



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

---

PROCEEDINGS OF THE 42<sup>ND</sup>  
ANNUAL MEETING OF THE  
TRANSPORTATION RESEARCH FORUM

---

Annapolis, MD  
November 29 - December 1, 2000

---

# Customer Perspectives On Intermodal Transit

This paper is submitted for The Transportation Research Forum

42<sup>nd</sup> Annual Research And Policy Forum

Robert Lockhart, Senior Research Projects Analyst  
Telephone (510) 464-6253  
E-Mail rlockha@bart.gov

Aaron Weinstein, Manager  
Telephone (510) 464-6199  
E-Mail aweinst@bart.gov

Customer & Performance Research Department  
San Francisco Bay Area Rapid Transit District  
800 Madison Street  
PO Box 12688  
Oakland, CA 94604-2688  
FAX (510) 464-6196

## TABLE OF CONTENTS

	<u>Page</u>
I. Introduction.....	1
II. Background.....	2
A. The BART System.....	2
B. The Hayward Intermodal Facility.....	2
III. Evaluation Measures.....	3
IV. Ridership Data.....	3
V. Customer Behavior and Perceptions.....	4
A. Survey Methodology.....	4
B. Customer Survey Findings.....	5
C. Bus Driver Survey Findings.....	12
VI. Conclusions.....	14

## I. INTRODUCTION

The customer's decision to use transit includes consideration of the access modes that he or she would use to/from the transit stations on both ends of a trip. Those customers not within walking distance of a transit station are faced with a choice to use automobiles or take another form of transit to/from their stations.

One way to enhance the transit option is to construct "Intermodal Facilities" at the transit connecting points. These specifically designed and constructed transfer sites facilitate the transition between modes. Thus, intermodal facilities are an integral part of the transit services and are therefore part of the customer's mode choice decision. Some of the questions that are raised concerning intermodal facilities are:

- How important is the intermodal connection in the transit rider's overall mode choice decision?
- How can the impact of an intermodal facility be evaluated?
- To what degree can the effectiveness of an intermodal facility be determined?

The following paper documents customer reactions to an intermodal facility constructed at one BART station. Customer impacts are tracked by ridership counts and by survey research among the customers at the intermodal facility. The findings also include input from bus drivers who constitute an important sub-segment of intermodal facility users.

Ridership data, using passenger counts over time, provide information on the level of passenger activity. They also demonstrate the difficulty of using this type of data to evaluate the effectiveness of the investment in an upgraded intermodal facility. A key problem is that the intermodal facility is essentially passive. The transfer activity at the facility reflects dynamic changes in the transit service, the feeder services and shifts in the regional economy. These other factors are more likely to impact ridership than improvements to an intermodal facility. A customer's decision to use an intermodal facility is subject to an extremely wide variety of other factors as well. These include: auto availability, traffic congestion, and changes in the customer's residence and/or job location.

Although customer survey data are subject to sampling error and other limitations, they provide rich insights into the modal choice decisions. The survey data indicate how the intermodal customers rate the factors affecting their initial mode choice decisions and their decisions to continue or to increase their use of transit. Furthermore, the data present the users' perspectives on the facility, its operation, how well it functions as an intermodal transition point, and suggestions for improvement.

## II. BACKGROUND

### A. The BART System

The San Francisco Bay Area Rapid Transit District (BART) operates a 96-mile rapid transit system, spanning 4 counties, and 39 stations. BART is governed by 9 publicly elected Directors and employs over 3,000 individuals. BART trains, which operate on an exclusive right of way, are powered by 1,000 volt direct current provided by a third rail. BART carries over 90 million trips a year. using a fleet of 669 vehicles.

BART has constructed 6 intermodal Transit Centers as part of its Capital Improvement Program. These intermodal facilities are at the Bay Fair, Hayward, Walnut Creek, Concord, Pittsburg, and Daly City Stations. Each intermodal is composed of a bus berth transit center with benches, bus shelters, and signage improvements. As expressed in BART's Capital Program, the goals of constructing intermodal facilities are to "...improve traffic circulation in the vicinity of the stations, and improve the passenger experience by providing upgraded bus waiting and loading areas, weather protection and other amenities." Additional intermodal transit centers are planned for 7 more stations. These include Coliseum/Oakland Airport, El Cerrito Plaza, Fremont, Fruitvale, South Hayward, Union City, and West Oakland.

### B. The Hayward Intermodal Facility

The Hayward Intermodal Facility is the focus of the evaluation reported in this paper. This facility was funded by the Alameda County Congestion Management Agency. Bus service existed at the Hayward Station prior to the construction of the facility. Buses at that time used roadways open to autos and trucks and they competed with each other for limited curb space. The intermodal facility was completed in two phases. The "bus only" roadways, designated bus berths, new seating and lighting were finished in February 1997 and installation of the canopies was completed in the Fall of 1998.

The facility is served by buses from AC Transit and two shuttles: Cal State University and Mervyn's employee shuttle. A total of 17 AC Transit bus routes serve the facility. The buses stop at 16 permanent berths located on two "bus only" roadways immediately adjacent to the BART station entrance.

### III. EVALUATION MEASURES

Two approaches were considered to evaluate the impact of the Hayward Intermodal Facility: ridership counts and customer input. This evaluation is a requirement of the funding agreement with the Alameda County Congestion Management Agency(CMA) for the project. In discussions with the CMA it was determined that it is nearly impossible to gauge impact of the intermodal facility using ridership data alone. As noted above, the Hayward project was completed in two stages which spanned a two year period 1997 to 1998. During this same period BART opened a new line with two stations: Dublin/Pleasanton and Castro Valley. The new stations attract a significant number of former Hayward riders. The CMA agreed that the research requirement could be met using a customer survey to supplement ridership data. They also required that BART provide average customer access trip distance by mode for Hayward Station. Trip distance data in conjunction with ridership changes can provide some measure of possible auto mileage reductions. The trip distance information was developed using BART's system-wide Station Profile Survey which was conducted in 1998.

### IV. RIDERSHIP DATA

The recent history of customer activity at the Hayward Station reveals that the customer base is approaching ridership levels not seen since the opening of the Dublin/Pleasanton line in Spring of 1997. The intermodal transfer activity based on the two available counts is fairly stable. Some 3,200 persons were counted boarding buses in 1999 as compared to 3,229 boarders in 1996. Further evidence of this stability is apparent when the access mode data are compared using data from the 1992 BART Passenger Profile Survey and a similar study performed in 1998. In 1992 some 23% of the Hayward BART customers said they arrived at the station by bus; while in 1998 21% said bus (Note that this is not a statistically significant difference based on the sample sizes used).

Table 1. Hayward BART Station Entry Counts and Bus Boardings

Date	Station Entries (Average Weekday)	Bus Boardings (Survey Day)
October 1992	4,759	
May 1996	4,920	3,229
January 1997	4,788	
March 1997	5,155	
January 1998	4,052	
October 1998	4,439	
January 1999	4,221	
October 1999	4,723	3,200
January 2000	4,569	

The ridership data therefore do not show that the intermodal facility in itself has generated new riders. Neither do they negate the view that the intermodal facility has had a positive impact on transit access to BART, however.

Further confounding the use of ridership data are a host of other factors affecting bus passenger traffic at the intermodal facility. These include overall BART system ridership growth due to the increasing number of jobs in the region and increased traffic congestion. Also, during the same period BART riders had significant fare increases, there was a work stoppage, and the BART Express bus service serving Hayward ceased operation. All of these factors make it extremely difficult to determine a causal relationship between the intermodal facility and change in ridership.

- For example, since the 1996 and 1998 bus boardings are about the same, it might be concluded that the construction of the Hayward Intermodal facility attracted enough new riders to compensate for the elimination of the BART Express bus service in 1997. At the time the service was terminated BART Express was carrying 500 bus riders a day at Hayward. This conclusion, however, would discount all of the aforementioned changes affecting bus and BART ridership at Hayward.

## V. CUSTOMER BEHAVIOR AND PERCEPTIONS

A survey of bus riders and bus drivers was accomplished to assess the impact of the intermodal facility from the users' perspectives. This survey queried the bus riders on their current and past use of the facility. It probed to determine causal factors underlying the modal choice discussion. A critical question asked for change in trips at the intermodal facility. In addition to these mode choice questions the survey also included topics on the operation of the facility and ratings of the various features of the new layout and amenities. Bus drivers were also surveyed in recognition of their unique perspective as non-customer users of the facility.

### A. Survey Methodology

The surveys of riders and drivers were conducted by Godbe Research under contract to BART. The passenger survey required interviewers to give a survey form to every person departing on a bus from the Hayward Intermodal Facility between 6 a.m. and 7 p.m. on October 5, 1999. Some 3,200 persons were counted boarding buses during this time period. A total of 434 completed survey forms were received either at the survey site or by mail.

Care was taken to ensure that there was no systematic bias introduced in the survey process. Later analysis revealed that there was a higher rate of return from passengers riding at certain time periods. Weights are therefore assigned to completed interviews to adjust for over-sampled periods. These weights are based on the bus boarding counts.

The driver survey was performed as an intercept interview. These interviews were performed on the day of the survey. Completed interviews were obtained from 70 bus drivers. Note that this part of the research is considered as qualitative research to provide background and insights about the facility and the bus riders. Thus, weights are not assigned to the returns and percentages based on these data are only provided for illustrative purposes.



## **B. Customer Survey Findings**

### **The Intermodal Rider Profile**

The profile of bus riders at the Hayward Intermodal facility differs from a profile of those boarding BART trains at Hayward Station. These groups overlap as a result of the intermodal transfers. Although women form the majority of riders for both bus and BART; the bus riders are more ethnically diverse, younger, and have lower incomes than the BART riders. A key factor is the impact of a large component of students among the bus riders. Thus, although closely linked to BART train ridership, the intermodal facility serves a distinct market segment.

Most of the riders at BART and at the intermodal facility are female: 54% and 57% respectively. The majority of the BART riders are white, 51%, while only 21% of the bus riders categorized themselves as white. African Americans are the most frequently noted, 36%, ethnic group among the bus riders.

Although two thirds, 67%, of the bus riders are over 25 years of age; the 18 to 25 year age group is the most frequently noted category, 25%. This is comparable to the 29% of the bus riders who say they are students. More than 9 out of 10 of the BART riders are 25 years of age or older and only 7% are students. Fully 60% of the bus riders said they are employed full or part time, but the most frequent income category is \$15,000 or less specified by, 37%. Again, this may reflect the large student population. About three quarters of the BART riders are employed and 77% earn more than \$30,000.

Table 2 – Bus Rider and BART - Selected Demographic Comparisons

	<b>Bus Boarders</b>	<b>BART Entries</b>
<b>Ethnicity -----</b>		
Black	36%	22%
Asian	22%	24%
White	21%	51%
Hispanic	16%	16%
Native American	1%	1%
Other	4%	4%
<b>Age -----</b>		
Under 18	8%	1%
18 to 25	25%	9%*
26 and over	67%	90%*
<b>Employment-----</b>		
Employed	60%	76%
Student	29%	7%
Other	12%	17%
<b>Income -----</b>		
Under \$15,000	37%	7%
\$15,000 to \$30,000	27%	16%
Over \$30,000	36%	77%

\* Note: BART age groups are 18 to 24, and 25 and over.

(% may not total 100 due to rounding)

The distinctly different rider profile described above emphasizes the different sources of ridership for the intermodal facility vs. BART. The intermodal facility is primarily a BART/bus transfer point. More than half, 55%, of the bus riders say they come from BART. A third, 33%, are transfers from other buses and 10% walk to the facility. By contrast, the majority, 60%, of persons boarding BART trains, from home locations, use an automobile to get to the station; while only 21% come from bus.

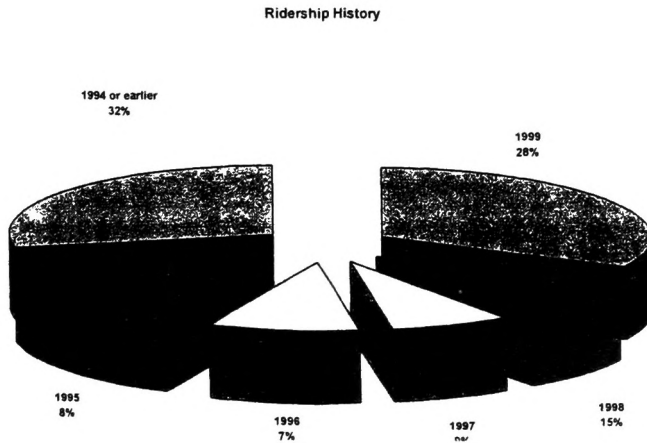
The BART connection is most pronounced during the AM and PM peak periods. During the mid-day the bus-to-bus transfer activity increases to 41% of all bus boardings.

Table 3 – Bus Rider Access Mode By Time of Day

Access Mode	Overall	Time of Day		
		A.M. Peak	Non-Peak	P.M. Peak
Base	400	131	141	119
Rode BART	55%	61%	48%	57%
Took a Bus	33%	27%	41%	29%
Walked	10%	11%	8%	11%
Carpooled	2%	1%	1%	3%
Drove Alone	2%	0	1%	0
Bike	<1%	0	0	0
Other	<1%	1%	1%	0

(% may not total 100 due to rounding)

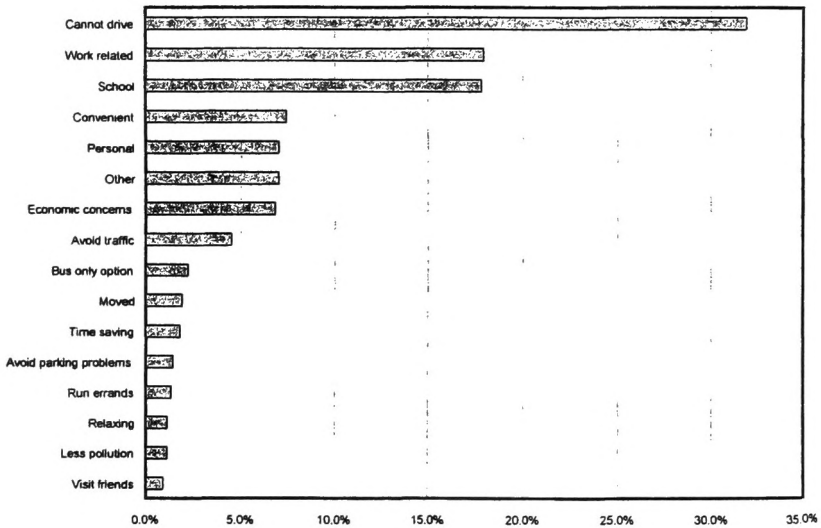
Riders were asked to indicate in what year they started using a bus at the Hayward Intermodal Facility.



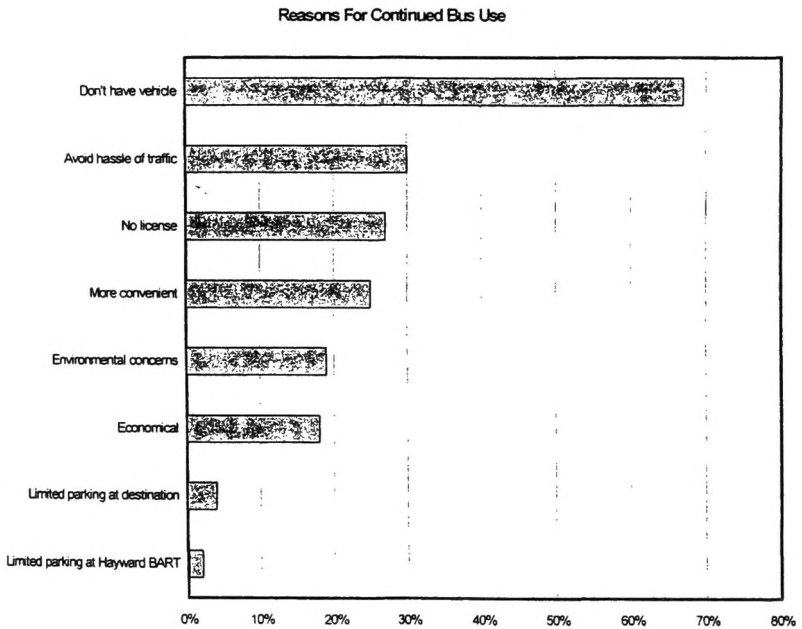
Nearly a third, 32%, started riding in 1994 or earlier and an additional 8% started in 1995. Thus, some 40% of the riders pre-date the intermodal improvements. Those persons, 7%, who started riding buses via Hayward in 1996 did so during the primary construction phase of the project which was completed in February 1997. The balance started riding in 1997, 9%, 1998, 15% or 1999, 28%. This latter group started after the work was substantially complete. These groupings will be used later in this paper to evaluate the impact of facility use history in relation to other factors.

When asked to provide the “initial” reason which led them to use a bus at the Hayward Intermodal Facility, a third, 33%, responded that they cannot drive. Note that this was an open-ended question in which the rider wrote in the most important reason rather than choosing from a range of options. Thus, the reasons are very subjective and include multiple responses. The next most noted reasons are Work Related, 18%, and School Related, 18%: they changed jobs or started school. These appear to be consistent regardless of when they started using the facility.

Initial Reasons for Using the Bus



The riders were asked why they choose to continue to ride the bus instead of another form of transportation. Again, they could provide multiple responses, but this time the respondents chose from a list of more focused responses. Here also the primary response reflects the lack of or inability to use an automobile. The automobile appears to be the preferred option. Fully two thirds, 67%, say that they use the bus at Hayward because they do not have a car and/or they don't have a license, 27%. Although many would like to use a car, a substantial 30% say that the bus lets them "Avoid the hassle of traffic" and an equally significant 25% see the bus as "More convenient than driving."



### **Rating Of The Intermodal Facility**

It is significant that the bus riders do not consider the intermodal facility itself as a reason for the initial choice of a bus or the reason that they continue to use a bus from the facility. It appears to be a given in their decision process. The intermodal facility appears to function well as a facilitator of the customers' transit travel, but it is not a motivating factor. The successful operation of the facility is documented in the rider responses to a series of rating questions.

Overall the majority, 55% of the riders give positive ratings of "Excellent" or "Good" to the Hayward Intermodal facility. Only 10% give a "Poor" rating. Some differences are revealed when the ratings are viewed in relation to the bus riders' access modes. It appears that those making connections from another bus are less positive than persons connecting from BART or walking to the bus facility. The customers may be factoring the transit operators performance into their final assessment.

Table 4. Overall Rating By Access Mode

Rating	Mode of Arrival			
	Overall	Rode BART	By Bus	Walked Only
Base	428	217	131	39
Excellent	11%	9%	11%	18%
Good	44%	50%	36%	54%
Fair	34%	31%	39%	20%
Poor	10%	10%	14%	8%

(% may not total 100 due to rounding)

Customer ratings of sixteen specific aspects of the intermodal facility provide a means to differentiate the perceived benefits and drawbacks of the facility from those of the transit services at the site. The customers rated these unique factors using the same "Poor" to "Excellent" scale used for the overall rating described above. Assigning values of "0" to "3" to the semantic rating scale allows us to calculate average scores with which to compare factors to each other and to the "Overall Rating". As shown on the following table seven of the factors score higher than the customers total rating. Note that the "Better" rated factors all focus on the operation of the facility: access, walking distance, safety, getting on/off bus, lighting, general appearance and bus information.

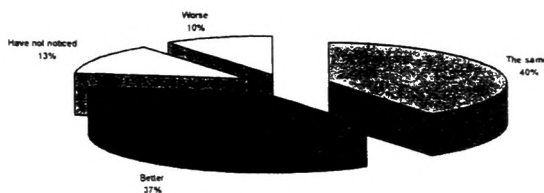
By contrast four of the nine "Lower" rated factors are ancillary to the facility itself. These include: bus frequency, timeliness, connection timing, and fares. The other low rated factors are: comfort of benches, weather protection, cleanliness, bus/BART coordination, and personal security. These remaining factors pertain to the facility itself and flag design areas that warrant consideration in the design of future intermodal facilities.

Table 5. Factor Ratings Compared To Overall Facility Rating

Factor	Rating(Score)				Average	
	Poor (0)	Fair (1)	Good (2)	Excellent (3)	Score	Factor to Overall
Ease of access to/from BART station	5%	17%	49%	30%	2.04	Better
Walking distance to/from my bus stop	4%	25%	40%	31%	1.97	Better
Pedestrian safety as a result of the bus layout/operation	5%	24%	50%	22%	1.89	Better
Ease of getting on/off bus	3%	21%	60%	15%	1.88	Better
Lighting	6%	30%	51%	13%	1.7	Better
Overall appearance	11%	32%	47%	11%	1.57	Better
Availability of bus information	15%	31%	39%	16%	1.57	Better
<b>Overall Rating</b>	<b>10%</b>	<b>34%</b>	<b>44%</b>	<b>11%</b>	<b>1.51</b>	<b>Overall Baseline</b>
Feelings of personal security while at the bus facility	12%	36%	44%	8%	1.48	Lower
Availability of seating	16%	37%	36%	12%	1.43	Lower
Frequency of bus service	24%	29%	37%	11%	1.35	Lower
Timeliness of buses	21%	34%	36%	10%	1.34	Lower
Timing of bus/BART connections	23%	32%	36%	10%	1.32	Lower
Cleanliness	22%	34%	37%	7%	1.3	Lower
Protection from the weather	29%	35%	28%	8%	1.15	Lower
Comfort of benches	26%	43%	27%	4%	1.09	Lower
BART/bus fares	25%	47%	23%	5%	1.08	Lower

Two questions were used to gain insight into the value of the improvements in the minds of the riders. First, the customers were asked to "...compare the way the bus facility at the Hayward BART station is today to the way it was when you first started using a bus at Hayward BART?" Although 37% say it is better, slightly more, 40%, did not think that anything had changed. Some 13% did not notice a change and 10% thought it was worse.

Facility Rating Over Time



Improving customer service tends to raise the bar in the minds of the riders. This is particularly true for new riders who only experience the improved facility. Some perspective is gained on these ratings when they are compared to when the customers specified they started to use the Hayward Intermodal Facility. Classifying the customers ridership history as “Before changes”, “During changes” and “After changes”, provides a frame of reference to evaluate the ratings. Thus, about half, 51%, of the new riders saw no change at the facility and only 26% thought that the facility was better. By contrast, half, 50%, of those who started riding before the changes noted that it was better, 28% said it was the same and 15% thought it was worse.

Table 6. Comparative Ratings: Impact of Ridership History

Rating	Overall	Started Riding Buses		
		After Changes	During Changes	Before Changes
Base	426	222	30	171
Better	37%	26%	48%	50%
Worse	10%	7%	5%	15%
The same	40%	51%	30%	28%
Did not notice	13%	17%	17%	7%

(% may not total 100 due to rounding)

In a follow-up question to determine the underlying reason for their ratings the customers responses again reveal the problem of differentiating the use of an intermodal facility from the modes which it serves. Thus, the most frequently noted reason for a “Better” rating was “Increased bus service” and the most noted specific reason for a “Worse” rating was “Fare increase”.

While individual transit service operations may be unrelated to the operation of an intermodal facility, the coordination of these services is a key factor. Riders were asked if the, “...buses typically wait for the passengers getting off the BART trains?”. As shown below, 32% responded “yes”, 40% said “no” and 28% were unsure.

The perceptions of BART/bus coordination appears to be a key factor in the riders’ overall rating of the intermodal facility. Riders who rated the intermodal facility as “Excellent” or “Good” overall, generally also say that buses typically wait for BART passengers: 48% and 36%. By comparison, half of the riders who offered “Fair” or “Poor” ratings to the facility also judge that buses do not wait for BART passengers: 50% and 51%.

Table 7. BART/Bus Coordination and Facility Ratings

Do buses wait for trains?	Rating of Intermodal Facility				
	Overall	Excellent	Good	Fair	Poor
Base	421	44	184	146	42
Yes	32%	48%	36%	22%	26%
No	40%	24%	34%	50%	51%
Undecided	28%	27%	30%	28%	23%

**Change In Intermodal Facility Use**

Rating of the intermodal facility and its amenities provides some measure of its ability to satisfy the customers needs. The “bottom line” however is in its ability to enhance the use of transit to attract and retain riders.

The survey addresses this point when it queried the riders concerning any change in their bus use since they first started using buses to and/or from the Hayward Intermodal. As shown below, 39% reported an “Increase” in the use of buses, 10% noted a “Decrease” and “51%” said that there has been “No Change”.

Some insight is gained by considering these results in relation to the mode riders use to get to the intermodal facility. More persons who are making bus-to-bus transfers also say they have increased their ridership, 45% as compared to those who come by BART, 32%, or walk, 36%.

Table 8. Change In Ridership and Access Mode

Change in ridership	Mode of Arrival			
	Overall	Rode BART	By Bus	Walked Only
Base	425	216	130	39
Increase	39%	32%	45%	36%
Decrease	10%	10%	8%	9%
No change	51%	58%	47%	55%

(% may not total 100 due to rounding)

**C. Bus Driver Survey Findings**

The interviews with the bus drivers at the intermodal facility were designed to be qualitative in nature. The questions were open-ended to encourage the drivers to expand on any of the issues raised during the course of the interview. Although qualitative in nature, many of the responses were coded to provide some percentage results for analysis.



### **Driver Experience With Intermodal Facility**

The bus drivers who use the intermodal facility provide a unique perspective on the facility, its operation and its customers. They constitute an experienced group who are knowledgeable about the facility and can offer operational suggestions beyond the competence of the average rider.

The drivers knowledge is based on experience. More than half, 57%, of the 70 drivers interviewed noted that they had been driving on the same route for more than six months. A third, 33%, stop at the intermodal facility more than five times a day.

### **Bus Driver Observations**

Bus drivers provided the following general observations about the intermodal facility.

- Some two thirds, 67%, of the drivers judged that overall bus ridership at the Hayward Intermodal Facility had increased since the completion of the project.
- Two thirds, 66%, also said that they thought their passengers felt positive about the intermodal facility. The drivers thought that the riders were reacting to the better appearance and organization of the facility. The leading negative observation is typified by the comment that, "BART/AC schedules are not connecting right."
- Some 62% of the drivers felt that the intermodal facility made their jobs easier. A prime reason offered by drivers for why the changes have made their jobs easier is that there is greater organization and maneuverability within the facility. Specifically, drivers mentioned: "Each bus has its own spot", "Stops are clearly marked", "[It is] easier to get in and out of spots", and "Wider streets". Drivers noted particularly the absence of cars on the intermodal roadways and the access to the restroom facilities in the BART station. The critical comments included some instances of maneuvering problems and coordination problems between BART and the buses.

### **Key Coordination Issues**

The drivers echo the bus rider refrain of a lack of coordination between BART and buses. The intermodal facility incorporates a feature which is designed to address this problem: the bus beacon. The bus beacon is a revolving yellow light which signals bus drivers that a train is arriving at the station. This alerts them to wait for the riders making a train-to-bus connection.

Four out of five, 81%, of the drivers said that they were aware of the bus beacon and its function. The rest of the drivers, even though they saw the flashing light, did not know its purpose.

More significant is the fact that 60% of the drivers feel that the bus beacon is ineffective. The drivers support this contention with such comments as: "the bus beacon simply does not work", "it goes on too soon", "[drivers] do not pay attention to it", "other drivers don't know what it is for", and "only can see [the bus beacon] from certain stops".

Another issue related to BART/bus coordination is the AC Transit bus schedule. Bus drivers were asked if they have enough flexibility in their schedules to allow them to wait for passengers transferring from BART. Over two thirds, 67%, of the drivers said "No". One driver mentioned that in some schedules they are specifically told to wait for BART passengers. However, if waiting for BART passengers is not factored into their schedules, then they do not wait.

The driver interview concluded with a questions which asked what changes the drivers thought should be made at the Hayward intermodal facility. The suggestions included being notified when BART trains are running late, easier access to restrooms for drivers, more BART Police to keep cars out of the facility, increased running and layover time at Hayward BART, cleaner restrooms, better coordination with BART, better weather shelters and more seats.

## **I. Conclusions**

The questions posed in the introduction to this paper can be answered as follows:

- How important is the intermodal connection in the transit rider's overall mode choice decision?

The transit riders overall mode choice decision is governed by many significant considerations. The initial choice to use the facility reflects changes in job or school and the fact that driving was not an option. The primary issue for continued use of the facility appears to be the lack of a vehicle and/or a driver's license. This does not mean that the facility has no impact, but that the other issues are primary.

- How can the impact of an intermodal facility be evaluated?

The preceding paper shows that the impact of an intermodal facility can be measured using a variety of tools. The ability to maintain and increase ridership is a core measure, but the numbers need to be carefully evaluated in light of a host of related factors: e.g. transit service route and frequency changes, regional economic changes affecting jobs and housing.

The transit customer can rate the facility, but these results require careful evaluation to identify the true cause of a rating. Is it the facility or the transit services at the facility which are being rated? Turnover in the transit rider market also means that the new riders have no frame of reference concerning past conditions and so accept the intermodal facility as a given commodity. Tracking this turnover is important.

A retrospective customer survey, such as that described above, can cost effectively provide a measure of rider use of the facility over time and indicate changes in use. It does not, however, provide a complete picture of the changes at the facility. A pre/post survey design would be needed for a complete tracking of rider behaviors which would include information on those former riders who ceased using this facility during the change.

- To what degree can the effectiveness of an intermodal facility be determined?

Due to the extended construction period at the Hayward Intermodal Facility and the variety of confounding factors affecting ridership during this period, a complete accounting of ridership impacts was not viable within the research budget. Positive impacts on the quality of the customer and driver experience are, however, clearly documented. Low income populations in particular appear to have benefited from the intermodal facility. The intermodal facility enhances and makes more accessible the transit operations which it serves. This is particularly evident in increased bus-to-bus transfers.

Some recommendations to improve the service are clear from the survey. These include:

- Improve scheduling to facilitate BART and bus connections.
- Promote the bus beacon function and check the timing to accurately denote when a train is arriving.
- Build some flexibility into the bus schedule to allow drivers to wait for riders without causing delays for riders further along their routes.
- Address rider concerns about weather protection.

If, as revealed above, the intermodal facility is essentially a passive factor in the riders mode choice decision, then the way to stimulate further growth is by expanding bus operator service and experimenting with other "Intermodal" modes.

- Research has shown that the greatest increase in mode of access to/from BART in recent years are shuttle services. These may be residential, employer, shopper or school services. They tend to expand the service area beyond the walking radius and the reach of fixed route buses.
- Another, more innovative approach, is through the use of Station Cars. These are cars which are shared by "home end" users during the night and on weekends and by "work end" users during the weekdays. They are not transit, but neither can they be considered to be private automobiles. They fill a niche between the shuttles and the private auto.