviews took place in the midst of a challenging time for the board. Since that time, the board members' relationships have improved and ridership has increased.

The evaluation team used the same interview questions that were used during the second round of interviews to guide this final round. The evaluation team had several objectives for the stakeholder interviews:

- Assess the impact of the institutional environment on the development, implementation, and operation of CTS services.
- Document the progress of the project concerning the challenges faced by the CTS MCO Board during the initial phases of implementation.
- Document lessons learned from stakeholders concerning the application of ITS technology to public transit services.

5.2 FINDINGS

Four major topics emerged from the interview process as areas of emphasis for the CTS stakeholders:

- Capital and operational funding.
- Implementation of technology.
- The public/private partnership.
- Issues regarding operation of the system.

The following sections detail the information gathered from the interview process. The findings are categorized into the four main topics mentioned above.

5.2.1 Funding

A topic discussed unanimously by stakeholders during interviews was securing funding for the project. Most stakeholders mentioned both operational and capital costs for the project, and interviews revealed a greater emphasis on operational funding, as this has been the larger challenge for the stakeholder group.

5.2.1.1 Capital Funding via SAFETEA-LU

The Tahoe area has been successful in securing Federal funding for capital expenses associated with the CTS project. CTS received funding for BlueGO vehicle replacement in the recent SAFETEA-LU legislation.[23] Local match funding was obtained through a joint effort from several different organizations: TRPA, the Transportation and Water Quality Coalition, the League to Save Lake Tahoe, the Gaming Alliance, the North Tahoe Lake Association, and the Forestry Service. These groups worked collectively to present a unified request for Federal funding in the region.

5.2.1.2 Understanding the Application Process for Federal Transit Funding

One stakeholder emphasized that the stakeholder group lacked experience with the Federal transportation appropriation process. This lack of experience with the process increased the time and effort necessary to obtain Federal funding for the project. As a result, the stakeholder group has not mirrored successes achieved for CTS capital spending on the operational side. Currently, the Tahoe region is not classified as an urbanized area by the US Census Bureau. The region does not meet the population density requirements defined in the 2000 Census for an urbanized area or urban cluster. By census definitions, the South Lake Tahoe area is designated as rural. This designation severely limits the ability of the CTS stakeholders to obtain Federal funds for operating expenses.[24] The majority of operational funding comes from California

[23] "Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users," 109th Congress (2005). Public Law 109-59.

[24] "Qualifying Urban Areas for Census 2000; Notice," US Department of Transportation, Federal Transit Administration (2002). Retrieved on November 23, 2005, from http://www.fta.dot.gov/legal/federal_register/2002/278_1486_ENG_HTML.htm.

and Nevada State funding, contributions of the casino properties, and fare income from the system.

When discussing the future of CTS, multiple stakeholders emphasized the desire to expand the system. Several interviewees indicated that they favored increased service levels on both the casino shuttle and the Fixed Route services. Goals for an expanded service include reducing headways to decrease waiting time for riders. The major limitation on expanding CTS services is the lack of the necessary operational funding.

5.2.1.3 Local Taxes

Several stakeholders interviewed identified a local tax as a source of permanent operational funding. The tax could be an increase on the existing hotel room or skiing lift ticket taxes. Residents have voted down several previous attempts at increasing these taxes, so educating the public on the benefits of the transit system will be essential for a local tax increase to pass a public vote.

5.2.1.4 Funding Lessons Learned

The following are the important lessons learned concerning funding sources for the CTS project:

- Coordinate your funding efforts among the stakeholder group.
- Secure operational funding before implementing the system.
- Understand that having experience with the Federal appropriations process for transit funding is essential.
- Be aware that Federal definitions for population density can affect the region's ability to secure Federal funding for transit operational costs.

5.2.2 Public/Private Relationship

A key institutional issue for the CTS project was the unique arrangement of the CTS MCO Board, made up of representatives from the casino properties and the participating public agencies. Overall, the majority of stakeholders indicated that the board has been an effective institutional arrangement for the management of CTS services. Overall, the most important success of the board was keeping the private and public partners on board, especially when working through difficulties with the technology and the declines in ridership associated with those problems. The following section highlights the important issues identified by members of the board.

5.2.2.1 Differences in Perspectives

An important institutional issue for the CTS project was the relationship among the private businesses and public agencies participating. The different objectives of for-profit enterprises versus public agencies created varying perspectives and priorities on the CTS Board. In general, the private partners tend to view their operating dollars for CTS as in investment in their company, and they are interested in seeing a return on that investment. In contrast, the public agencies have a mission to provide a transit service that promotes mobility and environmental benefits for the citizens of the area. Many interviewees acknowledged this difference in perspective. Most indicated that although this was a major issue, the commitment of the board members to the common goal of establishing a coordinated transit system allowed the board to move past these

differences. One public stakeholder noted that "the private/public board makes sense. We have some dedicated people who are willing to listen and consider things. It is good to have the private members on board since they get things moving."

Stated another way, the project garnered two different levels of commitment from the public and private representatives: a transit service is part of the mission of a local transportation agency, while the casino properties are primarily interested in their business interests; this dichotomy creates the discrepancy in the level of commitment between the public and private stakeholders. A private stakeholder related that "getting government members to look at CTS like a business is difficult, and it is equally difficult to get business people to walk away from their personal business interests. Business participants have a personal stake and a business to run, and this creates a balance that is different for each person."

Discussion of the decision-making process with the CTS Board members emphasizes the difference in perspective between the public and private stakeholders. The majority of the private partner stakeholders indicated that they felt the decision making process was slow and bureaucratic. In contrast, several of the public agency representatives mentioned that the group accelerated the process, sometimes moving too quickly. The decision to roll out all of the technology at once highlights this difference in perspective. One public stakeholder indicated that the influence of the private partners probably affected the speed of the deployment of technology: "Perhaps we could have rolled out [the technology] more slowly, but then the question is whether you want all the implementation difficulties for 1 year or have those drawn out over a period of 3 years? The board has businessmen as stakeholders, so the board said 'we should get it over with and battle it now.'"

5.2.2.2 Keeping Private Partners at the Table

Many stakeholders interviewed emphasized the importance of keeping all of the participants at the table. The fact that the casino properties provide operating funding has made their involvement vital to the success of the CTS project. Because of the differences in perspective identified earlier in this section, it is clear that the private partners feel more pressure to succeed on the project to justify their business expenses. Several stakeholders indicated that they thought the most significant challenge for the CTS project was keeping the casino properties on board. One private stakeholder said, "I think the CTS Board worked amazingly well considering the large number of people from diverse backgrounds that had to work together."

5.2.2.3 Transit Experience of the MCO Board

Most stakeholders endorsed the CTS Board as an effective institutional arrangement for managing CTS, but some indicated that the lack of transit management experience cause project setbacks. One stakeholder remarked that "in the beginning, we did not have the experience about operations, funding, and marketing — all the basic aspects of running a business in transit services. The operating contractor has been a critical key player for us. It is absolutely necessary to have someone with transit operations experience." Another indicated that "originally the planners of the system were made up of marketing and business experts, but they lacked [a] transit or transportation background. The design of the system had to be done and redone, which wasted transportation funds." An important lesson learned from the CTS project is to have

transportation practitioners with transit experience to manage the implementation and operation of the system.

5.2.2.4 Strong Leadership

A common theme of the CTS Board member interviews was the necessity of a strong leader who understands the perspectives of both the public agencies and private partners. Many interviewees agreed that it is critical to have a chairperson who can make a unifying case for a coordinated transit system to both the for-profit businesses and the public agencies. One stakeholder noted that "the chairman was very good at articulating the vision from both the public and private side. He energized the group about the possibilities and did not focus on the negative aspects of the project. This was important to our success."

The majority of the stakeholders agreed that the CTS MCO was able to react and respond quickly to needs. As a whole, the board was able to make decisions, act on problems, and come up with viable solution founded on a consensus-based vision and goal for CTS. While the reviews were mixed as to whether a single individual or "leadership by committee" was a preferred option, all stakeholders indicated that they experienced good leadership in the current CTS MCO Chairperson. They saw him as a leader who, as one stakeholder related, "uses a rational, problem-solving technique to help us keep together."

5.2.2.5 The Participation Agreement

The stakeholders (including the private partners) created a participation agreement[25] in 1998 to tie them together contractually. In order to opt out of the contract, a member must give 90 days notice to the board and must provide evidence to the board that CTS is not meeting their needs from an operational and technical standpoint. There have been several occasions when a private member was unhappy with an aspect of the system, but the participation agreement made it difficult for a participant to leave CTS. The agreement allowed the stakeholders to work through their differences and solve problems with the CTS service. A public stakeholder noted that, "a member cannot arbitrarily walk from the project. It is up to them to prove to the board that their needs are not being met. So far, we have received no issues with service and no fears from anyone." A private stakeholder stated that, "there was a lot at stake with this project. The contract was structured in such a way that the stakeholders could not simply walk away from the agreement."

5.2.2.6 Casino General Manager Turnover

A significant challenge for the CTS Board has been the frequent turnover of the general managers of the casino properties. Often, these managers are only in a location for 2 years or less. The recurrent movement of general managers makes it challenging to obtain buy-in from the upper-level management of the casino properties. Each time a new general manager comes on board, the board has to solicit the benefits of CTS and justify the casino's contribution of operating funding to the project to that person. The representative from the casino property to the board itself does not necessarily change, but the support for the project from upper-level casino

[25] The Participation Agreement to Implement a Coordinated Transit System at South Lake Tahoe was signed in 1998, with an addendum completed in 1999.

management is necessary for the continuing operation of CTS. As one stakeholder put it, "At one point we were all 100 percent on board, but then a new general manger comes in whom none of us has met. We do not know where they stand or whether they want out of the participation agreement. This really shows that the biggest challenge is not the technical aspect or the acquisition of equipment, but it is the interpersonal relationships on the project."

5.2.2.7 TRPA/Casino Property Relationships

The Tahoe Regional Planning Agency (TRPA) has a unique standing as the transportation planning body for the region as well as the environmental regulation agency charged with protecting the natural surroundings, specifically the water quality of Lake Tahoe. Lake Tahoe is specially designated under the Clean Water Act as an Outstanding Natural Resource Water, one of only three such designations in the Western United States.[26] Because of the effect of auto emissions on the clarity of water in Lake Tahoe, TRPA significantly restricts development in the area. For TRPA to approve any additions to the casino properties, those properties must gain congestion mitigation credits to offset the increase in traffic the development will bring. These mitigation credits are a significant incentive for the participation of casino properties in CTS. Several private stakeholders acknowledged that this was a factor in the agreement to improve the transit system in the Tahoe area via CTS.

Several private stakeholders also mentioned the importance of the general public's perception of the casino properties and the benefits CTS can provide to the casinos' image. These properties are large players in the local economy for the Tahoe area, and it is important for the public to see them as members of the local community, not just as businesses.

5.2.3 Operations

The CTS Board maintains a close relationship with Area Transit Management (ATM), the operator of transit services for CTS. The stakeholders indicated that aspects of this relationship were very important to the success of the project, and this section details some of the major issues identified in the stakeholder interviews.

5.2.3.1 Operator Capabilities

Overall, the stakeholders responded favorably to the capability of the operator, specifically with regard to the use of the installed technology for CTS. Board members identified ATM as an asset during the implementation phase of the project. As one stakeholder related, "technology use in transit demands an operator that is proficient in its use." Multiple aspects of ATM's operations were affected by the addition of the technology, and the stakeholders acknowledged the benefit of having an operator that was able to facilitate these changes as smoothly as possible.

Another point that surfaced in the interviews was the necessity of having an operator that is flexible to changes and problems in the system. The CTS Board relied on its relationship with the contracting operator to adapt quickly when problems arose. One stakeholder said that, "our transit operator and our CTS Board are quick to respond to

[26] "Lake Tahoe Facts and Figures," Tahoe Regional Planning Agency (n.d.). Retrieved on November 16, 2005 from http://www.trpa.org/default.aspx?tabindex=4&tabid=95.

issues when they come up. It is usually clear when something is not working, like the phone system and kiosks. We never wasted much time discussing the problem too much; we would make a decision and the operator was efficient in making the change."

A final consideration is the community-minded nature of the operator. Although a private entity, several stakeholders remarked that ATM has the best intensions of transit riders and the general public in mind when making operational decisions concerning the CTS services. Because of the separate operating contracts for the different services, CTS needs an operator who is trustworthy with accurate reporting under the various contracts. One stakeholder noted that, "we needed a community-minded operator that is not double dipping with separate operating contacts to make more money – we have this in ATM. A significant hurdle for us now is the cost of the operating contracts; however, this is not because of ATM, which does a good job controlling costs."

5.2.3.2 Communications Infrastructure Cost

Another cost that those planning a similar system should consider is the necessary communications infrastructure. The kiosks require a high-speed network for data transfer to the dispatch center. In the case of CTS, the installation of a wireless local area network has eliminated the bulk of the recurring cost of communications through a service provider. However, because of state jurisdictional issues with local telecommunications providers, the system incurs a $700 monthly cost for a T1 data transfer across the California-Nevada State line. Even with this cost, the capital expense of installing the wireless network is proving cost effective for CTS.

5.2.3.3 First-Drop Algorithm

One of the more difficult issues in this project was determining how to equitably distribute passengers to the participating casinos. The fear was that customers would have a tendency to get off at the first stop and stay at that casino for some time as studies have shown that the first casino a patron goes to is where they lose the most money. In response to this, the project team developed the concept of a "first-drop algorithm," which was designed to address this issue. The concept was that the CTS would automatically vary the order of stops and keep track of how many passengers have been dropped at each to maintain an equitable distribution of customers. Based on early interviews the evaluation team conducted with stakeholders, it was clear that this was a "make it or break it" issue for the private sector participants, but of little concern to some public sector stakeholders.

ATM diligently tracked this measure for a short time as combined operations began, and they found that the system was operating within 1 percent of where it should have been according to how much of the total cost each casino was contributing (i.e., if a casino is contributing 40 percent of the operational cost of the service, 40 percent of the "first-drops" should be to that particular casino). Over time the stakeholders became comfortable with the system and first-drops were not as much of a concern as they focused on keeping ridership up across the board. Eventually operations evolved to what the operator referred to as "majority rules," meaning that the driver's first-drop should be where the majority of the passengers would like to go.

5.2.3.4 Facilitating Billing for Different CTS Services

Initially, the concept for CTS was to have a single master operating contact that would assist in shifting vehicles around on the fly between the services. Due to institutional issues between the contractor and CTS stakeholders, the single operating contract was not feasible. Separate operating contracts exist for each of the CTS services, and personnel at ATM devised a software program that tracks service hours and ridership for each service. This program ensures proper billing for each service by providing separate profit/loss and ridership reports. The CTS stakeholder group is generally pleased with this arrangement. The program was not difficult for ATM to develop; the most significant challenge with the billing situation was the communication necessary to understand the needs of each stakeholder and tailor the software to those needs.

6 TECHNOLOGY LESSONS LEARNED

The lessons learned from the implementation of technologies to transit services are important results of this evaluation. The following chapter documents issues and challenges faced by the CTS stakeholder concerning the implementation and operation of these technologies.

6.1 APPROACH

The information presented in the chapter comes from a variety of sources. Stakeholder interviews, discussions with TRPA and ATM, and survey information were all employed to gather this data. The evaluation team's personal experience with riding the different CTS services also provided insight and information for this chapter.

6.2 FINDINGS

The majority of the stakeholders interviewed discussed both the benefits and challenges of implementing technology for the CTS system. Specific areas that many respondents identified were:

- Pioneering new technology.
- Roll-out schedule.
- Training.
- Contracting.
- Focus Groups and Demographics of the Ridership Pool.
- Kiosk appearance.
- Issues with the MDT, AVL, and CAD systems.

6.2.1 General

6.2.1.1 Pioneering New Technology

Several stakeholders interviewed warned against being the first to implement a new technology for transit services. Issues concerning the public's ability to use the kiosks and the problems with the automated phone reservation system were the two most common topics discussed in the interviews. Stakeholders stressed simplicity with regard to choosing a technological solution to improve transit services. One stakeholder conveyed that, "Transit is a very, very basic technology. When you start incorporating computers into it, it takes time for the general public to sign on with it." Another stakeholder provided a stronger statement: "Do not be a pioneer with high technology."

In general, the stakeholder group underestimated the extent to which problems with software and hardware would affect the system performance. The fact that the system required a large amount of software customization added to this problem. Off-the-shelf software is usually updated regularly by the vendor to correct problems, but this is not the case with customized software. One interviewee strongly recommended

considering an extended software maintenance agreement if a customized software solution is chosen. The CTS implementation of a customized product highlights the trade-off between a custom and an off-the-shelf solution: custom products can provide specific functionality tailored to the user's needs; however, maintenance, support, and updates to the system are typically more costly and time consuming.

6.2.1.2 Roll-out Schedule

Most stakeholders agreed that the deployment plan of introducing all of the elements of the new technology at one time was too ambitious. The mobile data terminals, reservation kiosks, and re-branded casino shuttles were all deployed within a 6-month period. This created challenges with driver training as well as communication with the public. When first installed, few customers could use the kiosks to book trips. As one stakeholder noted, "The technology build was outstanding, but we should have phased [the implementation of the technology] more than we did." Another interviewee said that, "in retrospect, we tried to introduce technologies that were difficult to implement from a design side, and we also went beyond the riders' ability to interface with the technology." There was a clear consensus among interviewees that increased public awareness of the changes to the transit services would have benefited the deployment of the kiosks.

In addition to the problems of the roll-out timing, there was a lack of staff resources to manage the deployment of the technology. Before the MCO Board was formed in the fall of 2003, there was a single TRPA employee who managed the bulk of the development and deployment of the technology for CTS at the time of initial implementation. One stakeholder acknowledged that, "the most significant challenge was the implementation of the project. We needed more resources to meet the expectations of the project."

6.2.1.3 Training

Along with a phased deployment schedule, training was an issue echoed by many interviewed. Stakeholders identified the necessity for improved training for both operators and the traveling public as important lessons learned on the project. They felt that training on the kiosks for the traveling public could have reduced confusion with the technology and increased the use of the kiosks for booking rides.

Hotel front desk staff members are seen as an important aspect of the BlueGO marketing effort, as they are the major interaction point for visitors who may ride the system. The CTS Board recognized this and in response began holding training luncheons with hotel staff in the summer of 2003. High turnover for hotel employees from the summer to winter peak seasons creates the need for continued training, so the luncheons are now held each fall and spring. The majority of interviewees considered these training luncheons a success. Additionally, TRPA staff make a point of checking in with each of the hotel and resort properties served by the Casino periodically to ensure that they are satisfied with the service.

With regard to training for operators, the operating contractor was forced to realign some staff members' positions, which was an unexpected outcome of implementing the technology. For example, they found that some drivers were not comfortable working with the MDTs. Over time they moved some staff around to accommodate these challenges that some individuals had in working with the new equipment.

Training needs carried into operations and maintenance. A representative of the operating contractor felt that although sufficient training was provided on operating the software, more training on repairing the hardware and re-installing it following repairs would facilitate ongoing system maintenance efforts.

6.2.1.4 Contracting

One stakeholder related that an important lesson learned from the project was to ensure that the selected vendor's core business matches the transit services included in the system. Many contractors have a specific area of specialization, and this can be different from the focus area of a transit system. The CTS added another degree of difficulty with the consolidation of several different transit services. This made it difficult for a contractor to integrate CAD and automatic booking systems for the casino shuttle and door-to-door services.

As an additional lesson learned with regard to contracting for the development of transit technologies, one stakeholder recommended obtaining a longer service contract on the hardware purchased for the system. The interviewee indicated that it was somewhat difficult to obtain help from the vendor after the agreed upon service contract had expired.

6.2.2 Kiosks and IVR System

The largest challenge with the kiosks has been the user interface. The initial user interface required eight or nine steps to book a ride, and with this interface it was found that many passengers were not successfully completing all of the required steps (and many of these individuals thought that they had successfully booked a trip). In November 2003, just 1 month after the initial roll-out, the stakeholders elected to shut down the kiosks briefly to allow them to revise the user interface. They re-released the kiosks about a month later and the updated interface now involves a three-step process. The first screen asks the patrons where they would like to go, the second screen asks them how many individuals are in their party, and the final screen provides them with confirmation information, including a 30-minute time window of when they can expect the bus to arrive and what the cost of the trip will be. This simplified system does result in some "accidentally scheduled" trips, but the stakeholders feel that this is less of a concern when compared with patrons being unable to book a trip at all.

The evaluation initially planned to look at kiosk usage over time, but the evaluation team was unable to obtain any detailed quantitative information on kiosk usage. The stakeholders recently implemented tracking software that will help them better understand where people are going and which advertisements are the most effective (i.e., the ones most often clicked on by kiosk users). It does appear that kiosk usage is increasing. It is estimated that approximately 50 percent of the casino shuttle ride requests originate from a kiosk, which is surprisingly high considering that all pick-up locations do not have a kiosk. Kiosk advertising and WIFI revenue combined currently represent approximately $8,000 to $10,000 each month, which makes up approximately 8 percent of the overall operating costs of the service.

As of publication of this report, the IVR system is not in use. All trips booked by phone are booked through a dispatcher. The IVR system was deployed on the door-to-door service for a short time in October 2003 (along with the initial kiosk roll-out), but the system did not operate as anticipated. Technical problems with the reservation system

resulted in a significant drop in ridership on the door-to-door service (this was discussed in further detail in Section 4.2.3). Subsequently the stakeholders decided to remove the system from operation indefinitely until the problems could be resolved. For some time, the stakeholders have attempted to modify the system to address the problems that they experienced with the initial roll-out, but as of publication of this report those issues had not yet been resolved.

According to the stakeholders, it appears that whenever the system reaches its capacity it simply shuts down. When this happens it gives the caller a busy signal and hangs up on those who are already on hold. The system often reaches capacity on Friday nights and during popular holiday weekends such as the 4th of July. At this point the stakeholders are unsure if this is an infrastructure problem or a software problem, but they are certain that it is unreasonable for them to rely on a system that may shut down for 2 to 8 hours at a time during their busiest times.

6.2.2.1 Focus Groups and Demographics of the Ridership Pool

In retrospect, the stakeholder group collectively overestimated the riders' willingness to use a computer system to book rides. As a result, the benefits from automated trip booking and the computer aided dispatch were less than expected.

The majority of interviewees strongly recommend using focus groups comprised of riders of the system to make decisions on designing the interface of the phone reservation system and the kiosks. Focus groups could have eliminated the need to reprogram the kiosks after the initial deployment. As discussed in Section 6.2.2, it was discovered that the 8 to 9 steps necessary to book a ride were too complicated, which in turn deterred most riders from using the automatic trip booking function on the kiosks. After simplifying the process, the kiosks were re-deployed; however, the stakeholders may have been able to avoid this extra programming and re-deployment step if they had employed focus groups at the outset. One stakeholder described the usefulness of a focus group approach to the design of the kiosks and the phone reservation system: "It was a fundamental design issue. In retrospect, we should have taken some users aside once we had this concept and said to them, 'this is what we're intending to do, and what is your response to that?' We would have immediately realized that no one would be able to use it."

One stakeholder noted that, "a major lesson learned was to look at the population and determine who will be riding your system. A demographic study would have helped." Two demographic issues of the ridership pool available to BlueGO affect riders' propensity to use the technology. The first is the familiarity of riders with technology because of age and a lack of exposure to the use of computer systems. A significant portion of casino shuttle and door-to-door riders are of this category. Second, in a situation where most of the riders are visitors to an area, some new riders have a first experience with the system almost weekly. This increases the time it takes for riders to become acclimated to using the new system.

The fact that potential riders are on vacation poses yet another challenge. According to one stakeholder, "The system was designed with all the bells and whistles, but was so complicated that many people could not use it. It is especially difficult because it is a tourist environment. The last thing a visitor wants to do is spend time trying to figure out how to use the system. They're on vacation – they'd rather go down to the front desk and ask them to call a bus."

6.2.2.2 Kiosk Appearance

Some stakeholders felt that there was too much of an emphasis on restaurants and attractions on the screens; that it should have been clearer to users that ride-booking, not advertising, is the major purpose of the kiosks. Stakeholders indicated that they received feedback from riders that they were unsure of the specific function of the kiosks. It is possible that the additional tourism information provided on the screens contributed to this confusion, and that the appearance of the cabinet housing the kiosks also added to riders' misunderstanding of the kiosk's primary function. An important lesson learned from the CTS project is the significant effect the kiosk appearance and interface have on the public's ability and willingness to interact with the technology.

6.2.3 AVL and MDTs

6.2.3.1 Efficiencies from MDTs Did Not Meet Expectations for Door-to-Door System

Originally, the MDTs were employed to facilitate the use of the CAD system and to reduce the reliance on radio communications between drivers and dispatch. The automated phone system and kiosks were to be an integral part of this arrangement. The system was designed for riders to call into the automated system, which would book rides directly using the CAD system without the need for a dispatcher to take a call. The problems with the automated phone system, however, caused a drop in CAD usage and ridership. One stakeholder noted that, "we had hoped that radio usage would be cut down by 75 to 80 percent. However, once the technology was rolled out, they started seeing dropped calls. The drivers were instructed to only use the radio when necessary. The expectation with the door to-door system was that drivers would have an easier time receiving booked ride information and that patrons would have an easier time making the calls to book the rides; however, this did not pan out as planned."

In addition, the transit operator experienced significant problems with hardware reliability. They found that the units often had to be sent out for repairs, which leaves one or more buses without a unit for an extended period of time. There are typically no more than five casino shuttles on the road at one time, so having one MDT down is a significant problem. As a result, the dispatchers often found themselves resorting to radio communication with the drivers for last-minute trips rather than relying on the CAD / MDT system. As a result, the MDTs are not relied on to the extent that was originally envisioned.

6.2.3.2 AVL Benefits for Fixed Route Customer Service

The AVL system has provided some benefit to transit services in Lake Tahoe, specifically with regard to customer service for the fixed route service. The operator receives frequent calls concerning the real-time status of bus locations, especially when buses are running behind schedule. The AVL tracking system allows the operator to determine how far behind schedule a particular bus is within a matter of seconds. This is especially critical in the event of inclement weather or unusually heavy traffic. A representative from the operator said, "People call in asking about how far behind the bus is, and with the AVL system, it is easy to tell them the information they need."

6.2.4 CAD

6.2.4.1 Service Area and Origins and Destinations for CTS Services

The transit operator and stakeholders experienced significant problems with the implementation of the CAD system on the door-to-door service. The CAD system is better suited for the casino shuttle than for the door-to-door service because of the casino shuttle's limited service area and limited origins and destinations. As compared to the casino shuttle service, the service area for the door-to-door service is large geographically. At approximately 100 square miles, the door-to-door service area is about 4 times the size of the casino shuttle service area. One stakeholder explained that "the size of the door-to-door service area is a major challenge. There is simply not enough operating funding to put enough vans out there to get to people fast enough. Half the time there is only one van deployed, and people using the automated system are unable to get a ride in a timely manner." The large service area, longer distance trips, and limited funding for deployed vehicles create a situation where the CAD system provides minimal efficiency for the door-to-door service.

Additionally, the casino shuttle has a very limited number of origins and destinations. The CAD system was designed for traditional paratransit systems that operate much like a taxi, where individuals are picked up and dropped off one at a time. South Lake Tahoe's casino shuttle operates more like a ride share, with the driver often picking up several people at one location and dropping off several people at another common location. The CAD system implemented via CTS is most efficient when optimizing the taxi-like paratransit trips, making it less helpful when optimizing the casino shuttle rides.

6.2.4.2 New Reservation System Lacks Significant Efficiency over Existing Practices

The transit operator indicated that the automated system provides little efficiency in scheduling rides. Before the additions of the technology, the operator took calls and scheduled rides out to drivers via radio communications. A representative of the operator indicated that the technology does not take away a significant amount of effort from dispatch responsibilities: "Approximately 7 to 8 percent of our trip requests are booked via kiosk. The rest are booked by phone either by individuals who call directly to BlueGO or by concierges or front desk staff. The dispatchers have found that they can address a trip request in approximately 5 to 6 seconds in person, whereas they have found that it requires approximately 90 seconds if the computer books the trip. For walk-ons the dispatchers do use the computer automated dispatch some, but it is mostly done over the radio." The kiosk system has reduced the number of calls coming into the dispatch center, but the increased processing time affects the ability of ATM to operate the system efficiently.

6.2.4.3 No-shows Have Smaller Impact with Casino Shuttle

The combination of the limited service area and the limited origins/destinations makes no-shows less of an issue on the casino shuttle. ATM's procedure for handling no-shows is the same for both the casino shuttle and the door-to-door service. The driver waits 30 seconds before calling the dispatcher. After 60 seconds the dispatcher calls the house. If the person does not show after 90 seconds, the driver assumes it is a no-show and records the trip as such. Because of the small service area and the limited

number of origins and destinations on the casino shuttle, no-shows do not result in a significant delay. The service area is so small that the driver likely did not go out of his way for that pick-up. Additionally, if there is a no-show, there is often already someone else at that pick-up location waiting for a bus. Conversely, drivers often travel very far out of their way for pick-ups on the door-to-door service, so a no-show can cause a significant delay.

7 SUMMARY AND CONCLUSIONS

7.1 INTRODUCTION

This document has presented the evaluation strategies and objectives, the data collection methodologies, and the results of the evaluation of the South Lake Tahoe Coordinated Transit System (CTS).

7.2 SUMMARY

The results of the analyses are summarized here according to each of the five evaluation objectives:

- Assess the impact of CTS on transit ridership.
- Assess the impact of CTS on traffic congestion.
- Assess the impact of CTS on transit system efficiency.
- Assess transit operator perceptions of the system and the technologies.
- Assess the impact of CTS on customer satisfaction with transit services in South Lake Tahoe.

7.2.1 Assess the Impact of CTS on Transit Ridership

In order to assess the impacts of CTS on transit ridership, the evaluation team obtained transit ridership data from the transit operator for the BlueGO Casino Shuttle (beginning in October 2003) and for the BlueGO Door-to-Door service (beginning in January 2002). Transit ridership on the casino shuttle was studied along with other factors expected to influence ridership on this tourist-focused service (including room-nights sold data and gaming revenue data for casinos). The evaluation team obtained these data from the Lake Tahoe Visitor's Authority.

It appears that ridership on the casino shuttle decreased significantly post-CTS. However, this decrease cannot necessarily be attributed to the consolidation of the services or to the addition of technologies. There were accompanying changes to the "brand" of the service and to the cost of the service (shuttles that were previously free now cost a $1.00 fare per one-way trip) which likely affected the ridership, and it will take some time for the service to recover from these changes. Since the implementation of the MDTs, CAD, and kiosks 2 years ago (in October 2003), ridership has increased overall for the casino shuttle. The casino shuttle has experienced a 10.3 percent increase in summer peak ridership and a 14.3 percent increase in winter peak ridership. It was found that the casino shuttle ridership data since the addition of CTS does in fact track closely with room-nights sold. Although the number of room-nights sold has decreased over the past 5 years, it has stabilized in the last 2 years and is now showing a positive upward trend.

Ridership on the door-to-door service was significantly affected by some of the technological changes associated with the initial roll-out of the CTS project. Passenger trips for the door-to-door service declined by 45 percent from July 2003 to November

2003. This time period coincides with the initial rollout of the kiosks and phone system that were initially planned for use on the door-to-door service (as many riders had difficulties using the automated trip reservation system). Since the automated phone reservation system was removed from operation, the door-to-door service has shown a steady pattern of growth. While it has not reached pre-CTS levels of ridership, the service is showing a positive trend over the past 2 years.

7.2.2 Assess the Impact of CTS on Traffic Congestion

Traffic congestion was measured by gathering traffic count data from continuous count stations in California and Nevada along US Route 50 and comparing data before and after CTS deployment (from January 2000 through September 2005).

Surprisingly, traffic volumes do not show the significant seasonal variance seen in the room-nights sold data, and there are several possible explanations for this discrepancy. The most likely explanation is a reduction in the duration of visits (i.e., the number of people traveling to the Lake Tahoe area has not changed, but their hotel stays are shorter or non-existent in the case of a day trip by car). A less likely scenario involves fewer visitors flying to Reno or Sacramento and traveling to the area via mass transit.

The winter peak season traffic volumes show more variation from year to year than the summer peak seasons. When comparing 2005 to 2003, the summer peak is down 10.2 percent and the winter peak is down 7.7 percent. There are a number of factors that influence vehicle trips, especially in an area with a tourist-driven economy. But as transit ridership is improving, specifically on the casino shuttle, traffic counts in the Lake Tahoe area are decreasing. These data provide some indication that CTS has likely impacted VMT in the area, and that the main periods of impact are during times of high tourist volume.

Another indication that traffic volumes in Tahoe may be on a downward trend is that the percentage of respondents who reported having access to a car while visiting South Lake Tahoe dropped from 91 to 80 percent from August 2002 to August 2004. This bodes well for the stakeholders' goal of increasing the number of visitors who leave their car at home.

7.2.3 Assess the Impact of CTS on Transit System Efficiency

Transit system efficiency was assessed by evaluating passenger trips, operating hours, and operating costs for fixed-route and demand-response services. Operational cost data was provided by the transit operator. Information on other operational efficiencies was obtained from TRPA and other stakeholder interviews and correspondence. Only *passenger counts* were available for the privately operated casino shuttle service that operated before the new CTS casino shuttle service existed. Therefore, *passengers per operating hour* and *operating cost per hour* were calculated for all services with the exception of the casino shuttle services.

7.2.3.1 Number of Vehicles

At the inception of the casino shuttle service, the stakeholders believe that anywhere from five to eight buses were providing the on-demand casino shuttle service at any given time with wait times between 15 and 20 minutes during peak times. Due to the

addition of the technology and the consolidation of the casino shuttle services, the current system provides the same level of service with only three to four buses. The reduction of the vehicles is an approximation of the operator; the number of buses deployed at any given time varies somewhat depending on the demand for the service. This reduction is a tangible benefit of the CTS project that should mean reduced operational costs, fuel consumption, and wear on CTS vehicles over time.

Due to the consolidation of the services and the combined operations at one dispatch center, the transit operator has the ability to switch vehicles between the door-to-door and casino shuttle services on an impromptu basis to meet needs. Although this does not occur on a daily basis, the operator now has more flexibility in meeting the ever-changing demand of the two services.

7.2.3.2 Operating Costs

The door-to-door service has experienced a slight decrease in operating costs while experiencing a slight increase in passenger trips. This indicates more passenger trips with a similar level of service, although the exact number of service hours data for FY 2005 is not available. This small gain in efficiency for the door-to-door service is a positive sign, but the data is inconclusive in terms of showing whether the improvements employed in the CTS project had any significant effect on cost efficiency for the service.

7.2.3.3 Operating Efficiency

A 20 percent increase in passenger trips per service hour from 2002-03 to 2003-04 makes it appear promising that efficiency is improving. Due to the significant changes implemented by CTS that affected ridership, it is difficult to make conclusive statements about increases in efficiency; however, the data do suggest a positive trend after the initial drop in ridership in FY 2003. This improvement can likely be at least partially attributed to technological improvements implemented with the CTS project.

7.2.3.4 Passenger Trips per Mile (Door-to-Door Service)

Because the door-to-door service is on demand, there is not a clear sense that a higher number passenger trips per mile of service is measuring “better” efficiency for that service. A higher value of this statistic would imply that more passengers are riding a vehicle simultaneously, which is one view of efficiency. However, because of the wide area of coverage for the service, multiple travelers on the same vehicle trip could mean a significantly lower level of service for passengers (i.e., as origins and destinations are farther apart, trips with multiple pick-ups and drop-offs are longer for passengers). Taking this into consideration, the fact that the door-to-door service is maintaining an acceptable level of efficiency reflects positively on the service and the changes implemented with CTS.

7.2.4 Assess Transit Operator Perceptions of the System and the Technologies

Transit operator perceptions of the system and the technologies were gathered through informal interviews that the evaluation team undertook while conducting the on-board surveys. The evaluation team inquired about the drivers’ experience with the MDTs and the CAD system. When talking with the dispatchers, the team inquired about their experiences with the AVL interface, the CAD system, and the IVR system.

Although most drivers expressed general satisfaction with the MDT units, some had specific complaints about the user interface, stressing that driver focus groups would have helped to ensure that the interface would meet their needs. When it came to the CAD system, many felt that it was not effective at assigning trips efficiently among the vehicles. They felt that assignments can be made more efficiently through radio communication between the dispatcher and the various drivers considering that there are never more than five vehicles on the road at any given time and that the casino shuttle service area is not geographically very large. The dispatchers for the most part agreed with the drivers about the effectiveness of the CAD system for their needs, particularly for the door-to-door service.

In terms of the AVL, the dispatchers were satisfied with the interface and felt that there is truly a benefit in knowing where the buses are in real-time. The most significant benefit that they noted was being able to tell customers where the buses are in real-time.

The benefit to operators is perhaps best summed up by the statement of one operator: "In the end, I think we got the product we wanted, but we're using it in different ways [than we expected]. It's good to know we will have these tools available down the road when we need them when we add or expand services. We've made the initial investment and now the cost will be incremental to expand."

7.2.5 Assess the Impact of CTS on Customer Satisfaction with Transit Service

In terms of respondents' overall impression of transit services in South Lake Tahoe, opinions did not change significantly between the before and after surveys. Customers generally had a good impression. A high percentage of baseline and post-CTS respondents (89 percent and 81 percent, respectively) indicated a "positive" or "very positive" impression overall.

In terms of reactions to the trip reservation capabilities (by phone and by kiosk), respondents seemed generally satisfied. Of those who had used a phone or kiosk to book a trip, the overwhelming majority reported being "satisfied" or "very satisfied" with the ease of scheduling a trip (78 percent of those booking by phone and 67 percent of those booking via a kiosk). With that said, satisfaction with the ease of trip-booking did decrease from the baseline survey (90 percent of baseline survey respondents indicated that they were "satisfied" or "very satisfied" with the ease of booking a trip). When it came to satisfaction with the information received about expected wait time using the phone and kiosk, 72 percent receiving information by phone were "satisfied" or "very satisfied" while 62 percent receiving information via a kiosk were "satisfied" or "very satisfied". Of those who indicated that they had not used a phone or kiosk to book a trip, about a third reported that the reason they did not use that option was that they were not aware of it. A lower percent of respondents reported that they were aware of the option but did not want to use it (20 percent of those referring to the phone and 16 percent of those referring to the kiosk).

In terms of customer satisfaction with the overall operations of the casino shuttle, respondents' satisfaction with *the number of stops to pick up and drop off other passengers* was nearly the same before and after CTS with the majority of respondents indicating that they are either "satisfied" or "very satisfied" (83 percent of baseline respondents and 80 percent of post-CTS respondents). When asked to rate their level of satisfaction with four different aspects of the service (*time spent waiting*

for a shuttle, the *cost of a trip*, the *total travel time*, and the *service overall*), respondents reported a high level of satisfaction in all areas (78 to 89 percent were "satisfied" or "very satisfied"). In terms of expectation about wait time, respondents were satisfied. Approximately 86 percent reported that the wait time was about what they expected or was shorter than they expected.

Among the 212 respondents indicating that they had used the prior independently-operated casino shuttle services, there was general agreement that the new consolidated service is as good as the previous service, if not better. Eighty-five to 88 percent of respondents reported that the service was "about the same as before," "somewhat better than before," or "significantly better than before" when asked about *time spent waiting for a shuttle*, *travel time*, and the *number of stops to pick up and drop off other customers*.

7.3 CONCLUSIONS

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, have not been supported by the results of the evaluation, or are inconclusive at this time.

- **Hypothesis: CTS will result in increased transit ridership**. The hypothesis is not supported as CTS technologies actually resulted in a significant drop in ridership on the door-to-door service over the few months that the IVR telephone trip reservation system and initial kiosk user-interface were in place. Since the IVR system has been removed from operation and the kiosk interface has been simplified, however, ridership on the service has increased steadily.
- **Hypothesis: CTS will result in increased use of transit by visitors**. This hypothesis is inconclusive. Although ridership on the casino shuttle appears to have decreased significantly since the consolidation of the services, it is not clear that ridership numbers from before and after CTS can be compared. Additionally, the number of visitors to South Lake Tahoe appears to have decreased in recent years (the number of room-nights sold decreased by 15 percent from August 2002 to August 2004), which means that there was a decrease in the population of potential riders. Furthermore, the customer intercept surveys revealed that there has been an increase in the number of residents riding the casino shuttle (the percent of those surveyed reporting that they were residents decreased from 97 percent in August 2002 to 77 percent in August 2004), which means that studying total ridership on this tourist-focused service is no longer the best indication of the level of transit use by visitors.
- **Hypothesis: CTS will result in reduced traffic volumes**. This hypothesis is supported by traffic volume counts and by customer satisfaction surveys. When comparing 2003 to 2005, traffic volumes on US 50 in South Lake Tahoe decreased by 10.2 percent and 7.7 percent, respectively, for the winter and summer peaks. This is further supported by the fact that the casino shuttle experienced a 7.5 percent increase in riders over this time and by the fact that the percent of survey respondents reporting having access to a car dropped from 91 to 80 percent from August 2002 to August 2004.
- **Hypothesis: With CTS, transit services will operate with greater efficiency than the existing transit system**. This hypothesis is supported for the casino

shuttle service, but is inconclusive for the door-to-door service with the current data. The consolidation of casino shuttle services as a result of CTS resulted in an efficiency gain in terms of providing a similar level of service with less vehicles. Also, being able to share resources between the two demand-response services on occasion is another direct operational efficiency benefit of CTS. There were small measured efficiency gains on the door-to-door service in terms of 'cost per passenger-trip', 'passenger trips per operating hour' and 'passenger trips per mile'. However, the data is inconclusive in terms of demonstrating whether the CTS project had any significant effect on these efficiency gains.

- **Hypothesis: CTS will benefit transit operators**. This hypothesis is supported by information gathered through formal and informal interviews with shuttle drivers and dispatchers. Drivers saw the biggest benefit in receiving automated trip changes through their Mobile Data Terminals while dispatchers saw the biggest benefit in having real-time vehicle location at their fingertips and in having some kiosk trip requests automatically assigned by the CAD system.
- **Hypothesis: With CTS, transit riders will be more satisfied with available transit services**. This hypothesis is supported through the customer satisfaction surveys. Customers are as satisfied with the casino shuttle service as they were with the independent casino shuttles that operated pre-CTS. Customers are generally satisfied with the operation of the service (e.g., wait time, travel time, and number of stops to pick up and drop off other passengers) as well as with the cost of the service and with the trip-booking technologies.

Appendix A: Survey Instruments

1. BlueGO Casino Shuttle Survey (Post-Implementation)

2. Park-n-Roll Casino Shuttles Survey (Baseline)

Note: The format of the following survey forms has been modified to fit this document. The content remains the same.

WE VALUE YOUR OPINION! Transit services are an important part of the transportation system in the South Lake Tahoe area. Local government agencies and private companies are working together to find ways to increase the use of transit to reduce traffic and maintain the natural beauty of this special area. We would very much appreciate your input on this topic by completing this survey. Thank you very much for your time!

1. How many times would you estimate that you have taken a BlueGO Casino shuttle THIS YEAR?

- ❑ This is my first time
- ❑ 2 – 5 times
- ❑ 6 – 10 times
- ❑ More than 10 times

2. Have you ever used the phone in an attempt to schedule a trip on a BlueGO Casino shuttle?

- ❑ Yes (*go to question 3*)
- ❑ No → Please indicate below why you haven't used the phone reservation system.
  - ❑ I was not aware of the phone reservation system (*skip to question 4*).
  - ❑ I was aware of the phone reservation system, but didn't know how/where to call (*skip to question 4*).
  - ❑ I was aware of the phone reservation system, but didn't want to use it (*skip to question 4*).
  - ❑ Other (*skip to question 4*) _____

3. Based on your experience reserving a trip by phone, how satisfied are you with each of the following? (Please use a scale of 1 to 5, with 1 being "not at all satisfied" and 5 being "very satisfied".)

	Not at all Satisfied 1	Not Satisfied 2	Neutral 3	Satisfied 4	Very Satisfied 5
Ease of scheduling a trip by phone	❑	❑	❑	❑	❑
Information received about expected wait time	❑	❑	❑	❑	❑

4. Have you ever used a touch-screen computer kiosk in an attempt to schedule a trip on a BlueGO Casino shuttle?

- ❑ Yes (*go to question 5*)
- ❑ No → Please indicate below why you haven't used a touch-screen computer kiosk.
  - ❑ I was not aware of the kiosks (*skip to question 6*).
  - ❑ I was aware of the kiosks, but didn't know where to find one (*skip to question 6*).
  - ❑ I was aware of the kiosks, but didn't want to use one (*skip to question 6*).
  - ❑ Other (*skip to question 6*) _____

5. Based on your experience using the computer kiosks, how satisfied are you with each of the following? (Please use a scale of 1 to 5, with 1 being "not at all satisfied" and 5 being "very satisfied".)

	Not at all Satisfied 1	Not Satisfied 2	Neutral 3	Satisfied 4	Very Satisfied 5
Ease of scheduling a trip using the computer kiosks	❑	❑	❑	❑	❑
Information received about expected wait time	❑	❑	❑	❑	❑

6. How much time did you spend waiting for THIS shuttle as compared to how long you expected to wait? (Use a scale of 1 to 5, with 1 being "significantly more" and 5 being "significantly less".)

Significantly More Time	Somewhat More Time	About the Same	Somewhat Less Time	Significantly Less Time
1	**2**	**3**	**4**	**5**
❑	❑	❑	❑	❑

7. On a scale of 1 to 5, in general, how satisfied are you with the following aspects of the BlueGO Casino shuttle service?

	Not at all Satisfied 1	Not Satisfied 2	Neutral 3	Satisfied 4	Very Satisfied 5
Availability of information about the service	❑	❑	❑	❑	❑
Time spent waiting for a shuttle	❑	❑	❑	❑	❑
Cost of a trip	❑	❑	❑	❑	❑
Travel time from origin to destination	❑	❑	❑	❑	❑
Number of stops to pick up/drop off other passengers	❑	❑	❑	❑	❑
The BlueGO Casino shuttle service overall	❑	❑	❑	❑	❑

8. Which of the following statements best describes the time you spend in South Lake Tahoe?

❑ I am visiting this area for the first time (*skip to question 11*).

❑ I have visited this area before, but I visit less than once a year.

❑ I visit this area at least once a year.

❑ I live in this area part of the year.

❑ I live in this area most of the year.

❑ I am a full-time resident.

❑ Other_____

9. Several casinos in South Lake Tahoe (e.g., Caesar's, Harrah's, Harvey's) used to provide their own independent shuttle services. In October of 2003, these shuttle services were merged into the BlueGO Casino shuttle service. Did you use any of the individual casino shuttles before the services were merged?

❑ Yes (*go to question 10*)

❑ No (*skip to question 11*)

10. Overall, how would you rate the BlueGO Casino shuttle service as compared to the individual casino shuttle services? (Use a scale of 1 to 5, with 1 being "significantly worse than before" and 5 being "significantly better than before".)

	Significantly Worse than Before 1	Somewhat Worse than Before 2	About the Same as Before 3	Somewhat Better than Before 4	Significantly Better than Before 5
Time spent waiting for a shuttle is…	❑	❑	❑	❑	❑
Travel time from origin to destination is…	❑	❑	❑	❑	❑
Number of pick-ups and drop-offs during a trip is…	❑	❑	❑	❑	❑

11. Using a scale of 1 to 5, with 1 being "very negative" and 5 being "very positive", what is your overall impression of transit services available in the South Lake Tahoe area?

Very Negative 1	Negative 2	Neutral 3	Positive 4	Very Positive 5
❑	❑	❑	❑	❑

12. What were your sources of information about the BlueGO Casino shuttle service before using it for the first time? (Please mark all that apply.)

❑ I saw a BlueGO Casino shuttle, computer kiosk, or phone
❑ A BlueGO shuttle driver
❑ Hotel or casino staff
❑ Another visitor or resident
❑ I can't recall
❑ Other_____

13. Do you currently have access to a personal automobile here in South Lake Tahoe?

❑ Yes
❑ No

14. Please check the category that contains your age.

- ❑ Under 21
- ❑ 21 – 35
- ❑ 36 - 55
- ❑ 56 - 70
- ❑ Over 70

15. Please indicate if you are:

- ❑ Male
- ❑ Female

Please add any comments or suggestions you have about transit services in the South Lake Tahoe area:

_____

_____

_____

THANK YOU !!!

Park-and-Roll Passenger Survey

WE VALUE YOUR OPINION! Transit services are an important part of the transportation system in the South Lake Tahoe area. Expanding the use of public and private transit options here is a key element of a plan to reduce traffic and maintain the natural beauty of this very special area. Right now, local government agencies and private companies are working together to find ways to increase the use of transit. We would very much appreciate your thoughts on this important topic.

Instructions: For each question please mark the box corresponding to your answer and return this survey form to the survey worker as you leave the vehicle. Thank you very much for your time.

1. What is your overall impression of the transit services available in the South Lake Tahoe area?

(2)

Very negative	**Negative**	**Neutral**	**Positive**	**Very Positive**
❑ [1]	❑ [2]	❑ [3]	❑ [4]	❑ [5]

2. Thinking now of just Park-and-Roll services, how satisfied are you with each of the following?

(3-7)

	Not at all satisfied [1]	**Not satisfied** [2]	**Neutral** [3]	**Satisfied** [4]	**Very Satisfied** [5]
Easy access to information about the service	❑	❑	❑	❑	❑
Ease of making trip reservations	❑	❑	❑	❑	❑
On-time pick ups	❑	❑	❑	❑	❑
Availability of information about delays	❑	❑	❑	❑	❑
Number of stops to pick up and drop off during my trip	❑	❑	❑	❑	❑

3. Again thinking about Park-and-Roll services, how important to you is each of the following?

(8-12)

	Not at all important [1]	Not important [2]	Neutral [3]	Important [4]	Very Important [5]
Easy access to information about the service	❑	❑	❑	❑	❑
Ease of making trip reservations	❑	❑	❑	❑	❑
On-time pick ups	❑	❑	❑	❑	❑
Availability of information about delays	❑	❑	❑	❑	❑
Number of stops to pick up and drop off during my trip	❑	❑	❑	❑	❑

4. Including this trip, how many one-way trips have you taken on a Park-and Roll shuttle?
(13)

- ❑ **[1]** 1 to 3 trips
- ❑ **[2]** 4 to 10 trips
- ❑ **[3]** More than 10 trips

5. How did you first learn of Park-and-Roll?
(14)

- ❑ **[1]** I saw a Park-and-Roll shuttle.
- ❑ **[2]** At a local hotel, casino, or other attraction.
- ❑ **[3]** Someone I know told me about it.
- ❑ **[4]** On the Internet.
- ❑ **[5]** I can't recall.
- ❑ **[6]** Other_____**(15)**

Into which of the following categories would you put yourself?
(17)

- ❑ **[1]** I am visiting this area for the first time.
- ❑ **[2]** I have visited this area before, but less than once a year.
- ❑ **[3]** I visit this area at least once a year.
- ❑ **[4]** I live in this area *part* of the year.
- ❑ **[5]** I live in this area *most* of the year.
- ❑ **[6]** I am a full-time resident.
- ❑ **[7]** Other_____**(18)**

6. If you are a visitor, how did you get to this area for this visit?

(19)

- ❑ **[1]** Personal automobile or rental car
- ❑ **[2]** Tahoe Casino Express from the airport
- ❑ **[3]** Other shuttle, limo, or van from the airport
- ❑ **[4]** Intercity bus or charter bus
- ❑ **[5]** Other_____**(20)**

7. Within which age range are you?

(21)

Under 21	21-35	36-55	56-70	Over 70
❑ **[1]**	❑ **[2]**	❑ **[3]**	❑ **[4]**	❑ **[5]**

8. Please indicate if you are:

(22)

- ❑ **[1]** Male
- ❑ **[2]** Female

9. Please add any comments or suggestions you have about transit services in the South Lake Tahoe area:

(23)

Please return this survey form to the survey worker as you leave the shuttle.

Thank you