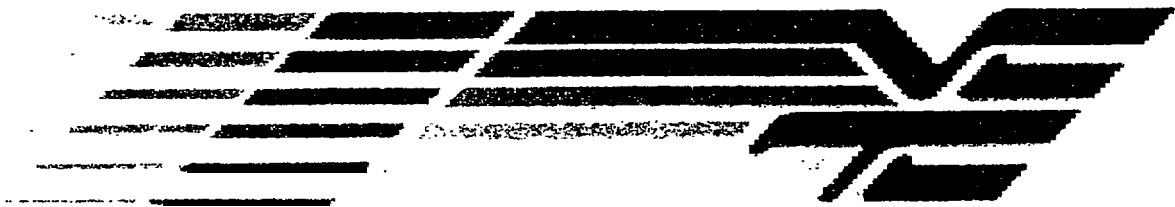


# "Smart Passport"



Ventura County Transportation Commission's

## *Demonstration Project*

Prepared By  
**Ginger Gherardi**  
Executive Director, VCTC

September 1998

## Foreword

VCTC is indebted to the following people for their patience, cooperation, support and assistance with the implementation and operation of the Ventura County Smartcard Demonstration Project. In particular, VCTC thanks Ray Rebeiro and Jacki Bacharach for their written reports used to prepare this document and Steve De George, VCTC staff for his editing assistance.

Antelope Valley Bus Company - Marla Caner, Ron Carter, Roy Mc Daniel, Dennis Sines  
Jacki Bacharach & Associates - Jacki Bacharach  
Caltrans - Vicki Cobb, Hector Obeso, Shara Lynn Kelsey, Pat Reid, Bob Ratcliff, Margaret Moilov, Connie Frayer, Cliff Loveland  
Echelon - Ray Rebeiro, Eleanor Judd, Sandy Miller, Patrick Chang  
Camarillo Area Transit - Kathy Lowry, Tom Fox  
FATCO - Geri Morris, Terrie Metzler  
Federal Highway Administration - Mary Gray, Jane Garvey  
Federal Transit Administration - Sean Ricketson, Walter Kulyk  
Jackie Golub & Associates - Jackie Golub  
Mayerson & Associates - Nancy Mayerson  
Moorpark Transit - Mary Lindley, John Brand  
City of Ojai - Dan Singer  
Partnership for Advanced Transit and Highways (PATH) - Ted Chira Chavala  
Santa Barbara Transportation Company - Ken Stokes, Lee Phillips, Frank Bailey  
Simi Valley Transit - Diane Jones, Ray Turpin, Hibbee Hayslett  
South Coast Area Transit - Peter Drake, Maureen Hooper Lopez, George Jones, Laura Caskey  
Thousand Oaks Transit - Roy Myers  
University of Southern California - Genevieve Guiliano, Jim Moore, Elif Karsi  
Ventura County Transportation Commission - Ginger Gherardi, Laurie Anderson, Donna Cole, Steve DeGeorge, Carlos Hernandez, Kureyn Hopwood, Maureen Hooper Lopez, Adam Martinez, Patty Ramirez, Miguel Rodriguez, Mike Rose, Sally Sabin, Mary Travis  
Ventura County Public Works - Kathy Connell  
Volpe Center - Ross Holstrom, Mike Dinning

# Table Of Contents

Background .....	Page 4
What Is The Smartcard?.....	6
Goals & Objectives.. .....	8
Development of Policies.....	9
Smartcard Start-Up.....	10
Challenges Encountered.....	11
Current System Performanc & Recommended Actions.. .....	15
Has The System Achieved Its Goals?.....	18
Customer Costs & Benefits.. .....	19
Agency Costs & Benefits.. .....	20
Costs & Benefits To Decision Makers & The Industry.....	21
Lessons Learned.....	22
Where Do We Go From Here?.....	24

# **“Smart Passport” Ventura County Transportation Commission’s Demonstration Project**



In January 1996 the Ventura County Transportation Commission (VCTC) began the implementation of an advanced bus pass (fare card media), or Smartcard, called the “Passport,” on all Ventura County transit systems which incorporated a number of emerging technologies. This paper discusses the history of the VCTC “Smart Passport” demonstration project, the problems encountered, the successes, some of the valuable lessons learned from its continuing operation and some possible future directions. It is expected that the University of Southern California will complete an independent evaluation of the Smart Passport at some time in the future, under contract to Caltrans. This report reflects the views of the people and agencies who participated in the Ventura County Smart Passport project.

## **BACKGROUND**

In the spring of 1994 the California Department of Transportation (Caltrans) and the United States Department of Transportation (USDOT) Research and Special Projects Administration’s, Volpe Center, asked VCTC to test an Advanced Fare Media Card, or, Smartcard and other integrated bus data systems that were being developed by Echelon Industries. As Los Angeles County’s northern neighbor, Ventura County (population 720,000) provided a manageable test

bed for this new technology within an urbanized setting. At the time, VCTC was introducing a new intercity bus system called VISTA and a countywide bus pass called the Ventura County Passport that would allow bus riders to travel among and between the **six** independent transit systems in the County.

Prior to the Ventura County Smartcard Demonstration, two earlier phases of the project analyzed the feasibility of several advanced fare payment technologies and field tested several of the technologies on three commuter routes in Los Angeles County operated by Torrance, Gardena, and City of Los Angeles. From the results of the first two phases it was determined that proximity, Radio Frequency (RF) Smartcards were the most accurate, effective and reliable of the advanced fare technologies tested. The Ventura County Passport or Smartcard was designed to field test the operational feasibility of the proximity, radio frequency technology in a variety of types of transit operations. Caltrans would fully fund the project with minimal cost to VCTC and no cost to the operators. At the end of the demonstration period, the operators could keep all of the installed equipment at no additional charge or they could ask that it be removed and have their vehicles restored to their original condition.

Ventura County residents are technologically advanced and receptive as evidenced by the 1990 census which showed that the County had the highest percentage of households in the United States with home computers. The opportunity to use a “state-of-the-art” or “cutting-edge” bus pass was attractive to the VCTC. More importantly, however, VCTC was interested in the Smartcard system’s ability to collect operational data for VCTC and the other transit operators. In addition to testing the passenger’s use of the Smartcard, data was to be collected for functions such as fare collection, passenger counting, and vehicle location and could provide the operating information needed to submit the Federal Transit Administration’s (FTA’s) required National Transit Database (NTDB), formerly called Section 15, reports.

By January 1996, the system had been developed, the necessary equipment installed on most buses and at bus maintenance yards, and several pass outlets had been opened. With that, the VCTC kicked off its “Smart Passport” demonstration project, the first demonstration in the nation to test the use of a common card on multiple systems with different fare values.

Originally seventy-six buses, eight garages and eight sales outlets participated in the program. The buses included various types of vehicles ranging from S-passenger vans to state-of-the-art 40-passenger Compressed Natural Gas (CNG) buses. The following operators have participated in the Smartcard Demonstration:

- The VCTC - VISTA intercity and DAR services,
- The South Coast Area Transit (SCAT),
- Thousand Oaks Transit,
- Camarillo Transit,
- Simi Valley Transit,
- Moot-park Transit.

## WHAT IS THE SMARTCARD?

The Smartcard equipment is actually called FARETRANS VMS (Vehicle Maintenance System) but for purposes of this report is referred to as Smartcard equipment. The Smartcard itself is a radio frequency proximity card. The card has the ability to store, transmit and receive information (data) using a built-in microprocessor and radio transmitter/receiver. Data is stored on the card and includes information about the fares and the user. The Smartcard communicates with the buses through a reader/writer unit called a passenger unit. The passenger unit can “read” information from the card and also “write” information to the card. The cardholder simply passes the Smartcard over the reader/writer to record a fare transaction. As long as it is passed within four inches of the reader/writer, the card can even be used while inside a wallet.

In order to create a commercially viable system, the equipment was designed to combine off-the-shelf modular components so that maintenance and change-outs would be relatively easy. There are three components to the on-board system:

- The driver unit shows the details of the fare transaction, indicates if a card is lost, stolen or defective and shows the time and date. It is also used to input the Bus Number, Route Number, Runs and to set the operating parameters.
- The passenger unit checks the fare card, debits cash, tells passengers the cost of the trip, how much money is left on the card, and identifies the card as a valid monthly pass. It also identifies lost, stolen and defective cards and upon payment adds value to the card.
- The control unit collects transaction data and sends it to the garage and it receives data from the garage on lost or stolen cards, new fares, etc. It controls the driver and passenger units, uses global positioning satellite receivers to establish the location of the bus and controls the passenger counter, speech and other functions.

Base computers are located in each of the maintenance garages. The on-board bus computers download and upload information daily when the bus drives within 900-1000 feet of the garage computer location with a clear line of sight. This exchange is performed in a matter of seconds.

In its entirety, the “Smart passport” system not only tracks fare payments but card usage by type, such as senior or student, by transit system, by route, and by stop. Incorporated within the smart card system is a global positioning system which allows the geographic tracking and timing of bus movements which, when coupled with the data transferred from card usage, becomes an invaluable planning tool tracking at which stop passengers board and alight, the passenger load, and on-time performance. In addition, about 20% of the fleet is equipped with an Automated Passenger Counting system to count all boardings and alightings by stop. Each bus is equipped with a spread spectrum local area radio for automated data upload and download.

The Smartcard provides seamless fare and transfer payments within and between agencies. Smartcards are accepted on all public transit fixed route services and Dial-a-Rides operated in Ventura County. The goal was to create a uniform overlay fare structure while permitting individual operators to continue their own local fare structure and media with the technology

providing a seamless system for the rider Smartcards are accepted on all systems for the following fare types:

Passport Monthly Pass - accepted by all of the operators: Prices are \$40 for adults, \$30 for students, and \$20 for seniors/disabled. There is also a \$16 upgrade for both the Dial-a-Ride and the new conejo Connection VISTA service. The monthly pass may be used for an unlimited number of rides during the month for which it was purchased.

Passport Cash Debit - A Debit card was provided because the various transit operators have different fare structures and it was considered an attractive option for the occasional rider. The debit card is sold in \$10 increments with a \$1 bonus for each \$10 purchased and requires a minimum \$10 purchase. The debit feature is used to allow electronic cash fare payment at the local operator's rates for each ride, rather than on a monthly unlimited ride rate.

Smartcard sales are administered by VCTC with outlets throughout the county. The Passport may be purchased and/or re-charged in person at VCTC, SCAT, FATCO, Santa Paula, and at Simi Valley, Thousand Oaks, Moor-park and Camarillo city halls. Each outlet uses a computer with the Fare Transaction Systems (FTS) software for card sales.

Patrons also can renew their monthly passes or add value to their debit card on all buses, by check or money order only (Camarillo will accept cash) except on the SCAT and Moor-park systems which do not allow any on-board recharging. So that the card holder will know whether they need to re-charge their debit card, there is a warning tone and message on the passenger unit when the patron's card is at a \$5 value or lower. All other sales are by mail or phone. The VCTC is the only agency which accepts credit card payment for Smartcards. Because the cost of each card is \$5 to \$6 there is a \$5 charge for replacing a lost card.

As the debit card is used, the correct fare is deducted and data is transferred and stored aboard the bus. At the end of each day as the bus enters the maintenance facility, the data collected during the day is automatically transferred to the garage computer via Radio Frequency (RF) as the bus drives past the reader. The data collected in the garages throughout the County is then uploaded to a central computer for data retrieval, dissemination and fare reconciliation.

Originally, sixteen of the 76 buses in Ventura County were equipped with automatic passenger counters (APCs), which work through infra-red beams in the bus stairwells. The sequence in which these beams are broken determines whether the passenger is getting off or on the bus. The intention was that operators would rotate the APC equipped buses on their routes so that passenger counts could be taken on each route at a frequency that would fulfill the federal Section 15 (NTDB) reporting requirements. Additionally, because the counters are linked to a global positioning system, the operators can receive operational and planning data, such as boardings and alightings and schedule adherence, for planning purposes.

After the system was in operation for some time it became apparent that to facilitate the reporting and Section 15 process, more buses would need to be equipped with APCs and 24 units were subsequently added to fully cover the VISTA Camarillo and TOT systems. In July 1998, to improve data collection, the Commission decided that all buses in Ventura County should be equipped with APCs.. To accomplish this, 35 additional Automatic Passenger Counters have been ordered (SCAT, 26 units; Simi Valley, 7 units ; and, Moorpark, 2 units) along with Smartcard units needed to fully equip all SCAT buses and the new Conejo Connection buses. In addition, spare units have been ordered to provide each operator with back-up replacement units at each of their bus maintenance facilities. It is expected that all the new equipment will be delivered, fully installed and operational by December 1998.

As part of the demonstration project Echelon also conducted a short term test of passenger information displays on the Thousand Oaks buses, similar to silent radio. This helped to better understand installation and operational issues such as what would be required to build such equipment, would it impact other on-board systems and what memory was needed. This equipment was subsequently installed in the Torrance project and continues to be in operation today.

## GOALS & OBJECTIVES

There were several goals for the project and their relative importance varied with each agency involved. For the federal and state governments as well as Echelon Industries, the primary goal was to use this test to advance the Smartcard technology for commercial use. Echelon Industries wanted to demonstrate how this could be accomplished with off the shelf components. All of the agencies involved were interested in creating:

- Integrated fare system
- Accurate planning data
- Equitable revenue distribution.
- Accurate and automated National Transit Database reporting
- Increased ridership
- Customer convenience - i.e. satisfaction
- System performance monitoring

VCTC and the operators thought they would be testing a fully designed system, whereas, Echelon's intention was to continue to develop the system, building on their knowledge and experience by designing new hardware and software. Unfortunately, Echelon's testing and re-design required ordering new equipment from vendors who they had not previously dealt with and ultimately this led to delays in delivery.



## DEVELOPMENT OF POLICIES

With six independent transit providers participating in the project, a number of policy and turf issues were expected. In the early stages of the project the administrative staff of the participating agencies met monthly to develop operating policies and monitor the progress of the demonstration project. There was a tremendous spirit of cooperation among the agencies and for the most part the issues that emerged were resolved easily.

Perhaps the area that was the simplest to resolve had to do with revenue sharing. VCTC staff acts as the “clearinghouse” for the revenue. The cities and/or outlets fill out a reconciliation form and send the money (or a check) for the monthly passes, renewals or debit card payments they have received to VCTC. The operators agreed to share revenue based on actual “usage” of the Smartcard as reported by the Smartcard system. VCTC prepares a draft quarterly payment schedule and after the shares have been approved by the various operators, issues the checks. At the beginning of the demonstration, when the equipment was not installed or working on all buses and was not yet reliable, revenue was shared based on estimates by individual agencies based on manual counts.

Other policies needed to be developed about how the equipment on the bus was to be used. Because of the differing structure, equipment and size of the various transit operators, some of the policies could not be applied uniformly. This meant that the equipment had to be programmed to perform differently for several types of transactions. This was not a problem, but was an additional challenge and added complexity. For example:

- All operators except SCAT initially allowed cards to be re-charged on the bus. Moorpark subsequently joined SCAT in prohibiting bus re-charges.
- All operators except SCAT allow the rider to ‘go negative’ up to \$5.00 on their cards. This means that if the card does not have enough value on it for the ride, the value of the card will become negative and when the card is re-charged the amount owed will be automatically deducted and collected.
- In order to prohibit a passenger from passing his Smartcard monthly pass back to the person behind him in line so that they could use it, the passenger unit on the bus was programmed to have a six second lockout which would not allow the same card to be used again as a monthly pass within six seconds. For Simi Valley, this was not considered enough time because their students enter the buses in long lines and would still have time to pass their monthly passes back. Therefore, they requested a four minute lockout which was added on all systems for the monthly pass. A six second lockout remained for the debit card, since this card could be used by multiple riders to pay the appropriate cash fare, as long as each of the riders was eligible for the rate programmed into the card, ie: adult, student, senior.



## SMARTCARD START-UP

As mentioned previously, when the opportunity to test the Smartcard was presented to VCTC by Caltrans, VCTC was preparing to launch the VISTA Bus Demonstration project. VCTC staff and the local operators thought a “temporary” plastic monthly pass would have to be used until the Smartcard was ready to be implemented in a couple of months. VCTC agreed to participate in the Smartcard project in June, 1994 and expected the system to be fully operational no later than November, 1994. For reasons beyond the control of Echelon or Caltrans staff, various delays with the grant and/or equipment caused the project to start approximately a year and a half later than expected, in January 1996 and it was not fully operational until mid-1996. Since it was all new equipment, both hardware and software, changes and modifications were literally on-going over the course of the demonstration. The complexity of installing and operating the diverse system components on the different types of vehicles in Ventura County was more significant than originally anticipated.

Caltrans designed the Ventura County Smartcard or “Passport”. VCTC created a “Get Smart” marketing campaign in English and Spanish, which included several newspaper and radio ads, Smartcard information and applications on the VCTC website, [goventura.org](http://goventura.org). Because of the delays, VCTC used some time and money designing advertising and promotions that were never used. Developing a marketing campaign requires substantial planning and radio spots, particularly at the holiday season, need to be purchased in advance. Fortunately, VCTC was able to substitute the radio spots for VISTA transit ads and was able to modify and use some of the holiday ads the following year.



Early in the project it was recognized that VCTC staff was too small to take on project management responsibilities to implement the Smartcard program. Caltrans agreed to provide funding for a "Project Manager" to oversee all aspects of the demonstration project including coordinating and facilitating meetings of the operating committee, Caltrans and other participating agencies. Jacki Bacharach, Jacki Bacharach & Associates, was retained for this purpose. Additionally, the Federal Highway Administration's Volpe Center also hired a team from the University of Southern California, University of California at Berkeley and the University of California to independently evaluate the demonstration.

Before the Smartcard began, a site visit was made to each operator by Echelon and the Project Manager to determine the locations for computers in maintenance garages and see if there were any other equipment or logistical problems. The availability of a phone line and the position of the computer was critical so that the buses could download and upload information daily via modem to the central computer at Echelon's offices. During this visit, the program was explained to the operations and maintenance staff.

In January 1996, the program began. Smartcards replaced the plastic passport but were used still as flash passes with monthly stickers for the first few months until the Smartcard fare collection equipment was fully operational in March. After March, sales began for the Passport debit cards as well as Passport monthly passes. Passengers were informed that they would now need to place their Passport/Smartcards on the passenger units and the program was fully operational with both monthly pass and debit card options. The Automatic Passenger Counters were not fully installed until the middle of 1996 and the first complete set of quarterly reports was produced in November 1996.

## CHALLENGES ENCOUNTERED

Although the Smartcard system seems to be working reasonably well now, there were many problems getting the program up and running, adjusting to changes in equipment and software and dealing with unforeseen circumstances. Perhaps the most significant problem with the Smartcard program was differing expectations.

Because VCTC was not involved in the grant process or in project scoping meetings, two very different views of the ultimate project were held. Caltrans and Echelon looked at the Smartcard demonstration as a system development project designed to test off the shelf components in the formation of a stable working system. VCTC's understanding of the project was one of the testing of an already designed system in a controllable and friendly environment. In essence, Caltrans and Echelon were implementing a "development project" whereas VCTC thought they were implementing a "deployment project". There was a commendable degree of patience

exhibited by almost everyone involved but that wore thin with the continual changes and adjustments. The program took over one year to begin to “settle down”.

For some time the VCTC Smartcard system was the only RF proximity card in operation in the United States; others are now in operation. Certainly the Ventura Smartcard system has been in revenue service for the longest period of time. No one knows what the actual “life cycle” of the system or components will be in continuous operation. Clearly, the Smartcard equipment needs to be tested and tracked over a much longer period of time before being certified for regular usage in other systems. Recognizing this fact, VCTC has contracted with Echelon to continue to fully maintain the system and produce any and all required reports for an 8-month reliability stabilization period.

In an effort to assist other agencies who are contemplating the implementation of a Smartcard system, listed below, in categories, are the various challenges that VCTC encountered during the Smartcard Demonstration.

#### Management of the Demonstration

- VCTC started the new VISTA bus service using temporary plastic “passports” with monthly stickers before the Smartcard was ready making it difficult to determine what additional ridership was directly attributable to the Smartcard. However, we do know from surveys that riders have traveled farther and tried more routes because of the availability of the Smartcard.
- Monthly meetings should have also been held with operations and maintenance department personnel rather than just administrative staff. We have now instituted a regular “technical” working group to identify issues and improve coordination and communication.
- Financial and “clearinghouse” functions were not included in project design and scoping and VCTC literally had to institute financial procedures overnight, as the project got underway.
- The complexity of the system required changes in the hardware and software design, particularly as operators gained first hand experience with the Smartcard equipment. It became very clear that significantly more than the one year planned was needed to fully install and test the system. VCTC addressed this issue by getting Caltrans to extend the grant.

#### Garage/Computers/Phones/Operator computer Experience

- Most of the operators did not have computers or dedicated phone lines and modems for the Smartcard program, and those operators willing to provide computers found that they were networked and the Smartcard use would breach their network’s security. VCTC eventually bought stand alone computers, dedicated to Smartcard use for the cities of Simi Valley, Camarillo, Santa Paula, as well as Santa Barbara Transportation Company and FATCO.
- At the start of the program computer literacy varied greatly from operator to operator and although self explanatory software was developed, it was not sufficient to overcome the

limited basic computer skills possessed by many of the outlet staff. It was necessary for Echelon and VCTC staff to work with each operator's staff individually to provide adequate training and easy to understand documentation to operate the Smartcard system.

- The original software operated through Windows 3. I. However, since new computers only came with Windows 95, the software had to be converted to Windows 95 in the middle of the Smartcard program. In addition, a decision was made to switch from "Access 2" to "Access 97" for the program base. This generated additional software changes and program modifications.

### Bus Equipment

- Equipment was not delivered to Echelon when they expected it and they had to work during non-revenue operating times to assemble the components and meet the installation schedule, which resulted in considerable overtime.
- Each of the operators used different types of buses or vans requiring different configurations for equipment installation, even within a single agency, and each had its own unique set of problems, from RF interference to depletion of the central unit's batteries. Each installation required one or more customized "solutions" and had to be "tweaked" according to specialized needs.
- Unknown to VCTC or the bus operators, Echelon tested 7 to 8 different G.P.S. receivers, 4 to 5 spread spectrum (radio) receivers and other parts of the system such as displays and printers. The unfamiliar performance as well as beeps and noises confused and annoyed bus operators, giving the impression of an unreliable system
- Throughout the project period there were changes in bus service and equipment used by the operators. Thousand Oaks ordered four new CNG buses and Camarillo changed from a predominantly fixed route service to a primarily Dial-A-Ride service and added new vans. SCAT received delivery of a large number of CNG buses and a new conejo Connection VISTA service began. In January/February of 1999, Simi Valley will take delivery of new CNG buses. All the Smartcard equipment had to be removed and reinstalled on the new buses.
- One technical challenge that was overcome dealt with power surges caused by the CNG Fueling station beginning its compression process knocking out the garage computer from the SCAT CNG buses.
- There were several unique downloading problems to the garage computers that required solutions: buses serving the Oxnard Transportation Center, located within 1/2 mile of the SCAT yard, or passing the SCAT facility en route tried to download information; and, as the buses came down the street to enter the yard in Simi Valley they were close enough to turn the computer on before they entered the yard for downloading.
- Some of the units on the buses beeped when they did not function properly, annoying the bus

drivers; the beep tone in the fare system was too similar to the CNG system warning beeps.

- Batteries that were supposed to last for at least five years wore out after one year, perhaps due to interaction with the ADA required wheelchair lift equipment, a problem which has now been corrected. .
- Sporadic electrical surge problems continue which disables the driver and or passenger units on some of the buses; a problem we are working to resolve.
- In some cases, there were only one or two riders using Smartcards in a day so drivers became lax in reporting problems.
- The Smartcard equipment was installed and is maintained by Echelon, separately from the rest of the bus maintenance. The operators have no idea how it works or how to maintain it, so they couldn't troubleshoot problems. Since most operators could not take a vehicle out of service to be worked on, there were only limited times, mostly on weekends, that the buses were available. This caused the maintenance and or repair period to take much longer and increased the amount of time a vehicle would operate with a defective Smartcard unit. Most of the "defective" equipment is simply removed by Echelon and replaced by a working unit. Repairs to units are performed off-site. In August 1998, after training by Echelon, in an effort to reduce down time, the operators agreed to try to swap out any malfunctioning driver and passenger units, replacing them with a spare unit from a supply stored at the operator's maintenance facility.

## Reports

- The continual adjustments and changes and lack of automatic passenger counters on all buses, made the early reports unreliable. In April 1998, VCTC provided Echelon with data that showed the passenger reports were inaccurate when compared with actual driver counts. Echelon checked the on-bus statistics and concluded that the software program was deleting some records, a situation which has been corrected. Interestingly, the operators have been satisfied that the reimbursements made based on the Smartcard reports are more accurate than the old manual method. This phase of the project cannot be considered complete until the actual transaction data from the system is reliable and accurate to meet the fiduciary needs of the participating operators and VCTC.
- Driver requirements for the Smartcard operation were purposely kept to a minimum. Even though the driver does not enter the bus number, the driver must enter his own number and the route number. Approximately 30-40% of the bus route designations entered into the Smartcard system were wrong, significantly complicating the reporting function. . On some routes that are interlined the drivers are not re-setting the route numbers when the route changes. With hardware changes, Echelon believes that eventually this can be rectified perhaps by tying the driver unit component to the destination sign so that the change is made automatically with the change of the destination sign.
- Reports from the system were first received and scrutinized in June 1996. There were data discrepancies and inaccuracies in the reports received and although they improved over time,

the operators still remain wary of their reliability and accuracy. VCTC discovered, in June 1998, that Echelon hadn't been provided an up-to-date listing of all the bus stops and schedules in their database. VCTC has now thoroughly checked each stop with all operators and in late August will have interns physically go to each bus stop with the Smartcard GPS device to record the exact location of each bus stop. This should greatly assist with the reporting function. On-going, regular updates will be provided in this operating phase.

## **CURRENT SYSTEM PERFORMANCE AND RECOMMENDED ACTIONS**

Except for the system start-up VCTC has not invested much effort in advertising or promoting additional Smartcard usage. Smartcard usage on the various bus systems throughout the County varies widely, with SCAT having the lowest percentage use of .4% and Camarillo Area Transit having the highest usage at 18.7% of all boardings. In Camarillo, the seniors have realized that the monthly pass is an exceptionally good deal on the City's Dial-A-Ride system, which accounts for the high percentage of use. The Smartcard accounts for about 16% of the boardings on VISTA the intercity bus system.

SCAT, the largest bus operator in the County, offers its own monthly pass and coupon program (10,20,or 30 rides) that about 17% of their riders use. Because it is priced lower than the Smartcard, it is more attractive for passengers staying solely within the SCAT boundaries. Simi Valley also has a tear-off coupon book that riders can use. Most of the bus riders in the county are low income and transit dependent and use monthly passes if they have the available cash flow to make the one time purchase. Because of these demographics, cash will likely remain the predominant method of paying a fare.

Once the official demonstration period ended, VCTC entered into a contract with Echelon to maintain and repair the Smartcard equipment as well as to prepare monthly and quarterly reports. The decision to contract for this service was made because it was clear that none of the operators had the technical expertise to maintain the system and the amount of staff time required to review the voluminous downloaded data and develop reports required the effort of a dedicated full-time staff person not available at VCTC. With the contract, VCTC would also be able to take advantage of any upgrades that were developed.

In order to gauge the current performance of the Smartcard system, Echelon has provided VCTC with an in depth review of the April 1998 Smartcard performance records. The purpose of the review was to determine how much of the revenue operating time the Smartcard equipment was operational. Below is a summary exhibit (Table 1) of the total bus download statistics report for April, and Attachment (A) shows the complete report. What this table really shows, however, is accessibility to equipment problems, rather than a reflection of system stability.

Table 1 shows the total number of transactions per bus, per day for select bus systems or routes. The records could include test card transactions, bus turn on transactions, fare card transactions and accumulated APC transactions (boardings and/or alightings), giving VCTC a fairly good way to assess whether or not the Smartcard equipment was operational. It is important to note that if there is no record for a specific bus showing transactions on a certain date, it does not necessarily mean that the Smartcard system was not operational on that day. It could also mean that the

specific bus was not in service on that day in question, i.e., the bus was in for repairs or scheduled maintenance. With these caveats in mind the following are some summary statistics.

Table I

AGENCY	TOTAL BUS DAYS	TOTAL BUS DAYS WITH MISSING FARETRANS DATA	% OF BUS DAYS SYSTEM NOT OPERATIONAL
Simi Valley	165	15	9%
Thousand Oaks	96	14	15%
Vista 101	44	6	14%
Vista Plimore	44	4	10%
SCAT	360	74	21%

These statistics suggest that for every 100 bus days, the Smartcard equipment is operational 80% to 90% of the time. It is important to recognize that this estimate also reflects the total downtime taken for “repair.” In other words, the fare card equipment might be out of service for 5 days. This includes the time for the bus company to identify that equipment was not operational, the time to set up an appointment to remove and replace the “defective” equipment, waiting for the appointed time, and actually removing and replacing “defective equipment.” Although the process of removing and replacing the equipment may only take 15 minutes to a 1/2hour, the system on the bus was out of service for 5 days. .

From the Table 1 it is clear that the operators with restricted access policies have significantly worse downtime performance. SCAT, for example, has a fleet with the highest percentage of spare buses at 25%, yet it is very difficult for Echelon to get access to the buses to change out any defective equipment. To make certain that Echelon promptly follows up on repair requests, VCTC asked the operators to fax copies of all problem/repair requests to VCTC, so that we can follow up and make sure the problem has been corrected.

Recently, to minimize the downtime of the Smartcard equipment the bus operators have agreed to swap out defective/suspect equipment (basically plug and play, not repairing the actual unit) by using some spare units that will be provided by VCTC and Echelon. Echelon will provide training for the operators and it is expected that equipment downtime will be reduced in a dramatic way. The operators have also agreed to keep better track of when failures occur in an effort to assist Echelon in identifying cause the problem.

It should be pointed out that equipment failure affects the fare card operation and the fare card reporting statistics. However, since 80-90% of Smartcard users are monthly pass holders, letting a passenger “ride free” when the units are not functioning properly (between 10-20% of the time) has had almost no effect on the farebox. Occasionally, some debit card holder may get a free ride, which is a lost fare. However undesirable, the impact on the farebox recovery is negligible. For example, based on the April statistics the potential impact on the SCAT farebox recovery, our largest bus operator with the highest percentage of downtime, is .0076 %.



The reporting statistics are factored to accommodate the “lost” transactions. The downtime of the equipment does not materially affect the passenger count reporting since there is more than enough data to establish ridership and usage patterns. A review of the data download statistics suggests that there is usually more than sufficient data to create accurate factored fare card usage totals.

To illustrate this, Echelon prepared a comparison between the raw and factored FTS data and the counts done by the “drivers” for Moor-park (driver count data was supplied by the Moorpark via the VCTC). The results are as shown below. It is also necessary to point out that the fare card recording performance does not affect the Section I5 type counts since only fully “operational” count days are used for this analysis. Daily sampling on all lines is far more accurate than FTA approved ridership sampling methods.

**Table 2**

<b>MOORPARK</b>					
<b>Periods</b>	<b>Smart Card Transactions: Driver Counts</b>	<b>Data Collection Days</b>	<b>System Operating Days</b>	<b>Actual FTS Transaction Counts</b>	<b>Factored FTS Transaction Counts</b>
January	186	15	21	133	186
February	239	14	19	184	248
March	226	16	22	172	235
<b>Total</b>	<b>651</b>	<b>45</b>	<b>62</b>	<b>489</b>	<b>669</b>

The data analysis done, including the example above, suggests that, when the equipment is working, the Smartcard equipment produces accurate records of card and other transactions. This means that the fare card transactions records can be used to determine on-bus card usage by agency if

- The failure rate is reasonable and similar between agencies.
- If buses are not moved from agency to agency.

Typically buses are not moved between agencies, but Echelon has coded Vista Santa Paula, Vista 101, Vista 126, Vista East, etc., as separate agencies in order to collect statistics on individual operations. It appears that Santa Barbara Transportation moves buses between services, e.g., Vista 126, Vista Santa Paula DAR, which has caused a problem with the statistics since they are tabulated on an Agency basis. Echelon is working with the operator to address this problem.

Currently, 9 SCAT buses do not have Smartcard equipment installed on them. To get reasonably accurate information about the SCAT system the buses that are equipped are rotated in service so that the transactions are appropriately sampled. For example, SCAT’s FY 97 Section 15 reports were done using the 9 buses in SCAT that were equipped with APC’s. The sampling method used was acceptable to the FTA and it forms the basis for Federal apportionments. By rotating the 20 buses that are equipped with Smartcard units, a reasonably accurate survey of fare transactions is possible.

In July 1998, the SCAT Board of Directors and the Ventura County transportation decided to fully equip the SCAT fleet with both the Smartcard units and the Automatic Passenger Counters (APCs) through our federal Program of Projects funds. With these actions and the recent repair assistance offered by the operators, it is expected that overall Smartcard performance will markedly improve in the 8 month reliability testing period.

## HAS THE SYSTEM ACHIEVED ITS GOALS?

VCTC staff believes that the system has addressed and exceeded its goals. The system accommodates interagency and corporate fare card usage. It utilizes vehicle location, local area radio, automated passenger counting and it uses speech production for fare transaction “corrections”. Speech production for bus stop announcements and printing of receipts/transfers were tested in our demonstration, however the budget did not permit system wide installation.

From the user’s perspective, the system worked and encouraged additional transit use. The Smartcard is a convenience for those who used it. Disposable cards with lower values might be an attractive addition for social service agency clients in the future. Smartcard users were understanding of the test and took the program’s ups and downs well. The users were minimally inconvenienced by any malfunctions and they were supportive of participating in a demonstration of new technology

This demonstration was also used to complete the development of ancillary system elements such as Automated Passenger Counting, improved fare card reporting, and improved technology integration. Over the last few years the following has been accomplished:

- Developed a uniquely American Automatic Passenger Counting program that is believed to be the most technically advanced, yet cost effective system available.
- Implemented an automated data upload/download (data transference) system that does not require operator intervention. The first of its kind anywhere.
- Created the “only” truly seamless bus fare card system in the USA where the passenger can travel on any part of the transit system in any area and pay the correct fare or transfer without operator intervention--and have appropriate reporting of the activity.
- Provided a leadership role for the entire US Transit industry regarding RF or proximity fare cards. The results of the work in Ventura have been used to change the position of the transit industry regarding fare payment technology.
- Recently completed testing (initiated in Ventura County and completed in Torrance) of the following subsystems:
  - Automated bus stop announcement systems using large displays and computerized speech.
  - \* Bus signal priority system using the same technology that uploads/downloads data.
  - \* Advanced wide area radio for AVL that does not require FCC licensing; a massive breakthrough.
- Showed conclusively that off the shelf non-proprietary systems can be used in public transit to achieve significant reductions in (acquisition) costs.
- Showed that a fully integrated system with fare transactions, bus stop announcements, signal

control, passenger counting, vehicle location, transfer printing and scanning, emissions monitoring, and automated data communication can be made and made cost effectively.

The Smartcard is most successful in the commuter market The Vista 101 line which has commuters going from Thousand Oaks to the County Government Center shows the largest use of debit card riders, about 20 to 30 per month. It is expected, therefore, that there will be a large number of new Smartcard users on the VISTA Conejo Connection bus which travels to and from Warner Center in Los Angeles County and began service on August 10, 1998.

The Smartcard Demonstration enabled some agencies and operators to try some unique applications for card sales. At FATCO, two vendors buy Smartcards for their patrons - the William L. Morris car service (also, the owner of the FATCO Dial-A-Ride) and the Fillmore Senior Center. Their respective Smartcards are kept in the FATCO vans and when a passenger rides to or from either of those two stops, the driver uses the 'company card' to pay for the ride.

Similarly, the Santa Paula Hospital Clinic also purchases several monthly passes which are kept on the Santa Paula Dial-A-Ride for use by patients going to and from the low cost clinic. This concept will soon be expanded into Fillmore when the Santa Paula Hospital clinic opens there. While Camarillo State Hospital 'was in operation, it prepaid \$5,000 in fares through a purchase order and received a number of Smartcards which were used on a debit basis for their employees and the foster Grandparents program volunteers. Even though the hospital has since closed, through the Smartcard transportation is still provided for some former patients, now mainstreamed throughout the County.

The Smartcard provides a great deal of flexibility in that it allows unique applications to be incorporated into the program. Right now, for example, the SCAT system produces its own monthly bus pass, specifically designed at the lower cost for those bus riders who do not travel outside the SCAT system. The Smartcard could be programmed to also provide a SCAT-only bus pass option (like the existing Dial-A-Ride only option) where all of those revenues would be returned to SCAT. This approach could reduce overall operating and printing costs for the SCAT Agency and may be something for the transit operator to consider in the future.

"I'm still a woman  
of independent means.. ”



## CUSTOMER COSTS AND BENEFITS

Through a phone survey VCTC was encouraged to find that Smartcard users have a positive attitude toward the Smartcard. They felt it was easy to use, gave them good value, and there was no longer a need to carry exact change. It is difficult to determine whether there were any

Significant increases in ridership specifically due to the Smartcard program. However, interviews with users determined that because of the ease of use of the Smartcard, existing riders stated that they used transit more often and tried different routes.

Assuming the system continues as is, the costs to the present customer includes periodic inconvenience when the fare card or the bus equipment fails. However, this inconvenience should be minimal since the customer is allowed to ride regardless of system failure. The amount of inconvenience to the customer as a result of system failure will be directly related to the attitudes of the drivers and outlet operators. One indication that the “inconvenience” might be minimal is the fact that fare card usage is reasonably constant from month to month without significant marketing.

In reality, the Smartcard system provides the customer with benefits that are greater than the benefits experienced with the previous fare card or pass system. With the Smartcard, the customer can recharge cards at a variety of outlets including on the bus. In addition, if the card is lost or stolen, the customer can regain the remaining value and the lost card can be voided overnight.

The customer also has a greater choice with regard to type of fare card. The card provides the flexibility to match anticipated bus use with the best “buy” for the transit rider. If a rider only uses the bus occasionally but needs to cross between bus systems, a debit function may be the best choice. On the other hand, for daily riders a monthly pass, perhaps including a Dial-A-Ride upgrade, may be the better choice. However, as important as these benefits are, the most important benefit is the ability to access any of the buses in Ventura County without having to worry about fares or transfers. Ventura County is providing today the most advanced seamless fare card system in the world.

In essence, **the Smartcard system as it exists today provides a significant improvement in customer convenience** for those customer who use the fare card. Any initial negative experiences that the customer may have had with the Smartcard today have been mitigated by the activities, attitudes, and approach of agency staff and operators. To the extent that today’s negative experiences are related to equipment and card reliability, we expect these occurrences to improve as the reliability of the system improves. **Clearly, the Smartcard benefits to the customer vastly outweigh the customer-related disbenefits, costs, and/or inconveniences.**

## **AGENCY COSTS AND BENEFITS**

There are various partners involved at this point in the project. They include the outlet (card issuance/recharge) operators, drivers, maintenance staff, planners, the contractor, funders and management.

With the exception of the VCTC, none of the agencies have incurred capital costs or have had their operating costs increased to accommodate the Smartcard equipment. The activities involving the Smartcard are essentially:

- Issuing and recharging cards
- Dealing with the public on issues of lost, stolen, and defective cards, and inoperative

- equipment.
- Reporting on-bus equipment failure.

For the most part this involvement is minimal, with the exception of VCTC, and takes just a few hours of staff time per month. With operators agreeing to become involved in replacing any defective equipment, the system reliability will be improved. It is not expected that this effort will take a significant amount of time, however, if the effort becomes labor intensive for the operators, it will be discontinued.

Related to this “problem” is the perception that the statistics gathered for the system are inaccurate or not representative. Certainly if equipment downtime is not accounted for in the analysis then the statistics can be misleading. However, when the equipment is operating the record of card usage is 100% accurate.

The following information provided by the Smartcard system is essential for public transit operators in Ventura County:

- Reporting on fare card usage to allow for distribution of fare revenues between agencies.
- Production of Section 15 reports. (For SCAT this activity is worth up to \$50,000 if it were to be done by outside consultants and a \$15-25,000 savings for the other transit operators reporting statistics.)
- Production of ridership and other statistics on an as-required basis for agencies wishing to understand individual route performance.

The reporting benefits listed above relate primarily to reporting on fare card sales and usage, and on customer profiles. Although some ridership statistics (including Section 15) were provided, generalized data for planning has not been provided to the transit agencies. There were many reasons for this, but the primary reason was that the passenger counting analysis proved to be extremely complex.

## **COSTS AND BENEFITS TO DECISION MAKERS, AND THE INDUSTRY**

In addition to the customers, i.e., passengers, and agency staff, there are other “team” members that incur costs and derive benefits from the Smartcard program. These include the senior management and elected officials in Ventura County, the transit industry, and Echelon.

The costs to the senior management and elected officials include (possibly) some small increases in staff frustration, some very small increases in staff work load, and periodically some possible negative responses from a few passengers. No capital or operating cost increases are expected. In contrast, the present and future Smartcard program provides Ventura County with the opportunity to maintain a leadership role in advanced transportation technology in California or, for that matter, in the world. In addition, the exercise provides staff the opportunities to learn valuable lessons about technology integration for the least possible costs (if they desire to exploit this opportunity).

## LESSONS LEARNED

When VCTC and the various transit operators agreed to participate in the Smartcard Demonstration, they thought they were getting involved with a fully designed, “off-the-shelf” system that was merely going to be “tested” in their county. As VCTC never received a copy of the grant proposal or contract between Echelon, Caltrans and Volpe, it was many months before VCTC realized that the objectives of the participating agencies were very different from their own

Echelon, Caltrans and Volpe’s emphasis was on the development and testing of “technology.” No planning was given by them to the more mundane policy decisions like who would handle the money, how would revenue be shared, what responsibilities were required by the various operators, etc. These “clearinghouse” type functions, handled by VCTC, were an afterthought, put in place after the demonstration had begun. Whereas in many places issues of “turf” could cloud the development of policy to benefit the community as a whole, VCTC was extremely fortunate because of the excellent cooperation between the various Ventura County transit operators and elected officials which allowed us to resolve these sorts of policy issues with very little difficulty. Clearly, any transit agency embarking on a Smartcard program needs to:

- Give serious consideration the “clearinghouse” and other financial implications.

If the transit agency is not fully involved in the design of the program, which is preferable, they should be fully included in:

- Development of the articulated goals of the program
- Understand what opportunities might alter the direction of the Smartcard program.

Originally, the goal was to provide each operator, via the Smartcard program, the tools to perform their own Automatic Passenger Counting (APC) analysis. The APC analysis process has proven to be much more difficult and complex than originally envisioned. This results from: limitations and inaccuracies in stop definitions; use of flag stops; drivers not correctly recording route and run number (a problem throughout the United States with new technology systems); the use of interlining ( for example: one bus completes a trip on Route A and then continues on Route B and then goes back to Route A, alternating between the two routes continuously) ; limitations in GPS ( vehicle location/heading) readings; drivers not always following defined routes; and, equipment failure etc.

These problems required that a reasonably complex process be developed to conduct APC analysis. The training required to conduct this analysis involves use of the APC analysis program, use of a Geographic Information System (MAP INFO) software, use of Microsoft Access, and knowledge of statistical sampling as well as control of vehicle assignments. Although, not initially intended, it has become clear that full-time dedicated staff is needed to perform this function on a continuing basis. It is not reasonable for small transit agencies to have staff dedicated for this purpose. The economies of scale may dictate that the advanced bus technologies are best implemented through long-term professional service contracts that include design, build, operate

and maintain responsibilities.

- **The opportunity to contract for APC analysis is an acceptable alternative for small transit systems such as those in Ventura County.**

Another original concept that is no longer in use is the feature where the rider could call the VCTC and using a credit card, request that their card be recharged the next time they used the card on a bus. This capability was operational and 50 to 100 cards were recharged in this manner. However, this procedure has stopped because it was inconveniencing the majority of card users so that a few could benefit. At present the Smartcard system does not have a wide area radio (coverage all over the County) with real time operation (i.e., the buses being in constant contact). This limitation creates a significant restraint on the remote recharging feature.

- **When a real time, wide area radio system, is in operation remote recharging on the bus system is appropriate.**

The Smartcard project was valuable because solutions were found to developmental and operational problems under a wide variety of conditions. This learning process will be of great value to future transit operators. Importantly, it was learned that the only way to really understand new technologies and what they will mean in practice is to field test them. And, being flexible and patient is the key.

From a technical standpoint, the project has been successful. The knowledge gained from field testing various and diverse components will advance the state of the art for the entire industry. The Ventura County Smartcard Demonstration has provided an incredible opportunity to integrate various automated systems together in revenue service and constitutes some of the most important testing conducted in the United States regarding this technology.

The lessons learned here will result in the only published information in the United States (other than what is available from vendors) regarding performance and reliability of different fare card systems, G.P.S. receivers, and other components. This work has been and will be influential in formulating the view of the industry concerning seamless fare systems.

Although there were a number of benefits the VCTC had expected and received from the Smart Passport project there were some surprises along the way. One such surprise was in the on-time performance category. Although there is little recurrent congestion in Ventura County the VCTC and the other transit operators in the county were very interested to know if their buses were running behind schedule. What VCTC found was surprising:

- **Buses were often running early.**

For the most part the Smart Passport project worked as promised. It collected and disseminated data, but was it in the proper format and did it provide reports that were really needed? In VCTC's case the answer was, "Sometimes." VCTC staff did have the opportunity to help design some new reports not originally envisioned in the project to show where Smartcard sales/renewals were sold and where the cards were actually used, to help with revenue distribution to the operators. Most of the problems would have been easily overcome or avoided altogether had VCTC been involved with the design of the project from the start, rather than simply "testing" the

project in a real world application. Finally, VCTC learned that:

- Good communication between all of the participating partners in the program is essential.
- One's audience must be carefully considered before formatting lesson plans, writing manuals and giving instructions.
- Future projects need to give greater consideration to the need for on-going operator training and also for on-going system maintenance and upgrades.



## WHERE DO WE GO FROM HERE?

During the last year, VCTC did not expend much effort to market further usage of the Smartcard, preferring to wait until the technical issues were resolved. This coming year and the following year, however, it is likely that many more people will want to use the Smartcard on a regular basis. On Monday, August 10, 1998 the VISTA Conejo Connection began providing bus service from Oxnard to the Warner Center, in Los Angeles County. The buses are equipped with Smartcard units and Warner Center is now an outlet to sell Smartcards. It is very likely that these regular commuters, many of whom will receive a subsidy from their employers, will want to take advantage of the Smartcard program.

Next year, Cal State University, Channel Islands will open at the former Camarillo Hospital location. The University administration has had discussions with VCTC indicating their wish to provide students with a "free" bus pass to assist them in getting to school using alternative transportation. CSU, Channel Islands intends to pay for the cards with student fees or parking fees. It is expected that additional bus service, in the form of electric shuttle(s), will be provided to and from the campus and several park and ride lots. In addition, as a part of their "Green Campus" concept, it is expected that students will be offered the free use of electric bicycles on campus. The bicycle application can easily be accommodated by the Smartcard program which has great flexibility. One challenge, however, consistent with the whole Ventura County experience, is that once again the Smartcard units will be placed on unique vehicles, in this case,



electric.

There are several new Smartcard opportunities on the horizon which are discussed in more detail later in this report. However, to insure that there is improvement in the operation of the Smartcard program next year, VCTC staff has taken a number of steps. Specifically, we have included Performance Criteria in each of the FY 1998/99 VISTA operator's contracts requiring them to take responsibility for the equipment, prompt reporting of any problems and to make the equipment available for repair during the week as well as on weekends.

VCTC has also instituted a fax procedure with all operators so that we are notified of any problems and can follow up with Echelon to make sure that they are addressed quickly. VCTC has also included specific Performance Criteria in the Maintenance contract with Echelon that requires:

- **Monthly reporting on fare card sales and on-bus fare card usage for all outlets and bus agencies.**
- **Quarterly reporting on route performance for all transit agencies other than SCAT, which will have annual reporting.** The route performance reports will show average daily passenger boardings and alightings by stop, route load profiles, and ridership summaries. Attachment (3) is a typical Quarterly Report for the VISTA 126 line using April 1998 statistics. A report of this caliber will be produced for each operator. (It should be noted that the ridership numbers for April are lower than usual, due to the impact of Easter vacation on student boardings).
- **Annual schedule adherence statistics for each route, for all bus services.**
- **Produce various "special request" reports to address the day-to-day needs of the agencies.**
- **Provide training for operators to replace any defective Smartcard units and work more closely with individual transit agencies in order to identify the cause of equipment failures.**
- **Require Echelon to provide any needed on-site repair within five (5) working days (2.5 working days for Simi Valley Transit).**

In addition, VCTC, in cooperation with the operators, will take the following steps to make the system work better:

- **Equip all buses with Automatic Passenger Counters (SCAT, Simi Valley and Moorpark).**
- **Equip the full SCAT fleet with the Smartcard units. This will require the new buses to be equipped and spares provided.**
- **Provide spare units to the operators to facilitate replacement of Smartcard units and**

reduce equipment downtime.

- Conduct in-field geocoding of bus stops in Ventura County so that we will know the precise location of each bus stop.
- Have Echelon, in cooperation with the operators assess the possibility of integrating the Smartcard units with, at a minimum, the on-bus destination sign controller. If this integration is feasible, then there will be less need to have the drivers code in the route numbers and the data downloaded will be much easier to use.
- Institute monthly operator meetings with maintenance staff, VCTC and Echelon. VCTC is currently developing some natural extensions of the Smartcard, such as a commuter rail application which would give the Smart Passport users the ability to link multi-modal transit trips. For some time now VCTC staff has been working with agencies in Los Angeles County, Caltrans and the FTA to develop a Ventura County Smartcard - Phase II project that would permit the Smartcard to be used on Metrolink, Additional uses might also include non-transit applications and ancillary services such as buying coffee or a newspaper at the train station and paying for parking in downtown garages for those trips that must be made by car. Attachment (c) on the following page shows how such a system might work. As a part of Phase II, benefits to the existing bus system would also increase as bus stop announcements will be automated and public information kiosks would be located in critical locations where bus systems meet, such as where the VISTA 101 bus meets SCAT or VISTA East, showing when the connecting bus will arrive.

Another possibility in the Phase II project is to work with Cal State Channel Islands to further develop and test what is called the "Combi" or combination card which is able to communicate via direct contact to the reader (ATM use) and half contactless communication for use in debit or monthly pass functions. Cal State Channel Islands plans to be a "technology" school and may provide the perfect place to further develop and test this concept. It is expected that the FTA will be releasing an RFP which could potentially fund the projects noted above.

Finally, with the County of Ventura, VCTC has been pursuing a Smart Car Sharing program to assist with the Welfare-to-Work program. This program also works off the Smartcard and is a further application and use of the technology. . Even though this project was not funded by the Department of Labor in its initial grant award, there is a great deal of interest in the program. VCTC staff has been pursuing other federal funding options.

In conclusion, the transit industry is just now moving in the "Smartcard" direction. A number of transit agencies in the United States are either installing or planning to install similar systems and there are now a few systems in operation. There are numerous applications of Smartcard technology emerging all over Europe and Asia. Ventura County has been on the cutting-edge of the implementation of this technology and we are convinced that Radio Frequency proximity cards, like our Smartcard, is the right technology for the public transit industry.

“There is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new system. For the initiator has the enmity of all who would profit by the preservation of the old institutions and merely lukewarm defenders in those who would gain by new ones.”

Machiavelli, 1531

# SMART CARD PROGRAM

6/26/98 3:21:24 PM

## Value/No of Successful On-Bus Fare Card Usage/Recharge - By Agency/Status/CardType 5/1998

<i>Agency Name</i>	<i>Transaction Description</i>	<i>CardType</i>	<i>Value of Transactions</i>	<i>No of Transaction</i>
Camarillo DAR	Basic Transaction	Debit Cash	\$107.50	92
		Monthly Pass	<b>\$863.50</b>	<b>494</b>
			Total=\$971.00	Total=566
Moorpark	Basic Transaction	Debit Cash	<b>\$36.75</b>	<b>49</b>
			total=\$36.75	Total=49
SCAT	Basic Transaction	OAR Monthly Pas	\$10.25	<b>26</b>
		Debit Cash	\$124.74	<b>167</b>
		Monthly - DAR Up	\$14.50	16
		Monthly Pass	<b>\$476.50</b>	<b>645</b>
			Total=\$625.99	Total=1056
Simi Valley	Basic Transaction	DAR Monthly Pas	\$34.00	34
		Debit Cash	\$43.33	79
		Monthly Pass	\$677.05	1119
	Driver Recharged Pass Card	DAR Monthly Pas	<b>\$16.00</b>	1
		Monthly Pass	<b>\$380.00</b>	14
			Total=\$1,150.38	Total=1 247
Thousand Oaks	Basic Transaction	Debit Cash	\$15.30	<b>26</b>
		Monthly Pass	\$46.25	85
			Total=\$61.56	Total=1 11
VISTA 101	Basic Transaction	DAR Monthly Pas	\$8.00	<b>16</b>
		Debit Cash	\$609.75	661
		Monthly - DAR Up	\$0.75	1
		Monthly Pass	\$301.75	468
	Driver Recharged Debit Cash Card	Debit Cash	\$320.00	12
	Driver Recharged Pass Card	Monthly Pass	\$130.00	<b>5</b>
		Total=\$1,450.25	Total 363	

Note: The values of all the monthly card types in the Basic transaction category are hypothetical.

**ECHOLON**

**Value/No of Successful On-Bus Fare Card Usage/Recharge - By  
Agency/Status/CardType  
5/1998**

<i>Agency Name</i>	<i>Transaction Description</i>	<i>Card Type</i>	<i>Value of Transactions</i>	<i>No Of Transactions</i>
VISTA 128	Basic Transaction	DAR Monthly Pas	\$336.25	381
		Debit Cash	\$201.25	201
		Monthly - DAR Up	\$86.00	57
		Monthly Pass	\$109.75	131
	Driver Recharged Debit <b>Cash Card</b>	<b>Debit Cash</b>	\$20.00	2
	Driver Recharged Pass Card	DAR Monthly Pas	\$384.00	24
		Monthly Pass	\$90.00	3
			Total=\$1107.25	Total=799
VISTA East	Basic Transaction	Debit Cash	\$43.50	43
		Monthly Pass	\$120.00	132
	Driver Recharged Pass Card	Monthly Pass	\$40.00	2
VISTA Fillmore	Basic Transaction	DAR Monthly Pas	\$508.25	829
		Debit Cash	\$81.00	105
		Monthly - DAR Up	\$31.50	38
		Monthly Pass	\$29.50	38
	Driver Recharged Debit Cash Card	Debit Cash	\$140.00	10
	Driver Recharged Pass Card	DAR Monthly Pas	\$448.00	28
		Monthly - DAR Up	\$56.00	1
		Monthly Pass	\$80.00	3
			Total\$1,374.25	Total=848
VISTA SantaPaula	Basic Transaction	DAR Monthly Pas	\$346.50	308
		Debit Cash	\$65.25	80
		Monthly - DAR Up	\$39.50	33
		Monthly Pass	\$134.50	147
	Driver Recharged Debit Cash Card	Debit Cash	\$30.00	2
	Driver Recharged Pass Card	DAR Monthly Pas	\$272.00	17
		Monthly Pass	\$120.00	4
			Total=\$1,007.75	Total=591

Note: The values of all the monthly card types in the Basic Transaction category are hypothetical.

**ECHOLON**

Daily Onbus-Card Transactions-Based Agency and Bus No- 5/1998

01/20/98 3 20 19 PM

Agency	Bus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Sub +	Group +	OverAll	
Camarillo DAR	101	11			4	14	4	13	14			8	2			13	1		14	18	23	2	4				8	7	6	5			171	171		
	102	23	2		15	4	10	18	5				9	5																			91	262		
	103	1				8	2		2			8	7	3					1	1	3		6				2	2		2			52	314		
	106				12	13	19			5	1	15	19	7	21	23			27	17			20	2			23	19	13	22	1		279	593		
Moorpark	52													1	9																		10	10		
	62											9	7	4													4	8	4	5			41	51		
SCAT	3000												6	5	5		1	1	3	3	1	2	2	2		1	2	1	1	2		3	41	41		
	3001																																3	44		
	3501		3		4	3	4	2	3	1			5	2	2	1	3		2	4	6		1	1							1		50	94		
	3502											5	5	7	5												4	1	4	2			33	127		
	3503																										4		8		5		17	144		
	3504	1																											2	4		1	14	158		
	3505	4	2		4	5	3		7	1										4	3	4	1	3	2			4	2	6			55	213		
	3506												9															6	7	3			25	238		
	3507												9	9	5	4	1	2		5	6	1	8	4				4		10	3	2	73	311		
	3508	1	2		4	5	5	2	5	3			4	4																	3	2	2	43	354	
	3509	2																										11	8	6	8			35	389	
	3511												3	5	7	5	1		4	2	1			4	3			2	14	4			55	444		
	3512	2	3		4	5	1	2	3	3			5		3	4	4		1	3	6	7	1	6	1			1	3			1	69	513		
	3513	4	2		2	9	5	5	3				2		4	5	2			2	5	9	2	5	2					5	3	6		82	595	
	3514	1				3	6	2					2	4	2	2	1																	23	618	
	3515	5			2	3	2	3	7	1			1	5	5	3	1												1		1	2		43	661	
	3516	9	2		13	8	6	6	5	3			10	16	10		10	2		14	12	17	6	7	2			12	7	5	5	2	189	850		
	4002	6	2	2	8			9	10	5	1		6	1		8	8	3		10									4	6	1		1	91	941	
	4003	3	2	3	6	3	7	3	11			2	4	2	1														19	5	8	9	1	89	1030	
	4006																																3	19	1049	
4007																																	15	1064		
4528																		3	8	2													7	1071		
4535	1																																1	1072		
Simi Valley	4506				4	5	5	11	22	3		22	3		24	19			10		11	18	12									28	6	15	218	218
	4507	6				14		6	11			8			15				6	16	9		10					9	13	5			128	346		
	4508				6			6							8				10	1		9	11										4		55	401
	4509				12		5		4			14	17			8					7		11	7				8	7		9			109	510	
	4510					15	17	2	4	5		6	15		8	7	3			7	17	26	8	15				5	10	9		9		188	698	
	4511	2	4		9	3	17					8	9		9	6	9			28	8	16	5		12			27	7	5	13			197	895	
	4512	15			4																	5	11		4	8			15		15	6		83	978	
	4513	19	4		1	7		22	13				9		26	10	9			11	6		22					3		8	9	1	1	181	1159	
4514	10			7	6	5	8	2	1		7	8		16							9	10					8	15	25			138	1297			
Thousand Oaks	23				4		1																										5	5		
	24	4			5	13	6	9	5			10			2	5				6							8	18	5			100	105			
	25						1					1										1	3										8	113		
	26				1		2	2	5				1							1	1			2						2		19	132			
VISTA 101	817	34			23	37		45	45			45		43	35				54	49	55	58	30				57	28	45	39			720	720		
	888				44	26	41	33			49	45			36	45				44	32	45	41	30				38	45	42	26			664	1384	
VISTA 126	3				4	18	42	22	18			21	12	19	36	20	8		8	10	6	27	8					34	8	8	13			342	342	
	5	26			23	7	7	14	2	1		3			4	10				8	47	10	26	17				10	20				235	577		
	10											27	18		10	42				23		20	5	14			9	33	23	45			269	846		
VISTA East	46											4																					4	4		
	48	8			13	7	8	9	4			7	2	1	6	3			3	6	10	7	1					5	4	4			108	112		
	49	5			2								5	3	9	9			9	6	3	9	4					3	2				69	181		
VISTA Fillmore	12	2	5		14	7	18	14	18			19	15	18	23				3	17	8	15	12				15	20	6	6			255	255		
	17	2			11	8	17	14	9	6		14	14	13	14	9				10	15	14	11	10	8			8	9	10	3		229	484		
	18	37			26	22	7		15			17	22	27	29	19	7			22	10	26	16	17				20	16	24	11	2		392	876	
VISTA Santa Paula	39	13			1	11	24	9		4	7	3	12	21	18	12		13		4	1	6	1	1			1	15								

Agency	Bus	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	(Sub +)	2*	Overall		
Cam Fixed	103	11			8	2		2			8	6	7	3			1	1	3		6				2	2		2			52	52	52			
Camarillo DAR	101			4	14	4	13	14			8	2		13	1		14	16	23	2	4				6	7	6	5			171	171	223			
	102	23	2	15	4	10	18	5			9	5													6	7	6	5			91	262	314			
	106			12	13	19		5	1		15	19	7	21	23			27	17			20	2			23	19	13	22	1		279	541	593		
Moorpark	52											1	9																		10	10	603			
	62										9	7	4													4	8	4	5			41	51	644		
SCAT	3000											6	5	5		1	1	3	3	1	2	2	2		1	2	1	1	2	3		41	41	685		
	3001																									3						3	44	688		
	3500																															0	44	687		
	3501		3		4	3	4	2	3	1		5	2	2	1	3		2	4	6			1	1			2			1		50	94	73		
	3502											5	5	7	5											4	1	4	2			33	127	77		
	3503																									4		8		5		17	144	78		
	3504	1																		2	4						2	1		4		14	158	80		
	3505	4	2		4	5	3		7	1								4	3	4	1	3	2				4	2	6			55	213	857		
	3506								9																		6	7	3			25	238	882		
	3507											9	9	5	4	1	2		5	6	1	8	4				4		10	3	2		73	311	9	
	3508	1	2		4	5	5	2	5	3		4	4																3	2	2		43	354		
	3509	2																									11	8	6	8			35	389		
	3510																																0	389		
	3511											3	5	7	5	1		4	2	1						2	14	4				55	444			
	3512	2	3		4	5	1	2	3	3		5		3	4	4		1	3	6	7	1	6	1			1	3				08	513			
	3513	4	2		2	9	5	5	3			2		4	4	5	2		2	5	9	2	5	2				5	3	6			82	595		
	3514	1				3	6	2				2	4	2	2	1																	23	618		
	3515	5			2	3	2	3	7	1		1	5	5		3	1		1							1		1		2		43	661			
	3516	9	2		13	8	8	6	5	3		10	16	10		10	2		14	12	17	6	7	2			12	7	5	5	2		189	850		
	3517																																0	850		
	4000																																0	850		
	4001																																0	850		
	4002	6	2	2	8			9	10	5	1	6	1		8	8	3		10								4	6	1		1		91	941		
	4003	3	2	3	6	3	7	3	11		2	4	2	1													19	5	8	9	1		89	1030		
	4004																																0	1030	1	
	4005																																0	1030	167	
	4006																																19	1049	169	
	4007													2	1					5	8												15	1064	170	
	4528																	3	8	2														7	1071	171
	4529																																	0	1071	171
	4532																																	0	1071	171
	4534																																	0	1071	171
	4535	1																															1	1072	171	
4542																																	0	1072	171	
Simi Valley	4506			4	5	5	11	22	3		22	3		24	19			10		11	18	12									218	218				
	4507	6			14		6	11			8			15				6	18	9	10						9	13	5	15		128	346			
	4508			6			6							8				10	1		9	11										55	401	211		
	4509			12		5		4					14	17						7		11	7			8	7		9			109	510	222		
	4510				15	17	2	4	5			6	15	8	7	3		7	17	28	8	15				5	10	9		9		188	698	24		
	4511	2	4		9	3	17					8	9		9	6	9		28	8	18	5		12			27	7	5	13		197	895	26		
	4512	15			4																												83	978	26	
	4513	19	4		1	7		22	13						9											15		15	6			83	978	26		
	4514	10			7	6	5	8	2	1		7	8														3		8	9	1	1	181	1159	28	
Thousand Oaks	23			4	1																											5	5	301		
	24	4		5	13	8	9	5			10			2	5			6								8	18	5			100	105	311			
	25				1						1				2																	8	113	312		
	26			1		2	5					1						1	1				2									19	132	314		
VISTA 101	808																															0	0	31		
	817	34		23	37		45	45			45			43	35			54	49	55	56	30				57	28	45	39		720	720	38			
	888				44	28	41	33			49	45		36	45			44	32	45	41	30				38	45	42	26		664	1384				
VISTA 126	3			4	18	42	2																													

# SMART CARD PROGRAM

6/26/98 3:20/50 PM

## ON-BUS CARD USAGE BY AGENCY AND ISSUING OUTLET 5/1998

Card Outlets	Transit Agency or Operaton											
	Camarillo DAR	CAM Fised	Fillmore DAR	Moorpark	Wanta Paula	SCAT	Simi Valley	Thousand Oaks	VISTA 101	VISTA 128	VISTA East	Total
CAM DAR	526					113	3	10	582	1	2	1,237
Cam State Hospital	17					31			6			54
Fillmore Area Transit			787		17	54			2	269		1,129
Moorpark City				39	2		28	1			15	86
PSSA						47						47
SantaPaula City			47		132	53		1	21	233		487
SCAT	10				7	270		26	172	33	2	620
Simi Valley City					14	7	1,214	7	18		84	1,344
Thousand Oaks City		2			24	10	30	32	116		51	266
VCTC		38		12	395	487	7	55	450	281	25	1,760
Total	693		834	61	691	1,072	1,282	132	1,387	817	179	6,918

- All transactions are with debit cards. Balances existed at closure of hospital and were transferred to cards assigned to clients at independent living sites.

Note: Card Usage Includes: "basic - transfer:", "negative cash", "Insufficient funds", "pass has expired", "pass use too early".

ECHOLON



# SMART CARD PROGRAM

6/26/98 3:21:02 PM

## No of On-Bus Card Usage and Recharges by Card/Fare type

5/1998

Agency	Debit Card Transactions								Pass Card Transactions								Totals
	Card Usage				Recharges				Card Usage				Recharges				
	Adult	Senior	Student	Disabled	Adult	Senior	Student	Disabled	Adult	Senior	Student	Disabled	Adult	Senior	Student	Disabled	
Camarillo D	49	15	31	2	0	0	0	0	213	228	33	22	0	0	0	0	593
Moorpark	1	0	44	6	0	0	0	0	0	0	0	0	0	0	0	0	51
SCAT	95	3	31	39	0	0	0	0	239	115	36	514	0	0	0	0	1072
Siml Valley	28	0	0	77	0	0	0	0	261	353	239	324	3	2	6	4	1297
Thousand O	6	1	17	19	0	0	0	0	30	43	8	8	0	0	0	0	132
VISTA 101	348	30	367	133	9	0	2	1	112	42	50	285	1	0	1	3	1384
VISTA 126	71	21	89	22	0	0	1	1	64	0	457	93	0	0	27	0	846
VISTA East	21	0	15	8	0	0	0	0	28	3	63	41	0	0	0	2	181
VISTA Fillmo	4	63	0	48	2	5	0	3	313	133	270	3	14	5	12	1	876
VISTA Santa	7	7	33	32	0	0	2	0	290	17	115	88	14	0	5	2	614
<b>Totals:</b>	<b>630</b>	<b>140</b>	<b>627</b>	<b>366</b>	<b>11</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>1,550</b>	<b>934</b>	<b>1271</b>	<b>1378</b>	<b>32</b>	<b>7</b>	<b>51</b>	<b>12</b>	<b>7046</b>
<b>Total %:</b>	<b>8.9%</b>	<b>2.0%</b>	<b>8.9%</b>	<b>5.5%</b>	<b>0.2%</b>	<b>0.1%</b>	<b>0.1%</b>	<b>0.1%</b>	<b>22.0%</b>	<b>13.3%</b>	<b>18.0%</b>	<b>19.6%</b>	<b>0.5%</b>	<b>0.1%</b>	<b>0.7%</b>	<b>0.2%</b>	

Note: Debit Card Usage Includes: "basic transaction", "transfer transaction", "negative cash", and "Insufficient funds"; Pass Card Usage Includes above plus "pass has expired" and "pass ure too early".

ECHELON

# SMART CARD PROGRAM

6/26/98 3:21:16 PM

## Value of On-Bus Fare Card Usage/Recharges - By Card/Fare Type

5/1998

Agency	Debit Card Transaction								Pass Card Transactions								Totals
	Card Usage				Recharges				Card Usage				Recharges				
	Adult	Senior	Student	Disabled	Adult	Senior	Student	Disabled	Adult	Senior	Student	Disabled	Adult	Senior	Student	Disabled	
Camarillo D	\$64.00	\$7.50	\$38.00	\$2.00	\$0.00	\$0.00	\$0.00	\$0.00	\$426.00	\$342.00	\$64.00	\$31.50	\$0.00	\$0.00	\$0.00	\$0.00	\$975.00
Moorpark	\$0.75	\$0.00	\$33.00	\$4.50	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$38.25
SCAT	\$M.31	\$1.50	\$20.36	\$115.63	\$0.00	\$0.00	\$0.00	\$0.00	\$230.00	\$67.56	\$26.25	\$1254.50	\$0.00	\$0.00	\$0.00	\$0.00	\$893.99
Simi Valley	\$26.40	\$10.00	\$0.00	\$27.28	\$0.00	\$0.00	\$0.00	\$0.00	\$255.00	\$122.50	\$226.00	\$112.00	\$0.00	\$0.00	\$180.00	\$0.00	\$1,167.18
Thousand O	\$3.90	\$0.40	\$7.95	\$5.60	\$0.00	\$0.00	\$0.00	\$0.00	\$20.25	\$16.60	\$8.00	\$3.20	\$0.00	\$0.00	\$0.00	\$0.00	\$64.10
VISTA 101	\$348.00	\$15.00	\$275.25	\$66.50	\$250.00	\$0.00	\$60.00	\$10.00	\$111.00	\$21.00	\$37.50	\$141.00	\$40.00	\$0.00	\$30.00	\$0.00	\$1,465.25
VISTA 126	\$95.00	\$14.25	\$60.50	\$13.50	\$0.00	\$0.00	\$10.00	\$10.00	\$61.00	\$0.00	\$315.00	\$644.00	\$0.00	\$0.00	\$474.00	\$0.00	\$1,117.25
VISTA Eaot	\$25.50	\$0.00	\$14.00	\$5.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28.00	\$1.50	\$46.50	\$19.50	\$0.00	\$0.00	\$0.00	\$40.00	\$180.00
VISTA Fil.m	\$4.50	\$544.25	\$0.00	\$35.25	\$40.00	\$70.00	\$0.00	\$30.00	\$306.00	\$65.50	\$197.25	\$0.50	\$264.00	\$80.00	\$220.00	\$20.00	\$1,377.25
VISTA Sant	\$9.00	\$4.25	\$29.50	\$21.50	\$0.00	\$0.00	\$30.00	\$0.00	\$406.50	\$12.75	\$112.00	\$66.00	\$248.00	\$0.00	\$108.00	\$36.00	\$1,083.50
<b>Totals:</b>	<b>\$665.36</b>	<b>\$87.15</b>	<b>\$498.50</b>	<b>\$196.76</b>	<b>\$290.00</b>	<b>\$70.00</b>	<b>\$100.00</b>	<b>\$50.00</b>	<b>\$1,843.75</b>	<b>\$639.55</b>	<b>\$1,032.50</b>	<b>\$672.20</b>	<b>\$648.00</b>	<b>\$120.00</b>	<b>\$1,012.00</b>	<b>\$236.00</b>	<b>\$8,161.77</b>
<b>Total %:</b>	<b>8.2%</b>	<b>1.1%</b>	<b>6.1%</b>	<b>2.4%</b>	<b>3.6%</b>	<b>0.9%</b>	<b>1.2%</b>	<b>0.6%</b>	<b>22.6%</b>	<b>7.8%</b>	<b>12.7%</b>	<b>8.2%</b>	<b>7.9%</b>	<b>1.5%</b>	<b>12.4%</b>	<b>2.9%</b>	

Note: Debit Card Usage Includes: "basic", "transfer", "Card usage with negative cash" and "Insufficient funds". Pass Card Usage Includes: hypothetical fare revenues from "basic" and "transfer". Pass Card recharges include: "Driver Recharge PassCard" and "Remote Recharge PassCard".

ECHOLON

## ROUTE 126- EXECUTIVE SUMMARY (SAMPLING FROM APRIL 1998)

The following is a brief commentary on the key performance aspects of Route 126. The attached exhibits show the key findings.

### RIDERSHIP AND LOADINGS

Route 126 carries on the average weekday, about 329 passengers. The passengers travel on the average about 15.6 miles per trip. This ridership level does not vary dramatically from day to day.

The boardings and alightings are spread (approximately) equally between communities-30% Fillmore, 20% Santa Paula, and 40% Ventura. Considering the population distributions, the boardings and alightings, raise questions as to why the Ventura boardings/alightings are not greater. There are only one or two stops that carry “questionable” loads. These stops should be examined within the context of the “Schedule Adherence” performance. Trip loads are not excessive.

### SCHEDULE ADHERENCE

The vast majority of the stops (over 85%) occur within 5 minutes of the published schedule. Of the remainder (i.e., 15%) over 90% of the stops are within 6 to 15 minutes of the published schedule. For an intercity bus operation this should be considered good performance. The stops in Santa Paula and Fillmore seem to perform slightly worse than the stops in Ventura. The FARETFUNS system does not allow for a completely defensible measurement of “buses leaving early.” However, our analysis suggests that this does not occur in any meaningful way. Although the schedule adherence performance is good there is room for improvement. A good target might be to have 95% of the stops no later than 5% and for the remainder, no later than 15 minutes. This will require detailed route and performance analysis.

### FARE CARD USAGE

There were about 570 fare card transactions on Route 126 in April. The bulk of these transactions (73%) were for monthly pass usage. However, only about 80 individual fare cards were used. This translates into about 7 trips per fare card. Clearly this extent of usage is incorrect. Individuals buying a monthly pass will not use the pass for 7 to 10 trips per month.

The on-bus data download statistics suggest that the FARETRANS equipment was operational over 80% of the time. This suggests either that:

- The FARETIUNS equipment was operational, but the card reader/writers were defective, or
- Individuals were using their Fare cards like passes, i.e., flashing them.

We need to investigate what is actually happening.

## DEMOGRAPHIC ANALYSIS

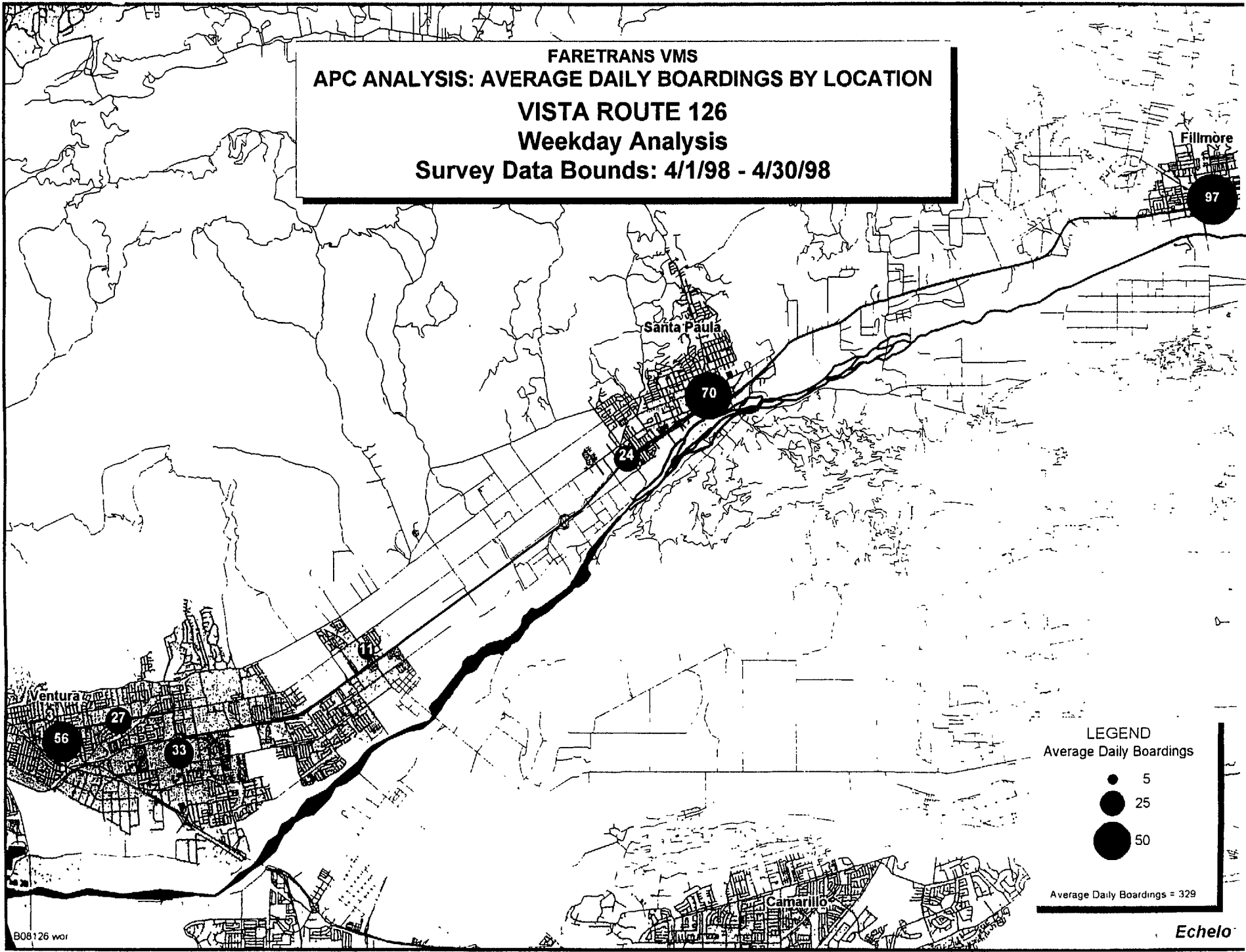
The demographic analysis was based on the 1990 census and the data reported in the Fare Card registration process. Fare card usage was such that demographic statistics should be reasonably representative of route performance. The following are some of the key findings:

- The age classifications used in the FARETRANS registration differ slightly from the census data that we're presently using.
- There are slightly more female passengers than male passengers when comparisons are made with the population statistics. However, the males use the system slightly more than the females.
- Slightly less than 1/2 of the population in the County are 18 to 44 years old. However, almost two thirds of the users and usage are between 16 and 45 years old. (We need to change the age classifications used in the card registration process or use different census classes if we continue this kind of analysis).

## STATISTICAL SAMPLING

The statistics, as presented are based on slightly over 7 days of trip sampling. In other words, if all the trips were to be added we would have 7.1 days of surveys. Of course, some trips are "sampled" more frequently than others. The analysis accommodates this sampling process. The data used exceeds the statistical requirements for Section 15 and schedule adherence analysis.

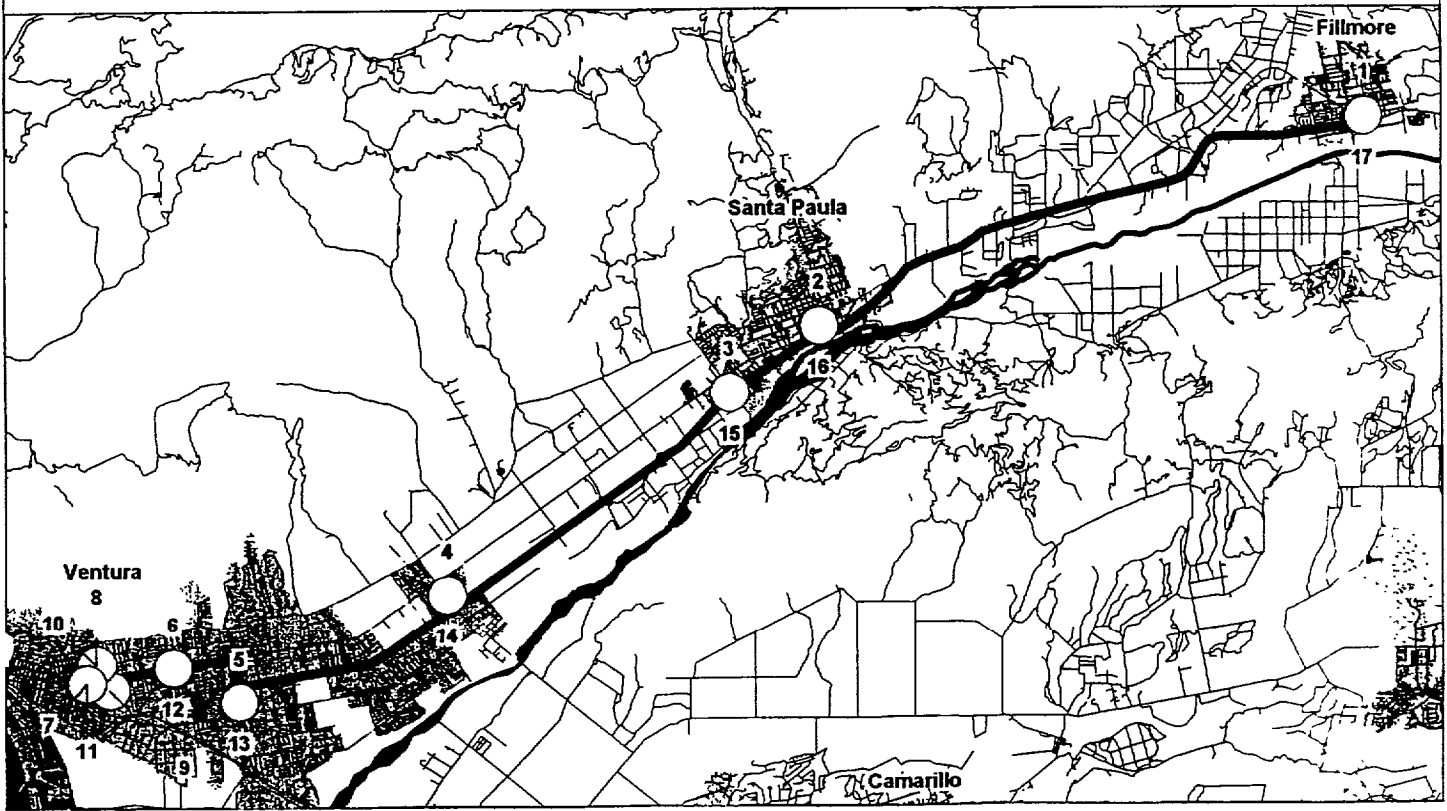
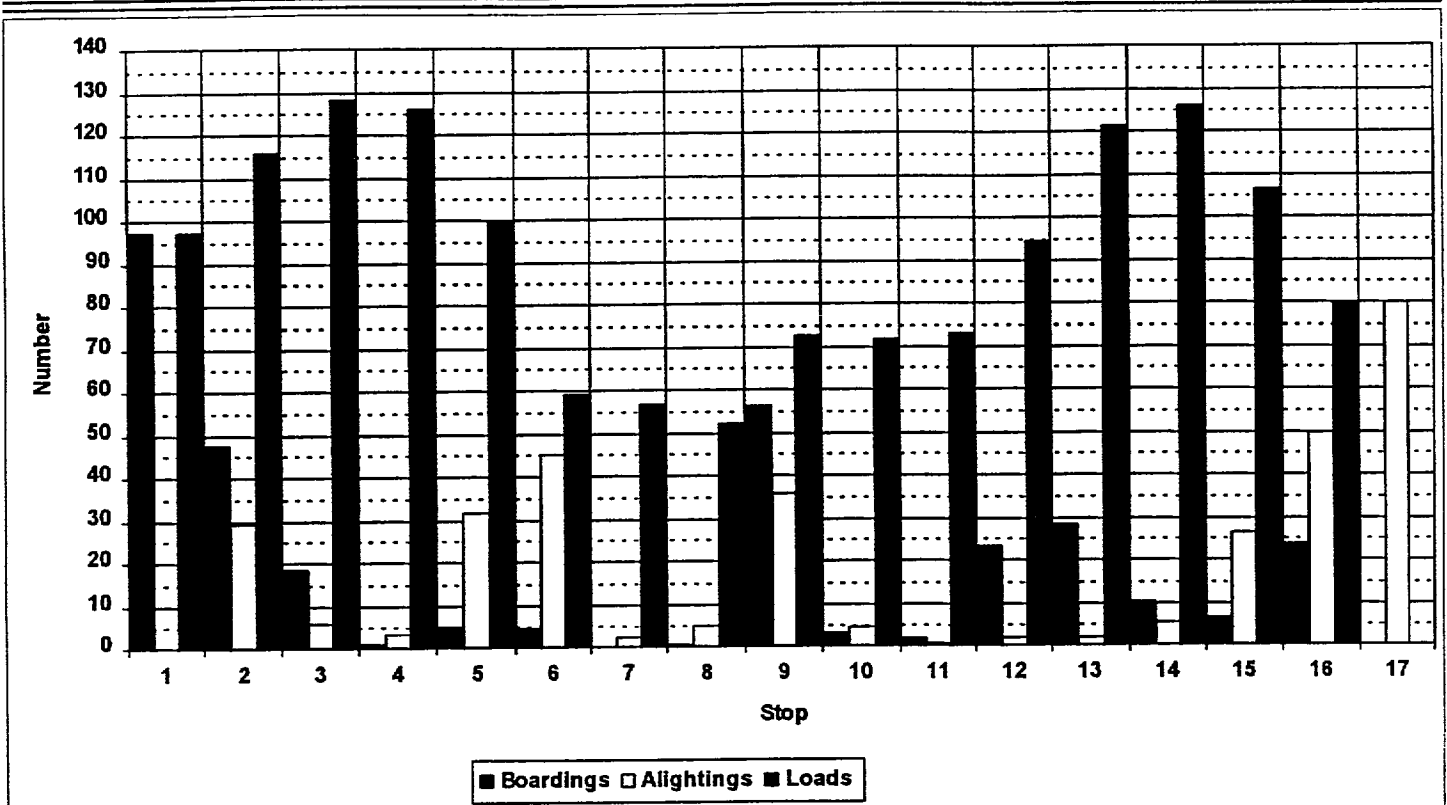
**FARETRANS VMS  
APC ANALYSIS: AVERAGE DAILY BOARDINGS BY LOCATION  
VISTA ROUTE 126  
Weekday Analysis  
Survey Data Bounds: 4/1/98 - 4/30/98**





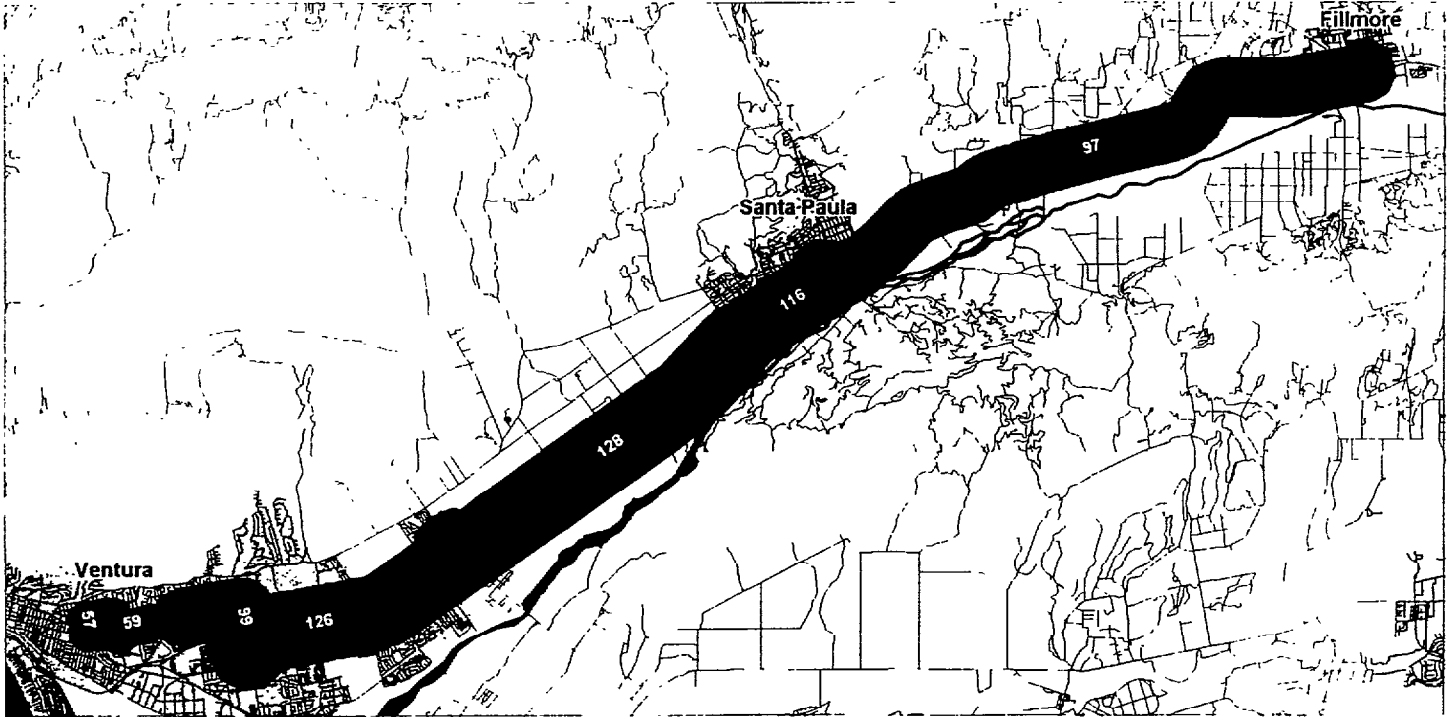
FARETRANS VMS  
 APC ANALYSIS: BOARDINGS, ALIGHTINGS, AND LOADS

VISTA 126 Route: Highway 126  
 Weekday Analysis  
 Survey Data Bounds: 4/1/98 - 4/30/98

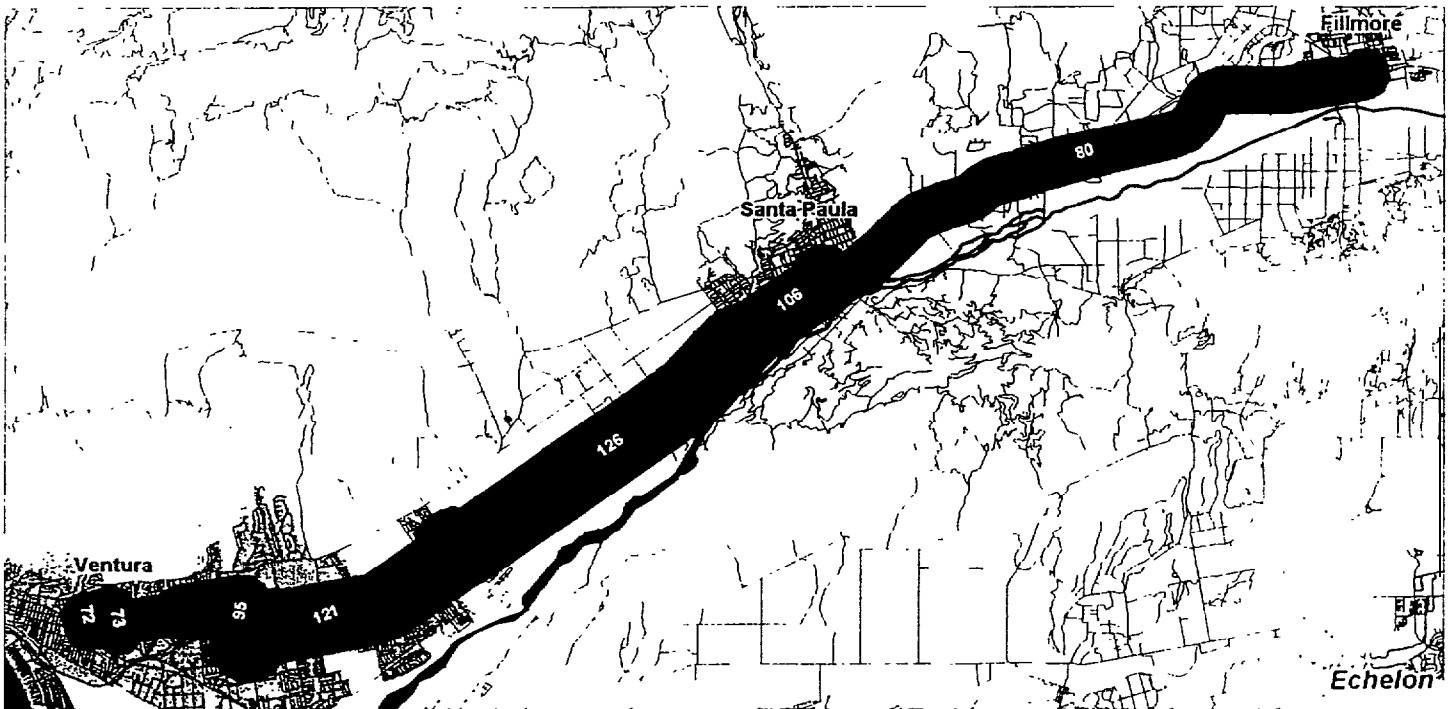


VISTA 126 Route: Highway 126  
Weekday Analysis  
Survey Data Bounds: 4/1/98 - 4/30/98

Southbound Loads

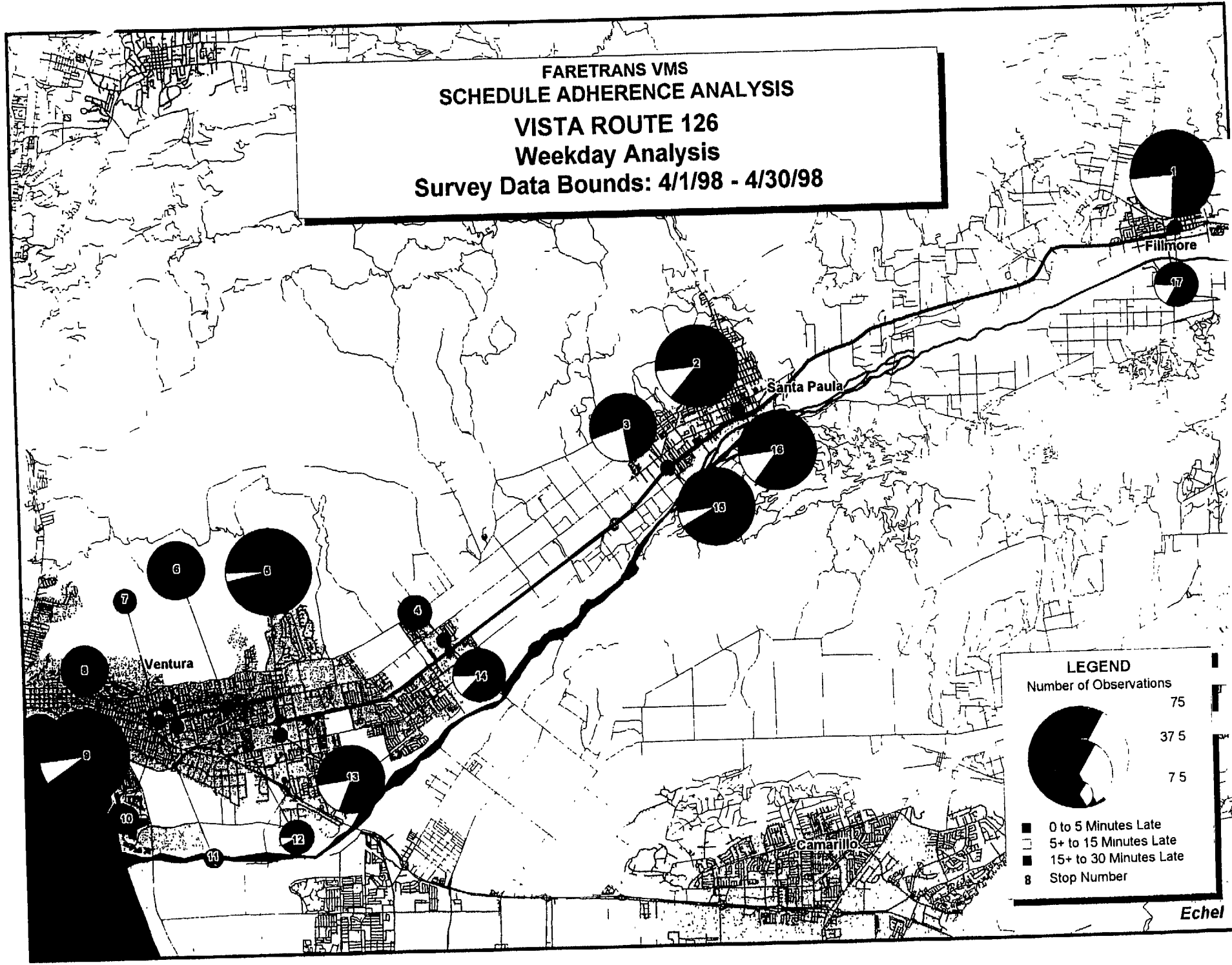


Northbound Loads





**FARETRANS VMS  
SCHEDULE ADHERENCE ANALYSIS  
VISTA ROUTE 126  
Weekday Analysis  
Survey Data Bounds: 4/1/98 - 4/30/98**



**LEGEND**

Number of Observations

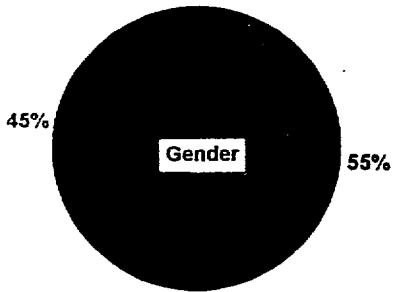
	75
	37.5
	7.5

0 to 5 Minutes Late  
 5+ to 15 Minutes Late  
 15+ to 30 Minutes Late  
 Stop Number

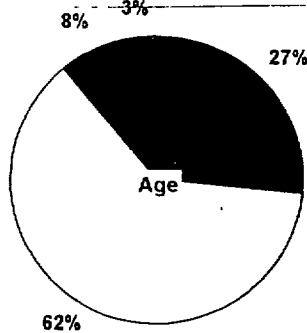
FARETRANS VMS  
 APC ANALYSIS: DEMOGRAPHIC ANALYSIS

VISTA 126 Route: Highway 126  
 Survey Data Bounds: 4/1/98 - 4/30/98

PROFILE OF CARD USERS



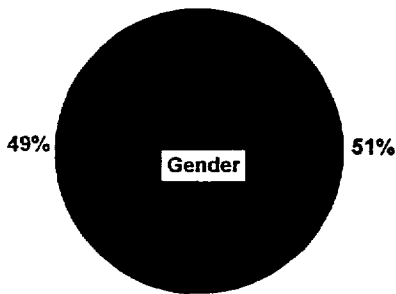
■ Female ■ Male



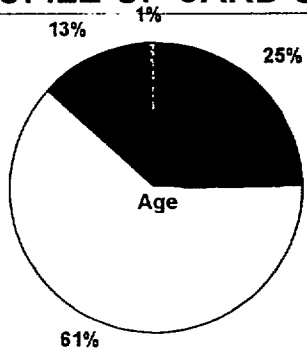
■ 0 to 15 years □ 16 to 45 years  
 ■ 45 to 65 years ■ 65+ years

Insufficient Data

PROFILE OF CARD USAGE



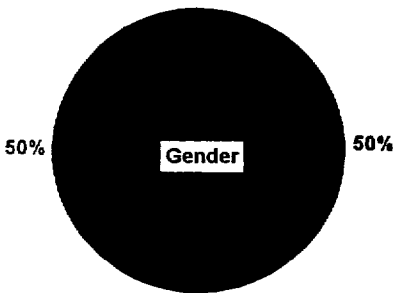
■ Female ■ Male



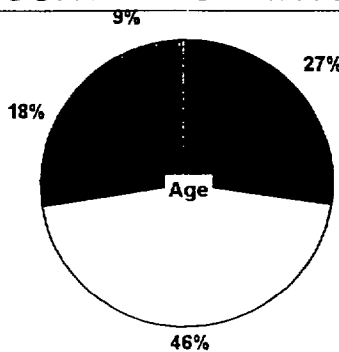
■ 0 to 15 years □ 16 to 45 years  
 ■ 45 to 65 years ■ 65+ years

Insufficient Data

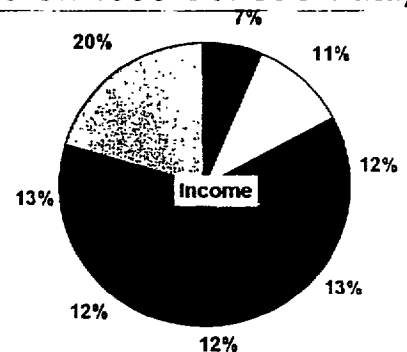
PROFILE OF VENTURA COUNTY RESIDENTS (Based on 1990 Census Data)



■ Female ■ Male



■ 0 to 18 years □ 18 to 44 years  
 ■ 45 to 64 years ■ 65 years and older



■ \$0 to \$9,999 □ \$10,000 to \$19,999  
 ■ \$20,000 to \$29,999 ■ \$30,000 to \$39,999  
 ■ \$40,000 to \$49,999 ■ \$50,000 to \$59,999  
 ■ \$60,000 to \$74,999 □ \$75,000+

FARETRANS VMS  
 APC ANALYSIS: ROUTE SUMMARY - AVERAGES

**VISTA 126 Route: Highway 126**  
**Weekday Analysis**  
 Survey Data Bounds: 4/1/98 - 4/30/98

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
1	97	0	97	920.64
2	47	29	116	207.31
3	19	6	128	709.19
4	1	3	126	506.87
5	5	32	99	163.92
6	5	45	59	78.11
7	0	2	57	40.69
8	1	5	52	28.20
9	56	36	73	39.24
10	3	4	72	51.40
11	2	0	73	96.85
12	23	2	94	155.47
13	29	2	121	488.39
14	10	6	126	697.76
15	7	27	106	190.82
16	24	50	80	759.51
17	0	80	0	0.00

**Summary for Route**

**Average Weekday**

	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
<b>Total</b>	<b>329</b>	<b>329</b>	<b>NA</b>	<b>5,134.37</b>
<b>Avg</b>	<b>NA</b>	<b>NA</b>	<b>87.11</b>	<b>NA</b>
<b>Max</b>	<b>NA</b>	<b>NA</b>	<b>128</b>	<b>NA</b>

**Annual Weekday Statistics**

<b>Number of Days:</b>	<b>258</b>
<b>Unlinked Passenger Trips:</b>	<b>84,872</b>
<b>Unlinked Passenger Trip Miles:</b>	<b>1,324,667.91</b>

FARETRANS VMS  
 APC ANALYSIS: SUMMARY OF SURVEY DATA BY RUN

**VISTA 126 Route: Highway 126**  
**Weekday Analysis**  
**Survey Data Bounds: 4/1/98 - 4/30/98**

Run: 1

		Survey Data						
Bus Number	Number of Scheduled Vehicle Trips	Date	Number of Vehicle Trips	Start Time	End Time	Number of Days Surveyed	Unlinked Passenger Trips	Average Number of Unlinked Passenger Trips per Vehicle Trip
3	10	4/9/98	2	4:18 AM	7:01 PM	0.20	49	24.5
3	10	4/10/98	5	6:20 AM	5:53 PM	0.50	134	26.8
3	10	4/13/98	5	5:31 AM	6:49 PM	0.50	153	30.6
5	10	4/13/98	2	6:37 AM	10:01 AM	0.20	73	36.5
3	10	4/14/98	6	5:21 AM	6:01 PM	0.60	300	50.0
5	10	4/14/98	4	6:31 AM	6:48 PM	0.40	55	13.8
3	10	4/15/98	5	5:35 AM	6:49 PM	0.50	162	32.4
5	10	4/15/98	5	6:32 AM	5:54 PM	0.50	177	35.4
3	10	4/16/98	4	5:32 AM	2:28 PM	0.40	117	29.3
5	10	4/16/98	4	6:24 AM	6:05 PM	0.40	104	26.0
3	10	4/17/98	3	11:26 AM	5:58 PM	0.30	129	43.0
5	10	4/17/98	4	5:34 AM	6:46 PM	0.40	138	34.5
3	10	4/21/98	4	5:29 AM	4:16 PM	0.40	85	21.3
5	10	4/21/98	5	6:14 AM	5:57 PM	0.50	159	31.8
5	10	4/22/98	5	6:24 AM	5:55 PM	0.50	193	38.6
10	10	4/23/98	4	11:04 AM	5:20 PM	0.40	141	35.3
3	10	4/24/98	4	9:42 AM	6:50 PM	0.40	42	10.5
Total:			71			7.10	2811	31.14

**APC Analysis Sample Statistics**

Number of Vehicle Trips Surveyed: 71  
 Number of Vehicle Trips Scheduled per Day: 10  
 Number of Equivalent Route Days Surveyed: 7.10

FARETRANS VMS  
**APC ANALYSIS: RUN SUMMARIES - AVERAGES**

**VISTA 126 Route: Highway 126**  
**Weekday Analysis**  
**Survey Data Bounds: 4/1/98 - 4/30/98**

Run 1

Stops	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
1	97.2369048	0	97.2369048	920.64
2	47.4702381	29.0833333	115.62381	207.31
3	18.7857143	6.14285714	128.266667	709.19
4	1.07142857	3.2202381	128.117857	506.87
5	5.01190476	31.6807143	99.4690476	163.92
6	4.71428571	45.1904762	58.9928571	78.11
7	0	2.16666667	56.8261905	40.69
8	0.5952381	5.19047619	52.2309524	28.20
9	56.227381	35.7976190	72.6607143	39.24
10	3.46428571	4.44047619	71.6845238	51.40
11	1.73571429	0.26785714	73.152381	96.85
12	23.3059524	2.00595238	94.452381	155.47
13	28.5297619	1.67261905	121.309524	488.39
14	10.4583333	5.5	126.267857	697.76
15	6.6952381	26.5369048	106.426190	190.82
16	23.6583333	49.8654762	80.2190476	759.51
17	0	80.2190476	0	0.00

Summary for Run 1

	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
<b>Total</b>	<b>328.960714</b>	<b>328.960714</b>	<b>NA</b>	<b>5,134.37</b>
<b>Avg</b>	<b>NA</b>	<b>NA</b>	<b>87.11</b>	<b>302.02</b>
<b>Max</b>	<b>97.2369048</b>	<b>80.2190476</b>	<b>128.266667</b>	<b>920.64</b>

---

---

FARETRANS VMS  
APC ANALYSIS: VEHICLE TRIP SUMMARIES - AVERAGES

---

**VISTA 126 Route: Highway 126**  
**Weekday Analysis**  
**Survey Data Bounds: 4/1/98 - 4/30/98**

---

---

Run: 1

Vehicle Trip	schedule		Unlinked Passenger Trips per Vehicle Trip
	Start Time	End Time	
1	6:00 AM	8:00 AM	29
2	8:00 AM	10:00 AM	45
3	10:00Am	12:00PM	39
4	12:00PM	2:00PM	48
5	2:00 PM	4:00 PM	48
6	4:00 PM	6:00 PM	28
7	6:52 AM	9:00 AM	31
8	9:00 AM	10:00 AM	19
9	4:00 PM	5:00 PM	22
10	5:00 PM	6:55 PM	20

Summary for RUN:1

Unlinked Passenger Trips:

Total Daily	328.981
Average Daili	32.8961
Maximum Dajly:	48.4286

FARETRANS VMS  
**APC ANALYSIS: TRIP DETAILS - AVERAGES**

**VISTA 126 Route: Highway 126**  
**Weekday Analysis**  
**Survey Data Bounds: 4/1/98 - 4/30/98**

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		

**Run 1: Trip 1**

Stop	Boardings	Alightings	Load	Unlinked Passenger Trip Miles
1	9	0	9	88.37
2	3	1	12	20.62
3	3	1	13	72.80
4	0	0	13	51.58
5	0	4	9	15.11
6	1	6	4	5.30
7	0	1	3	2.39
8	0	1	3	1.53
9	2	2	2	1.26
10	0	0	2	1.43
11	0	0	2	2.65
12	0	0	2	3.29
13	5	0	6	25.50
14	5	4	8	43.29
15	0	2	6	10.46
16	1	1	6	52.07
17	0	6	0	0.00

**Summary for Run 1: Trip 1**

Total	28.8533333	28.8333333	NA	307.63
Avg	NA	NA	6.88	23.30
Max	8.3333333	6	13.1666667	88.37

**Run 1: Trip 2**

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
1	20	0	20	189.36
2	10	5	25	43.93
3	2	1	26	143.75
4	0	0	26	104.49
5	3	4	24	39.83
6	0	17	7	9.71
7	0	0	7	5.25
8	0	1	7	3.78
9	4	5	7	3.51
10	0	0	7	4.66
11	0	0	7	8.61
12	0	0	7	10.70
13	2	1	8	32.88
14	2	2	8	44.21
15	1	1	7	13.15
16	2	3	6	55.23
17	0	6	0	0.00

**Summary for Run 1: Trip 2**

Total	46	46	NA	713.04
Avg	NA	NA	11.63	41.91
Max	20	17	26	189.36

**Run 1: Trip 3**

1	11	0	11	100.09
2	6	4	13	23.05

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
3	2	2	13	71.88
4	0	0	13	51.67
5	0	3	11	17.42
6	4	5	9	11.73
7	0	0	9	6.34
8	0	1	8	4.40
9	5	4	10	5.40
10	0	1	9	6.76
11	0	0	9	12.48
12	3	0	12	19.99
13	3	1	14	58.09
14	1	0	15	85.26
15	1	2	14	24.59
16	3	7	10	98.74
17	0	10	0	0.00

**Summary for Run 1: Trip 3**

Total	3B.1428671	39.1428671	NA	697.88
Avg	NA	NA	10.63	36.17
Max	10.6714286	10.4286714	16.4286714	100.00

**Run 1: Trip 4**

1	9	0	9	88.76
2	6	4	12	21.29
3	3	0	15	82.94
4	0	1	14	57.77

**FARETRANS VMS**  
**APC ANALYSIS: TRIP DETAILS - AVERAGES**

**VISTA 126 Route: Highway 126**  
**Weekday Analysis**  
**Survey Data Bounds: 4/1/98 - 4/30/98**

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
5	0	4	11	18.33
6	0	0	11	14.73
7	0	0	11	7.97
8	0	0	11	6.01
9	10	8	13	7.22
10	2	2	13	9.05
11	0	0	13	16.88
12	9	0	21	34.36
13	4	0	24	97.63
14	0	0	25	135.39
15	1	5	21	37.65
16	4	8	17	158.59
17	0	17	0	0.00

**Summary for Run 1: Trip 4**

<b>Total</b>	<b>48.376</b>	<b>48.376</b>	<b>NA</b>	<b>794.67</b>
<b>Avg</b>	<b>NA</b>	<b>NA</b>	<b>14.19</b>	<b>46.74</b>
<b>Max</b>	<b>10</b>	<b>16.76</b>	<b>24.6</b>	<b>158.59</b>

**Run 1: Trip 5**

1	11	0	11	104.15
2	4	4	10	18.19
3	2	1	11	59.24
4	0	0	11	43.06
5	1	4	7	11.77
6	0	0	7	9.46

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
7	0	0	7	5.11
8	0	0	7	3.86
9	12	5	14	7.79
10	1	1	14	9.94
11	1	0	15	19.86
12	6	1	20	33.39
13	5	0	25	100.07
14	2	0	27	148.41
15	2	5	24	42.26
16	3	12	15	140.67
17	0	15	0	0.00

**Summary for Run 1: Trip 5**

<b>Total</b>	<b>48.4286714</b>	<b>48.4286714</b>	<b>NA</b>	<b>767.23</b>
<b>Avg</b>	<b>NA</b>	<b>NA</b>	<b>13.23</b>	<b>44.54</b>
<b>Max</b>	<b>12</b>	<b>14.8671429</b>	<b>26.8671429</b>	<b>148.41</b>

**Run 1: Trip 6**

1	8	0	8	75.74
2	3	4	7	12.78
3	2	1	8	44.23
4	0	0	8	32.15
5	1	4	5	7.62
6	0	0	5	6.12
7	0	0	5	3.31
8	0	0	5	2.50

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
9	7	3	9	4.59
10	0	0	9	6.27
11	0	0	9	11.58
12	2	1	10	16.67
13	2	0	12	49.32
14	0	0	13	69.77
15	1	3	10	18.38
16	2	4	8	78.11
17	0	8	0	0.00

**Summary for Run 1: Trip 6**

<b>Total</b>	<b>28</b>	<b>28</b>	<b>NA</b>	<b>439.16</b>
<b>Avg</b>	<b>NA</b>	<b>NA</b>	<b>7.6</b>	<b>26.83</b>
<b>Max</b>	<b>8</b>	<b>8.25</b>	<b>12.625</b>	<b>78.11</b>

**Run 1: Trip 7**

1	15	0	15	145.18
2	8	3	20	35.26
3	3	0	23	124.40
4	0	0	22	89.09
5	0	6	17	27.47
6	0	13	4	4.63
7	0	2	2	1.43
8	0	0	2	0.90
9	2	2	1	0.63
10	0	0	1	0.84



FARETRANS VMS  
**APC ANALYSIS: TRIP DETAILS - AVERAGES**

**VISTA 126 Route: Highway 126**  
**Weekday Analysis**  
**Survey Data Bounds: 4/1/98 - 4/30/98**

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
11	0	0	1	1.54
12	0	0	1	1.92
13	1	0	2	7.38
14	0	0	2	10.13
15	1	1	2	2.99
16	2	1	3	26.83
17	0	3	0	0.00

**Summary for Run I: Trip 7**

Total	30.6	30.6	NA	480.62
Avg	NA	NA	6.84	28.27
Max	16.33333333	13.16666667	22.6	146.18

**Run I: Trip 6**

1	9	0	9	83.86
2	6	3	12	21.26
3	2	0	13	73.46
4	0	1	13	50.52
5	1	2	12	19.07
6	0	4	8	10.78
7	0	0	8	5.83
8	0	3	5	2.93
9	1	5	1	0.46
10	0	0	1	0.61
11	0	0	1	1.13
12	0	0	1	1.41

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alightings		
13	0	0	1	3.45
14	0	0	1	4.74
15	0	0	1	1.54
16	0	0	1	9.47
17	0	1	0	0.00

**Summary for Run I: Trip 8**

Total	18.7142867	18.7142867	NA	290.63
Avg	NA	NA	6.11	17.00
Max	8.86714286	6.42867143	13.2867143	83.66

**Run I : Trip 9**

1	1	0	1	5.68
2	0	0	1	1.08
3	0	0	1	3.32
4	0	0	1	2.41
5	0	0	1	0.99
6	0	0	1	0.79
7	0	0	1	0.43
8	0	0	1	0.32
9	6	1	6	4.32
10	1	0	9	6.45
11	0	0	9	12.16
12	3	0	12	19.75
13	4	0	16	64.42
14	0	0	16	66.42

Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miles
	Boardings	Alighting6		
15	1	3	13	23.67
16	4	9	9	61.42
17	0	9	0	0.00

**Summary for Run I: Trip 9**

Total	21.8	21.6	NA	316.66
Avg	NA	NA	6.69	16.67
Max	8.4	6.8	16	86.42

**Run I: Trip 10**

1	4	0	4	39.45
2	2	1	6	9.86
3	1	0	6	33.17
4	0	0	6	24.11
5	0	2	4	6.32
6	0	0	4	4.85
7	0	0	4	2.63
8	0	0	4	1.98
9	6	2	8	4.05
10	0	0	8	5.38
11	0	0	8	9.93
12	1	0	9	13.99
13	4	0	12	49.65
14	0	0	12	66.15
15	1	4	9	16.14
16	2	5	6	56.39

FARETRANS VMS  
**APC ANALYSIS: TRIP DETAILS - AVERAGES**

**VISTA 126 Route: Highway 126**  
**Weekday Analysis**  
**Survey Data Bounds: 4/1/98 - 4/30/98**

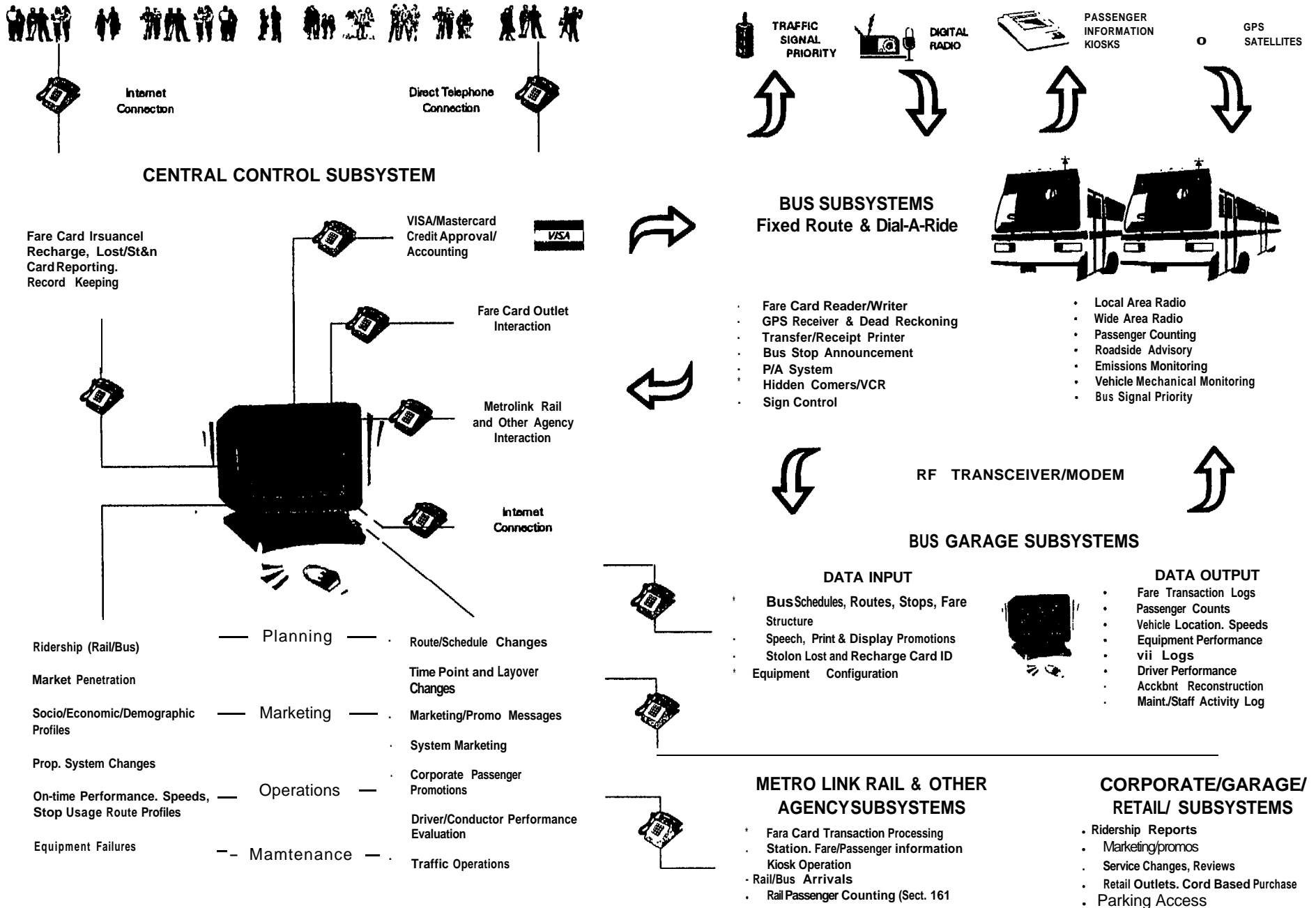
Stop	Unlinked Passenger Trips		Load	Unlinked Passenger Trip Miller
	Boardings	Alighting8		
17	0	6	0	0.00

**Summary for Run I: Trip IO**

<b>Total</b>	20.1666867	20.1666667	NA	348.06
<b>Avg</b>	NA	NA	6.31	20.47
<b>Max</b>	6.6	6.1666667	12.3333333	88.16

Exhibit 1

FARETRANS VMS (Fare Transaction and Vehicle Management System)  
VCTC PHASE II - SYSTEM ARCHITECTURE





September 1, 1998

Mr. Michael Dinning  
Volpe National Transportation Systems Center  
Kendall Square  
Cambridge, MA 02142 1093

Dear Mr. Dinning:

I'm pleased to be sending you the Ventura County Transportation Commission's (VCTC's) final Smart Passport evaluation report. This report details VCTC's experiences throughout the demonstration project. The report includes information supplied by Echelon Industries, Jacki Bacharach, the Project Manager, each of the participating transit operators as well as VCTC's own views of the demonstration project.

Sincerely,

Ginger Gherardi  
Executive Director