I-15 CONGESTION PRICING PROJECT
MONITORING AND EVALUATION SERVICES

TASK 13
PHASE II YEAR THREE OVERALL REPORT

Prepared for

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EXECUTIVE SUMMARY

This document summarizes the findings from the evaluation of the Interstate 15 (I-15) Congestion Pricing Project. The project was a three-year demonstration that allowed single occupant vehicles (SOVs) to use the existing I-15 high occupancy vehicle (HOV) lanes, known as the I-15 Express Lanes, for a fee. The project was part of the Federal Highway Administration (FHWA) Congestion Pricing Pilot Program and was managed by the San Diego Association of Governments (SANDAG).

The pricing project operated in two phases - the Phase I ExpressPass program, which ran from December 2, 1996 through March 30, 1998, followed by the Phase II I-15 FasTrak™ program, which ran through December 1999. During ExpressPass, participants were charged a monthly fee for unlimited use of the I-15 Express Lanes. During FasTrak, participants were charged a dynamic per-trip fee that varied based on time of day and traffic flow in the Express Lanes.

The project's primary goals were (1) to maximize use of the existing I-15 Express Lanes; (2) to fund new transit and HOV improvements in the I-15 corridor; (3) to test whether allowing solo drivers to use the Express Lanes' excess capacity can help relieve congestion on the I-15 main lanes; and (4) to use a market-based approach to set tolls.

San Diego State University (SDSU) conducted an independent, multi-element evaluation of the I-15 pricing project to assess its impacts. The evaluation considers whether the project met its primary objectives and reports on the measurable effects of pricing in the I-15 corridor during the three years of project operations.

This report provides an overview of findings presented in detail in 44 technical reports that address a range of topics such as traffic, travel behavior, and institutional issues. (See Appendix A for a complete list of reports.)

Traffic-Related Effects

At the end of the three-year evaluation, the I-15 pricing project appears to have met most of its primary objectives. There was a substantial better utilization of the Express Lanes, which was mainly due to the increase of subscriber vehicles. Both ExpressPass and FasTrak were feasible solutions, which generated sufficient revenue to fund transit service improvements in the I-15 corridor.

The revenue raised was successful in funding the new express bus service called Inland Breeze. The high proportion of Inland Breeze riders dependent on public transit for their travel, however, suggests that the service is primarily reaching segments of the population with traditionally higher levels of bus ridership. Although it is important for the Inland Breeze service to retain and perhaps expand this traditional customer base, the program's highest growth potential would appear to be in continuing to attract nontraditional bus riders.

Contrary to some pre-project expectations, neither ExpressPass nor FasTrak negatively affected carpool volumes on the Express Lanes. There were substantial increases in HOV volumes during ExpressPass that declined somewhat during FasTrak, but were still higher than in the pre-project period. FasTrak was primarily responsible for the continued increase in total Express Lane volume. Most importantly, FasTrak, in contrast to ExpressPass, was able to redistribute volumes from the middle of the peak to the peak shoulders. Despite steadily increasing Express Lanes volumes, free-flow conditions, as required by law, were maintained at virtually all times.

Another positive effect of the project is the apparent ability of the project to alleviate congestion on the I-15 main lanes. Average peak period volumes on those lanes generally decreased slightly, though not significantly, while overall volumes in the I-15 corridor increased moderately and were slightly lower than volume increases along the I-8 control corridor.

An important project benefit is the reliability of reduction in travel time delay. Under worst congestion conditions, FasTrak users can save up to 20 minutes avoiding delay on the I-15 main lanes and on the on-ramp to the main lanes.

Although SOV violation rates in the I-15 Express Lanes were higher during FasTrak than during ExpressPass, they continued to be low and substantially below the pre-project level. The reduction in SOV violations is likely due to the increased California Highway Patrol enforcement, made possible by project revenues. However, cost effectiveness of the extended CHP enforcement appears to have declined.

Other traffic-related findings are that the project moderated emission levels along I-15 during the study period, was able to attract enough program participants to the Express Lanes to reduce delay costs during the a.m. peak period, and did not emerge as a significant factor in reducing park and ride lot occupancy along the I-15 corridor.

ExpressPass/FasTrak Users and Carpoolers

Key findings support the view that in the I-15 corridor, the use of congestion pricing to better utilize the Express Lanes is a policy that has received considerable support. Several factors, one of which appears to be a lack of significant negative impacts, are likely to play a role in explaining the positive support for the project:

The use of ExpressPass/FasTrak was purely voluntary. Program participants saved time by using the Express Lanes. The most cited reason to join the program was the need for on-time arrival. ExpressPass/FasTrak customer's perceptions of timesavings were in the 20-minute range (which agrees with actual measurements) and they were convinced that the program positively impacted their travel time. The great majority of all other travelers reported no negative impacts of the program.

ExpressPass/FasTrak users, as well as I-15 carpoolers continuously perceived traffic conditions in the I-15 Express Lanes as satisfactory. This is a particularly important finding, as it shows that the policy of adjusting prices to traffic levels in the lanes has been successful in maintaining the level of service.

A vast majority of program participants and an increasing fraction of I-15 carpoolers considered the project a success. I-15 solo drivers (users of the main lanes) were split on this issue; they nevertheless supported the principle of charging solo drivers for the use of the Express Lanes.

Only few respondents knew that the program revenue had been used to fund the Inland Breeze service, and both program participants and carpoolers favored the opinion that the revenue should be used to add or extend and maintain the carpool lanes. Also, most FasTrak customers strongly agreed that the program was effective in reducing congestion, and the majority of other I-15 users also agreed but less strongly.

Support for the pricing policy continued throughout the project. The majority of customers were satisfied with dynamic per-trip pricing, and this preference increased during the project. Furthermore, the majority of all I-15 respondents favored increasing the per-trip charge over other solutions to prevent the Express Lanes from becoming too crowded. Also, over the entire study period, the majority of program participants themselves, not employers, paid for FasTrak.

The majority of all I-15 respondents agreed that solo drivers should be allowed to use the Express Lanes for a fee, and most importantly, they believed the project to be fair to travelers in both the main lanes and the Express Lanes. Also, equity issues did not emerge, despite the fact that FasTrak users came from the highest income groups.

Attitudes of Business and Land Use Issues

Potential business interest in FasTrak primarily hinges on the company's perceived travel dependency on a corridor where the program is installed. In the case of I-15, businesses found the more costly FasTrak per-trip pricing system as somewhat less attractive for frequent use than the moderately priced fixed-fee monthly ExpressPass system that allowed unlimited use of the facility. Businesses treated the program availability as a secondary factor influencing their travel, compared to supplies of goods and labor, price of certain commodities, and tax levels and policies.

Also, homeowners considered the I-15 pricing program as a secondary factor in their decision to relocate along the I-15 corridor. More important factors were quality of neighborhood, proximity to good schools, and cost of residence.

Institutional Issues

Many involved in implementing the project (project management team members and other stakeholders) perceived the project matched or exceeded their expectations and that it was a success by virtue of people's acceptance of pricing. They stated it proved pricing was technically and politically viable. The continued operation of FasTrak beyond the pilot period is testimony to the success and public acceptance of the pricing concept.

However, some felt that the project did not represent a full test of pricing since the price was not allowed to fluctuate in a truly dynamic fashion to any level. Also, the reduction

of congestion in the I-15 main lanes was perceived as unrealized and perhaps unrealistic.

The media satisfactorily informed the public about the project and provided a forum for expressing opinions about project-related issues. SANDAG as the project coordinator developed constructive media and public relations (by preparing special media information kits and events) from the beginning and was able to maintain them throughout the life of the project.

INTRODUCTION

This document summarizes findings from the monitoring and evaluation of the Interstate 15 (I-15) Congestion Pricing Project, which was designed as a three-year demonstration that allows single occupant vehicles (SOVs) to use the I-15 Express Lanes high occupancy vehicle (HOV) facility for a fee. HOVs of two of more occupants (carpools, vanpools, buses, motorcycles, and two-axle trucks) are permitted to use the I-15 Express Lanes for free.

The project's primary goals were:

- To maximize use of the existing I-15 Express Lanes
- To fund new transit and HOV improvements in the I-15 corridor
- To test whether allowing solo drivers to use the lanes' excess capacity can help relieve congestion on the I-15 main lanes
- To use a market based approach to set tolls

SDSU conducted an independent multi-element evaluation to assess the project's impacts on the I-15 corridor and the San Diego region by studying changes in I-15 corridor traffic, travel behavior, and attitudes towards the project throughout its duration. This report focuses on major findings from the 12 evaluation studies involving data collected from Fall 1996 (pre-project) throughout 1999. Detailed findings of these studies are presented in 44 technical reports listed in Appendix A.

Project Background

The Facility

The site of the I-15 Congestion Pricing Project is the I-15 corridor, a major north-south freeway in the inland San Diego region of Southern California. Interstate 15 connects several northern inland residential communities in San Diego and Riverside Counties with major employment centers to the south. The main freeway consists of four to five lanes in each direction.

The I-15 Express Lanes facility consists of an eight-mile (13-km) stretch of two reversible lanes in the freeway median between the junction of I-15 and State Route (SR) 163 at the southern end and the I-15/SR 56 junction at the northern end. Concrete

barriers separate the Express Lanes from the I-15 main lanes and access is available only at the two endpoints of the facility.

The I-15 Express Lanes operated in the southbound direction (inbound commute) from 6:00 a.m. to 9:00 a.m. and in the northbound direction (outbound commute) from 3:00 p.m. to 6:30 p.m. The hours of operation were extended in November 1997 from 5:45 a.m. to 9:15 a.m. and from 3:00 p.m. to 7:00 p.m. The facility is closed on weekends and holidays.

The History

The I-15 Express Lane facility opened in 1988. By the early 1990s, the facility, used by HOVs only, was underutilized while at the same time, the main lanes experienced severe congestion and transit service in the corridor was limited.

In 1991, San Diego Associations of Governments (SANDAG) Board member Mayor Jan Goldsmith of Poway expressed his concern with the relative lack of transit in the I-15 corridor, under-utilization of the Express Lanes and congestion on the main lanes. Mayor Goldsmith and SANDAG staff discussed the idea of selling the excess capacity on the I-15 Express Lanes to solo drivers at a market rate. At the May 24, 1991 SANDAG Board meeting, a resolution was adopted (No. 91-65) supporting a demonstration project to test the feasibility of pricing the use of the I-15 Express Lanes by SOVs, with revenues allocated to increase transit in the I-15 corridor.

To implement the project, SANDAG sought federal funding under the Congestion Pricing Pilot Program of the Intermodal Surface Transportation Efficiency Act (ISTEA), adopted by the United States Congress in 1991.

SANDAG's initial funding for the planning phase of the I-15 project was a $230,000 Federal Transit Administration (FTA) Section 26(b) grant awarded on September 30, 1992. In January 1995, SANDAG received a $7.96 million grant from the Federal Highway Administration (FHWA) under the ISTEA's Congestion Pricing Pilot Program to implement the I-15 Congestion Pricing Project. Local, in-kind funding of I-15 transit service provided the remaining $1.99 million of project funding.

State legislation (Assembly Bill 713) allowing SOVs to use the I-15 HOV facility for a fee was authored and sponsored by the then Assemblyman Jan Goldsmith and was signed into law in October 1994. The state law requires the I-15 Express Lanes ensure free-flow conditions for HOVs at all times. Free-flow conditions constitute level of service (LOS) B or the pre-existing LOS, which the California Department of Transportation (Caltrans) determined to be LOS C. Unrestricted, free access to the lanes by HOVs shall be available at all times. In addition, the law limits the use of revenue to transit and HOV improvements for the I-15 corridor.

The Sponsors and Partners

The FHWA was the primary funding agency for the project and provided oversight and assistance in evaluation design and technical matters. SANDAG coordinated and

managed the project. Caltrans was a primary project partner overseeing design specifications, physical improvements, and operational changes to the I-15 facility.

The California Highway Patrol (CHP) provided enforcement services, the San Diego Metropolitan Transit Development Board (MTDB) assisted in the planning and implementation of transit service improvements funded by the project. Wilbur Smith & Associates (WSA) headed the consultant team and assisted mainly with the planning phases of the project. TransCore provided the electronic toll collection and violation enforcement systems, and customer service operations.

A Project Management Team (PMT) consisting of staff members of all sponsors met on a monthly basis to provide technical review and direction on all aspects of project planning, design, and implementation. Other PMT members originally included Assembly Member Jan Goldsmith's Office, the City of San Diego, the City of Poway, and the Auto Club of Southern California.

Phase I ExpressPass and Phase II FasTrak™

The Phase I ExpressPass program ran from December 1996 through March 1998. In this phase, a limited number of solo drivers paid a flat fee for unlimited use of the I-15 Express Lanes. Initially, 500 monthly ExpressPass permits were made available in December 1996 at a cost of $50 per month. At the end of Phase I in March 1998, a total of 1,000 ExpressPass permits were available at $70 per month.

The Phase II FasTrak program began on March 30, 1998 and allowed solo drivers to pay a per-trip fee to use the lanes. The fees are adjusted dynamically based on time of day and traffic levels in the I-15 Express Lanes to maintain level of service (LOS) C on the lanes. The fees varied between $0.50 and $4.00 per trip; during severer traffic conditions they could reach $8.00 per trip. By March 26, 1998, the Customer Service Center (CSC) — responsible for customer relations, account management, and FasTrak data collection — had received a total of 2,271 transponder requests, representing 1,497 FasTrak accounts. By the end of the evaluation period on December 31, 1999, 11,091 transponders had been distributed.

For the first six months of Phase I, ExpressPass customers were provided with colored monthly permits to affix to the windshield of their vehicles. For enforcement purposes, the color of the windshield permits was changed every month.

As preparation for Phase II FasTrak, they were replaced with windshield-mounted transponders in June 1997. A third lane, the FasTrak-only lane, was installed in the toll zone area and was equipped with the automatic vehicle identification (AVI) system in August 1997. The AVI system became operational in September 1997 and consisted of overhead antennae and readers and vehicle detectors imbedded in the Express Lanes, which jointly determined traffic levels in six-minute increments and level of service and provided detailed program user information. The FasTrak-only lane was removed in July 1999 due to increasing customer complaints about difficulties in merging in and diverging from that third lane.

On August 31, 1998, SANDAG lowered the tolls during the peak period shoulders to encourage more FasTrak customers to use the I-15 Express Lanes during the off-peak hours when there is more capacity and to reduce FasTrak demand during the busier peak hours.

A summary of all project milestones is provided in Figure 1.

Figure 1
Summary of Milestones

Year	Period	Month	Mode	No. of ExpressPasses	No. of FasTrak Transponders	Price	Peak Periods	Toll Zone Area	Data Collection
1996	Pre-project	Oct					6:00-9:00 a.m. 3:00-6:30 p.m.		WSA
		Nov							
	Phase I ExpressPass	Dec	Monthly Decals	500		$50 per month		two lanes: HOVs and ExpressPass users	SDSU
1997		Jan							
		Feb		700					
		Mar				$70 per month			
		Apr		900					
		May							
		Jun							
		Jul	Transponders					three lanes: two carpool only lanes one ExpressPass/ FasTrak only lane	
		Aug							
		Sep							
		Oct							
		Nov					5:45-9:15 a.m. 3:00-7:00 p.m.		
		Dec							
1998		Jan							
		Feb							
		Mar		1,000	3,300				
	Phase II Year Two FasTrak	Apr			3,900	$0.50-$4.00 per trip			
		May			4,000				
		Jun			4,400				
		Jul			4,700				
		Aug			4,800				
		Sep			4,800	lower peak shoulder prices			
		Oct			5,300				
		Nov			5,900				
		Dec			6,500				
1999	Phase II Year Three FasTrak	Jan			6,600				
		Feb			7,000				
		Mar			7,100				
		Apr			7,500				
		May			7,900				
		Jun			8,000				
		Jul			8,300			two lanes: HOVs and FasTrak users	
		Aug			8,600				
		Sep			8,900				
		Oct			9,500				
		Nov			10,100				
		Dec			10,600				

METHODOLOGY

Monitoring and evaluation of the I-15 Congestion Pricing Project was designed to meet federal requirements for congestion pricing project evaluations, as well as the needs of SANDAG and other project partners.

Central to the evaluation were two major studies: (1) the Traffic Study, which monitored and evaluated a wide range of quantitative data on traffic volumes, travel modes, vehicle speeds, travel times, and violations, and (2) the Attitudinal Panel Study, which surveyed 1,500 individuals every six months from three different commuter groups. The evaluation also included potential changes in air quality and cost of delay, assessment of business impacts, bus ridership, land use, park-and-ride lot occupancy, public acceptance, media response, and marketing. In addition, the evaluation assesses institutional issues.

The methodology for the I-15 Congestion Pricing Project evaluation is described in more detail in the SDSU Task 1.4 report entitled *Detailed List of Key Issues*, July 1997. Characteristics of the methodology are summarized below.

Nature of the Studies

Evaluation studies of transportation demonstration programs are not controlled laboratory experiments. They rely on field or survey data that are collected in an organized and compatible fashion. For all traffic-related studies of the I-15 pricing project, a relevant section of I-15 coinciding with the location of the I-15 Express Lanes was selected as the study corridor, and a corresponding section of I-8 was selected as control corridor to sort out project-related changes from those that are not project-related.

There were numerous factors affecting the magnitude of various traffic characteristics on I-15 and I-8. It can be reasonably assumed that most of those factors, such as gasoline prices, were affecting both corridors in a similar way. However, some of the factors may have affected only one corridor, or both corridors but to different degrees.

Impacts of external factors could be systematically studied, and some of those external factors may have even remained unrecognized for at least part of the project duration. Thus, observed changes represent a combination of changes caused by the project itself, as well as those caused by external factors.

Control Corridor

A control corridor was established to distinguish changes attributable to the I-15 pricing project from changes due to variables outside the project, external factors, such as gasoline prices, employment levels, interest rates, etc.

An eight-mile section of I-8, an east-west commuter route, located approximately the same distance from downtown San Diego as the I-15 Express Lanes, was identified as the control site for the evaluation. Both freeways, I-15 and I-8, are major commuter

routes linking residential areas in the north and east, respectively, to downtown San Diego.

The I-8 segment constituted an imperfect control system, because there were several distinctive differences between the two corridors, the most important of which were that I-8 does not have carpool lanes, carries less traffic than I-15, and experiences generally better traffic conditions than I-15. I-8 commuters also have a lower socio-economic status, level of education, and a more balanced gender proportion when compared to I-15 commuters. However, the selection of the I-8 segment as study control was done carefully after examining alternative options. It was objectively the best control site available, and the decision to use the control corridor in this evaluation study proved to be beneficial.

Focus of the Studies

The main focus was the variety of potential impacts that the I-15 pricing project may have had on characteristics of the I-15 corridor. In order to study these potential impacts in a systematic way, the SDSU team developed the following system of general questions:

1) What happened in the I-15 study corridor, and what happened simultaneously in the I-8 control corridor with respect to the characteristic examined?
2) Were changes on I-15 different from changes on I-8?
3) Can changes observed on I-15 be attributed to the I-15 Congestion Pricing Project?
4) What were the major external circumstances, if any, which may have contributed to observed changes on I-15 (or I-8)?

This final report is also intended to capture the potential project impacts resulting from the switch of Phase I ExpressPass to Phase II FasTrak and potential impacts resulting from other project milestones presented in Figure 1.

Evaluation Waves

The evaluation was conducted in a series of periodic waves, which generally occurred in the Spring and Fall (typically April and October) of each year to avoid interference from the typical seasonal changes in traffic patterns. The pre-project traffic data were gathered in October 1996 by WSA. For most evaluation studies, SDSU conducted five waves of data collection, in Fall 1997, Spring and Fall 1998, and Spring and Fall 1999. A summary of data collection waves for individual studies is provided in Table 1.

Table 1
Waves of Data Collection

		Pre-project		Phase I ExpressPass		Phase II Year Two FasTrak		Phase II Year Three FasTrak	
	Historical	1996		1997		1998		1999	
	Data	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Traffic Study	[1]								
Bus Study									
Park & Ride Study									
Land Use Study									
Attitudinal Panel Study									
Business Impact Study									
Institutional Issues									

[1] from Spring 1988 through Fall 1995

Baseline Data

As part of the overall evaluation, all available historic data that could provide a background for the I-15 pricing project was utilized. Baseline data used include pre-project traffic, vehicle classification and occupancy, and violation data gathered by WSA in October 1996, as well as historical traffic and incident data from Caltrans for the period 1988-1996. These data were useful for impact analysis of trends.

Macroscopic and Microscopic Analysis

The SDSU evaluation team attempted to gather two types of data for each study wave. These data included: (1) *Macroscopic* (aggregate) travel related data from the I-15 study corridor and the I-8 control corridor, which consist of traffic data on mode use, time-of-peak distribution, speeds and travel time, traffic incidents, violations, and vehicle classification and occupancy; and (2) *Microscopic* (disaggregate) data about individual travel behavior, such as an individual's reported mode shifts and changes in time of departure, and traveler perceptions and attitudes, such as perceived changes in congestion, speeds, travel times, and safety of travel.

Gathering both types of data allowed the SDSU evaluation team to check for consistency of the findings and provided enhanced understanding of changes in project impacts observed from wave to wave.

Mix of Longitudinal and Cross-sectional Studies

The evaluation included both longitudinal and cross-sectional studies. Longitudinal data originate from studies that survey the same individuals over multiple waves to collect data on changes in travel behavior, perception, and attitudes (i.e., Attitudinal Panel Study), which offer a unique opportunity to study the complex dynamics of individuals' reaction to the project.

Cross-sectional data derive from studies that survey different individuals about the same topic (i.e., Business Impact Study and Land Use Study) or that simply collect same kind of data from the same location over multiple waves (i.e., Traffic Study).

Assessment of the Studies

Virtually all changes in various characteristics observed on I-15 or on I-8 were assessed using statistical methods. Appropriate statistical tests were used to establish whether observed changes are statistically significant or not. The level of confidence typically used in similar studies is 95 percent and was employed for all tests conducted.

However, a parallel assessment was made to examine whether observed changes were physically significant, noticeable, or likely to cause outcomes that were of interest to the project evaluation effort. For example, even a slight decrease in traffic volume may change the predominant conditions under which a freeway operates (e.g., a change from forced flow conditions [LOS F] to near-capacity conditions [LOS E]).

EVALUATION STUDIES AND FINDINGS

The major findings from SDSU's three-year evaluation effort are provided below by individual study. All studies presented below include a brief description of the study, major findings and a practical evaluation of the findings from the project objectives' point of view.

Macroscopic View

To provide a macroscopic view of the I-15 and I-8 corridors, the SDSU team conducted five individual studies of traffic conditions, bus use, park and ride lot usage, air quality, and cost of delay.

Traffic Study

The Traffic Study summarizes data on traffic volumes, vehicle occupancy and classification, and speed/delay for both I-15 and I-8. This study includes the pre-project traffic volume, vehicle speed, and vehicle occupancy and classification data collected by WSA, 12 years of historical traffic volume data from Caltrans, and vehicle occupancy and classification data collected by SDSU during Phase I and Phase II.

The focus of the Traffic Study was to detect changes in traffic characteristics from the pre-project period in Fall 1996 to Phase I ExpressPass and to Phase II FasTrak in order to evaluate traffic impacts of the I-15 pricing project.

The following traffic characteristics were monitored and analyzed on the relevant sections of I-15 and I-8:

Changes in Overall Traffic Volumes in the I-15 and I-8 Corridors

During the entire monitoring period from Fall 1996 through Fall 1999, volume increases along the I-8 control corridor were slightly larger than they were along the I-15 study

corridor[1] (eight percent vs. six percent). The volume increases along the I-15 corridor can be attributed to the substantial volume increases in the I-15 Express Lanes (48 percent) during this three-year period. These changes were likely to be noticeable to I-15 travelers on the I-15 Express Lanes but not on the main lanes.

The relatively flat volume profiles along the I-15 main lanes differ significantly from the increasing volume profiles along I-8. These differences are consistent with the interpretation that the I-15 pricing project alleviated congestion on the I-15 main lanes by redirecting an increasing share of volume onto the I-15 Express Lanes. The increases in total I-15 corridor volume, greater in absolute terms, though smaller in percentage terms than corresponding increases in I-8 corridor volume, reflect the pressures of demographic and socioeconomic growth on the I-15 travel corridor.

Changes in Various Traffic Volumes in the I-15 Express Lanes

Overall, average daily volume on the I-15 Express Lanes increased steadily during the ExpressPass and FasTrak phases by approximately 125 vehicles per month. This gradual and consistent increase, however, masks differential patterns among the three user groups of the I-15 Express Lanes.

Carpool (HOV) volume increased during the ExpressPass phase by approximately 81 vehicles per month, then declined slightly by approximately 27 vehicles per month during the FasTrak phase. However, HOV volumes during FasTrak were greater than during the pre-project period in Fall 1996.

Program subscriber volume was essentially flat during the ExpressPass phase, increasing by only 17 users per month, and then accelerated to a rate of 159 vehicles per month during the FasTrak phase. Violator (SOV) volume was usually the smallest component of total Express Lanes volume.

SOV volume fluctuated substantially in the middle of the monitoring period during the existence of a FasTrak-only lane, but was generally higher during the FasTrak phase than during the ExpressPass phase.

Modal Split Changes in the I-15 and I-8 Corridors

In the monitoring period from 1996 to 1999, the I-15 corridor experienced a substantial increase in SOV volume and a corresponding decrease in HOV volume during the a.m. peak period. The majority of this shift occurred between 1997 and 1998 during the transition from the ExpressPass to FasTrak phases of the I-15 pricing project. However, the trend continued in 1998 to 1999. The increase in SOV volume along the I-15 Express Lanes is attributable to scheduled expansion of the ExpressPass and FasTrak programs.

The sharper decline in HOV volume on the I-15 main lanes may reflect the general economic boom that occurred during the three-year monitoring period, as well as

[1] *Both I-15 main lanes and Express Lanes combined.*

general dissatisfaction with "unrewarded" carpooling.[2] Increases in SOV volume on the I-15 main lanes may indicate the strong influences of relatively high rates of commercial and residential development.

The shift from HOV to SOV volume along the I-15 corridor is particularly well captured in terms of person volume, rather than vehicle volume. From 1997 to 1998, average daily volume along I-15 increased by 2,672 vehicles but only by 551 persons. Average daily volume from 1998 to 1999 declined by only 702 vehicles, but there were 2,100 fewer travelers during this period.

The decline in HOV main lane volume along I-15 contrasts markedly with an observed rise in HOV volume along I-8 from 1997 to 1999. These results strongly suggest that corridor-specific factors, possibly including the I-15 pricing project, are responsible for these differences. The decline in HOV volume on the main lanes, where carpooling is unrewarded, was most pronounced during the a.m. peak period. HOV volume remained relatively flat in the p.m. peak period. Several factors might have caused people to withdraw from unrewarded carpooling, including rising levels of economic prosperity and frustration over lack of access to the Express Lanes.[3] Plans to extend the I-15 Express Lanes and improve access to them may reverse this trend in the future.

Level of Service C and Changes in Volume Distribution in the I-15 Express Lanes

Level of service (LOS) C, required by law to be maintained at all times, was indeed sustained at virtually all times.

There was a decrease in variance of volume distribution from Fall 1996 to Fall 1997 in the a.m. peak period and a subsequent general increasing trend through Fall 1999 in the variance of peak period volume distributions in both a.m. and p.m. peak periods. This result strongly suggests that the dynamic FasTrak fee structure was able to create desirable redistribution of a portion of Express Lanes traffic from the middle of the peak to the shoulders. The fixed fee structure of ExpressPass was not able to create such redistribution.

Some of the HOV volumes shifted from the middle of the peak to the peak period shoulders. It is possible that with both FasTrak and HOV volumes growing over time, both groups of Express Lanes users may have observed more traffic during the middle of the peak period (even though LOS C was maintained on the Express Lanes at virtually all times) and choose to avoid traveling during the middle of the peak period whenever possible, for extra safety and comfort.

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[2] Carpoolers who for different reasons have to use the I-15 main lanes instead of the Express Lanes can be considered "unrewarded," because they cannot enjoy the benefits of using the Express Lanes (higher speeds and reliability of on-time arrival) but experience inconveniences commonly associated with carpooling.

[3] As the Express Lanes only have one entrance, not all I-15 travelers are able to use the lanes.

Changes in Vehicle Occupancy in the I-15 and I-8 Corridors[4]

HOV proportions were substantially lower along the I-15 main lanes than along the I-8 corridor. HOV shares along both I-15 main lanes and I-8 lanes were much lower than on the I-15 Express Lanes. Along all three corridor segments under study, HOV proportions were generally higher during the p.m. peak period than during the a.m. peak period.

The proportion of SOVs on the I-15 main lanes increased steadily from Fall 1996 to Fall 1999, with a more prominent increase during the a.m. peak period than during the p.m. peak period. In contrast, SOV shares of volume on the I-8 lanes declined from Fall 1997 to Fall 1999, particularly during the a.m. peak period. Different corridor growth patterns may be responsible for this result.

As expected, with the growing number of FasTrak participants, SOV shares on the I-15 Express Lanes increased steadily and substantially between Spring 1998 and Fall 1999, with one exception in the p.m. peak period between Fall 1998 and Spring 1999.

Changes in Travel Time/Delay in the I-15 and I-8 Corridors[5]

There were substantial year-to-year changes in travel times along the I-15 main lanes and the I-8 lanes. The travel time profile along the I-15 main lanes differed significantly from the profile along I-8 in both a.m. and p.m. peak periods.

In the Fall study waves from 1997 to 1999, average travel times increased more sharply along I-15 than along I-8, presumably because of stronger influences of commercial and residential development along I-15 during the same time. In the Spring waves from 1998 to 1999, average travel times along the I-15 main lanes actually declined slightly, while increasing along I-8.

Results of the ramp delay study show that in the worst congestion, FasTrak users can save up to 20 minutes avoiding delay on the I-15 main lanes, which was approximately four minutes, and on the on-ramp to the main lanes, which was found to be approximately 16 minutes.

Cost of Delay Study

The intent of this study was to assess the impact of the I-15 pricing program on traffic delay and its cost in the I-15 corridor. To control for regionwide influences, traffic delays were also estimated for the corresponding segment of the I-8 control corridor.

Cost of Delay Study estimated the value of time lost by commuters as a result of traffic delays during peak periods along six-mile sections of I-15 and I-8. Delay costs were calculated using two factors. The first factor was the total delay (depending on traffic volume and speed) on the roadways as compared to a free-flow situation, which was

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[4] The 1996 vehicle occupancy data was based on a single day observation and therefore, could not be used for statistical assessment.

[5] Speed/delay studies were performed in Fall 1996 through 1999 and in Spring 1998 and 1999 using the "floating car" technique. The floating car technique uses a car that "floats" with the prevailing speed of traffic on the freeway to determine vehicle speeds.

assumed to be 72 mph. The second factor was the value of time defined as an individual's willingness to pay to avoid delays. Value of time was calculated with the assumption that value of time is 50 percent[6] of the average gross wage rate estimated from the Attitudinal Panel surveys that delivered household incomes and number of workers in a household.

Results generally show that delay costs were higher along I-15 than I-8, because traffic volume and wage rates were substantially higher for the I-15 corridor. In Fall 1999, SDSU estimated the total annual cost of delay as $5.94 million along the I-15 study corridor and $1.22 million along the I-8 control corridor. In Fall 1997, these estimates were $4.26 million and $1.00 million, respectively. These point estimates show that the total annual delay costs along I-15 increased by almost 40 percent from Fall 1997 to Fall 1999, compared to a 22 percent increase along I-8.

The increase in delay costs along I-15 is largely attributable to increases in total delay during the p.m. peak period, compounded by annual increases in the average wage rate and thus the value of time. Total delay during the a.m. peak period on I-15 actually declined from Fall 1996 to Fall 1999. Also, the study assumes a constant value of time. If time during the commute to work is valued more highly than time during the return home, then the increase in cost of delay along I-15 is overstated.

Delay costs did change over time along I-15, and the observed changes were different from those observed along the I-8 control corridor. These results show the I-15 pricing program may have been one of the factors influencing changes in delay costs along I-15. Specifically, it appears that the FasTrak program attracted enough program participants to the Express Lanes to reduce delay costs during the a.m. peak period. Higher FasTrak use in the morning can be explained by the need of on-time arrival for many travelers with work-related trip purposes. This on-time arrival does not seem as critical in the p.m. peak period during which more travelers decided to use the main lanes rather than FasTrak, thus contributing to an increased delay on the I-15 main lanes during that peak period.

Air Quality Study

The intent of this study was to assess the impact of the I-15 pricing program on emissions in the I-15 corridor. Various factors, such as the general level of economic activity, growth in housing, employment growth, and the I-15 FasTrak program, affected traffic volumes and speeds in the I-15 study corridor. The SDSU team also estimated emissions for the I-8 control corridor.

Emissions were calculated for four pollutants, including volatile organic compounds (VOC), nitrogen oxides (NO_x), particulate matter less than 10 microns (PM_{10}), and carbon monoxide (CO). In general, total emissions are the product of emission factors — functions of vehicle type and speed, expressed in units of grams per mile — multiplied by the number of vehicles and by the length of the corridor segment (six miles). Total emissions for each peak period along a corridor is determined by

[6] *See Small (1992)*

aggregating emissions over all segments in the corridor for all time periods and all vehicle types.

Data from the Fall study waves 1997 to 1999 demonstrate that the FasTrak program may have moderated emission levels along the I-15 corridor during a period when emission levels increased substantially along the I-8 corridor. The average relative increases along I-8 were three times larger than the average relative increases along the I-15 corridor in the a.m. peak period. In the p.m. peak period, this difference was even greater (five times).

Differential changes in average emission levels along the I-15 main lanes and Express Lanes over the same period possibly reflect the influence of the FasTrak program in displacing traffic from the main lanes to the Express Lanes. Average emission levels of all four pollutants on the Express Lanes increased substantially from Fall 1997 to Fall 1999 in both peak periods.

The differential trends in emissions observed along I-15 and I-8 manifested as significant corridor-year interaction effects in the regression analyses. These trends suggest corridor-specific developments, possibly including differential job growth, new home construction, population growth, and the I-15 FasTrak program, influenced average daily emission levels. Since the study is observational in nature, and other potentially influential factors could not be controlled or measured precisely, one cannot definitively attribute all observed differences in I-15 and I-8 emission profiles to the FasTrak program. Any other factor affecting volume and speed along only one of the two corridors would alter average emission levels, as would any corridor-specific changes in the relative proportions of vehicles types (e.g., passenger cars vs. light trucks).

However, the effects of the corridor-specific developments were more pronounced along I-15 than I-8 and could be expected to have increased emission levels along the I-15 corridor. No factors other than the FasTrak program were identified that could be expected to have reduced or mitigated increases in I-15 emission levels. From this perspective, one can reasonably conclude that the FasTrak program likely influenced, and in particular, moderated emission levels along I-15 during the study period.

Park and Ride Study

The intent of this study was to establish whether there is evidence that the I-15 pricing project had a tangible impact on park and ride lot occupancy; specifically, whether it contributed to a potential decrease in park and ride lot occupancy along I-15 because carpoolers who used park and ride lots and the Express Lanes could have started to use the lanes individually as ExpressPass/FasTrak subscribers. Therefore, the study monitored occupancy of 21 park and ride lots along the I-15 study corridor and 11 lots along the I-8 control corridor over five waves from Fall 1997 through Spring and Fall 1998 and 1999 for two consecutive days.[7] SDSU's observations were supplemented by

[7] SDSU monitored park and ride lots for two consecutive days rather than for a single day, to identify any day-to-day variability in park and ride lot usage.

the historical park and ride counts of the same lots conducted by Caltrans in Spring 1996 and 1997.

Results show park and ride lot occupancy rates along the I-15 and I-8 corridors fluctuated substantially and had significantly different profiles over time. Lot occupancy along I-15 was on average almost twice as high as along I-8 (43 percent versus 23 percent). This difference may partially be explained by the fact that I-8 does not have HOV lanes. Except for a modest spike in Fall 1998, I-15 lot occupancy rates remained stable relative to I-8 lot occupancy rates, which declined substantially from Spring 1996 to Fall 1997, and then increased between Fall 1997 and Fall 1999.

There is no evidence that the I-15 pricing project exerted a negative influence on park and ride lot occupancy during the study period, as one might reasonably have expected. The fluctuations in lot occupancy rates are not systematic and do not suggest any sustained trends in occupancy—declining or otherwise—that could reasonably be attributed to the project.

Also, occupancy rates of I-15 lots with bus access were lower than those of I-15 lots without bus access, which contrasts with the finding for I-8 that occupancy rates of lots with bus access were higher than those without bus access. This difference again may be partially attributed to the fact that I-8 does not have any HOV lanes, and therefore, users of the I-8 park and ride lots might have been more likely to continue their trip by bus rather than carpooling.

Overall, the results support the view that park and ride lot occupancy along I-15 and I-8 is subject to multiple confounding influences of unknown magnitude. The I-15 pricing project has not emerged as a significant factor in either suppressing or reducing lot occupancy along the corridor.

Bus Study

The intent of this study was to assess the project impacts on bus ridership levels in the I-15 corridor by monitoring and comparing changes in ridership on bus routes serving the I-15 corridor to changes in bus ridership in the San Diego region. In this study, regional transit ridership levels rather than I-8 transit levels were used as the control because of limited transit service in the I-8 corridor. The Bus Study also assessed the effectiveness of the project-funded Inland Breeze express bus service (Route 990) that began in November 1997 and is operated by the MTDB.

The I-15 and regional ridership data used in this study were collected from the MTDB and San Diego County Transit System (CTS). For the I-15, six express bus routes serving the corridor were included in this analysis. These express routes, defined as services making infrequent stops and traveling on a freeway for at least part of their route, were categorized into routes that use the I-15 Express Lanes and routes that do not use the Express Lanes. In addition SDSU conducted two onboard passenger surveys of Inland Breeze riders in Fall 1998 and Fall 1999.

Overall, bus ridership in the I-15 corridor increased by approximately nine percent over the entire study period from Fall 1996 to Fall 1999, whereas ridership in the entire San

Diego region increased substantially by 23 percent over the same period. The Inland Breeze was the main contributor to the overall ridership increase in the corridor. The extent of the project's impact cannot be clearly determined, however, as further results show most Inland Breeze riders used another bus prior to the Inland Breeze. There are indications that the Inland Breeze did not draw riders from buses in the same corridor, since mostly parallel changes in ridership occurred; i.e., at times when Inland Breeze ridership increased, ridership on other buses in the corridor also increased.

The SDSU team has found the Inland Breeze express bus service quite effective in attracting ridership and providing additional transit in the I-15 corridor. Although not as high as originally expected, Inland Breeze patronage is nevertheless substantial. Average daily ridership has grown steadily since the service began and has significantly increased bus patronage in the I-15 corridor. Moreover, a further and considerable increase in ridership occurred after the evaluation period, which ended in December 1999. Ridership on the Inland Breeze occurred primarily in the reverse commute direction, northbound during the a.m. peak period and southbound during the p.m. peak period, reflecting growing employment opportunities in San Diego North County.

The high proportion of "captive riders," riders that depend on public transit for their travel, on the Inland Breeze suggests that the service is reaching segments of the population with traditionally higher levels of bus ridership—individuals with relatively low household incomes and without access to automobiles. Although it is important for the Inland Breeze service to retain and perhaps expand this traditional customer base, the program's highest growth potential would appear to be in continuing to attract nontraditional bus riders.

Microscopic View

The microscopic view is provided by various studies which monitor and assess attitudes, perceptions, and travel behavior of individuals and groups potentially affected by the I-15 Congestion Pricing Project. This group of studies includes the Attitudinal Panel Study (longitudinal), and the Business Impact and Land Use studies (both cross-sectional). All three studies, described below, involve some form of individual interviews.

Attitudinal Panel Study

The intent of this study is to assess and evaluate the impact of the I-15 pricing projects on characteristics of travel behavior, perceptions of traffic conditions, and attitudes. Specifically, the study measures and evaluates changes in demographic characteristics, FasTrak use and mode split, departure time and timesaving, satisfaction with and perceptions of travel conditions, pricing and price sensitivity, and awareness and attitudes towards the pricing project.

This study was conducted in form of a panel survey that interviewed the same respondents at regular intervals, or waves. Approximately 1,500 respondents were surveyed at each wave in Fall 1997 (Wave 1), Spring 1998 (Wave 2), Fall 1998 (Wave 3), Spring 1999 (Wave 4), and Fall 1999 (Wave 5). The survey sample was comprised

of three main segments: (1) ExpressPass/FasTrak Customers, (2) Other I-15 Users including both solo drivers and carpoolers, and (3) I-8 Users also including solo drivers and carpoolers, which represent the Interstate 8 (I-8) control corridor. Comparisons across waves allow the study team to describe changes that took place, and statistical and analytic techniques and models were applied to help explain the reasons for the changes. The findings presented below are based on the analysis of all five waves.

FasTrak Customers differed from Other I-15 Users in the following ways: (1) they were from higher income households; (2) they were more highly educated (i.e., bachelor's degree or higher); (3) they were predominantly 35-54 years old and less likely to be 65 or older; (4) they were more likely to be home owners; (5) they were more likely to be middle-aged females; (6) they came from two vehicle households; and (7) they were more likely to be users of the Ted Williams Parkway on-ramp to southbound I-15 (the entrance to the Express Lanes).

General usage statistics show a high point of FasTrak use (5.27 trips per week) in Fall 1998. The significant increase in FasTrak use from Spring 1998 to Spring 1999 may reflect the effectiveness of the shoulder pricing policy (decreased toll prices in the off-peak hours) that was introduced in August 1998 to distribute traffic more evenly throughout the peak period away from the peak hour. The subsequent declines in FasTrak use partially may be due to a panel age effect that would account for some reduction in FasTrak trips. Part may be attributed to a declining effectiveness of the shoulder pricing policy, and part may be attributed to a reduction in timesaving during the same period.

Dynamic analysis also revealed that carpooling increased by six percent between Spring 1998 and Spring 1999 and that there was no change in the rate of carpooling versus solo driving between Fall 1998 and Fall 1999. There is no evidence that FasTrak customers were drawn disproportionately from former carpoolers. This is an important study finding as it shows that the I-15 pricing project did not have adverse impacts on carpooling. Furthermore, the majority of carpoolers did not feel that that their travel time had been impacted and their support for the project had grown over time.

Moreover, FasTrak had clearly influenced the times at which people travel. FasTrak Customers exhibited later departure times than Other I-15 Users in all survey waves, except in Fall 1998 when this difference disappeared. Furthermore, 76 percent of FasTrak Customers would leave at a different time in the morning if there was no FasTrak. The vast majority of those would leave earlier. For the return trip, only 38 percent would change their departure, divided equally between earlier and later. The results suggest some success of the shoulder pricing policy. However, results indicate that FasTrak users preferred to leave later and that cost savings associated with shoulder pricing may be insufficient to maintain that policy.

FasTrak Customers were asked why they joined FasTrak. The most frequently cited reason was to save time, and the need to be on time at their destination was a matter of concern to a significant number of commuters. Twenty-one percent of respondents said that they could not be late without consequences and an additional 10 percent said they had only a ten-minute window or less for being on time. Between Fall 1998 and Fall

1999, perceived time savings decreased significantly by -1.62 minutes for the most recent weekday a.m. trip. By Fall 1999, average timesavings by using FasTrak were perceived to be 16 minutes and 22 minutes during the a.m. and p.m. peak periods, respectively.

Throughout the project work and work-related trips remained the predominant journey purpose. Use of timesaving was unchanged over the study period. Not surprisingly, time saved by using FasTrak was mostly used for job and work tasks in the morning and for family and social purposes in the evening. Also, over the entire study period, the majority (84 to 90 percent) of FasTrak Customers themselves, not employers, paid for FasTrak, which is an important finding regarding the success of the pricing concept and its effects on commuter behavior.

Survey results show that average tolls paid dropped for the inbound a.m. trip from $2.25 in Spring 1998 to $1.77 in Fall 1999. Dynamic analysis revealed a significant decrease in tolls paid of 42 cents between Spring 1998 and Spring 1999. Outbound p.m. tolls paid displayed a similar decrease with the exception of Fall 1999, when average tolls paid increased to $2.28, suggesting changes in departure times. These results also indicate the effectiveness of the shoulder pricing policy, as some FasTrak Users moved from the peak to the shoulder periods with an accompanying decrease in the average toll paid. Users might have also been more selective in their decisions when to use FasTrak.

Traffic conditions on the I-15 Express Lanes were continuously perceived as satisfactory by FasTrak Users, as well as by I-15 Carpoolers. Also, users of the I-15 regular lanes believed that Express Lanes traffic had not been adversely impacted by the project. This is a particularly important finding, as it shows that the policy of adjusting prices to travel conditions in the Express Lanes had been successful in maintaining the level of service. Traffic conditions on the I-15 regular lanes were perceived by FasTrak Users, I-15 Carpoolers, and I-15 Solo Drivers as poor and deteriorating. FasTrak Non-users (FasTrak subscribers who used the I-15 main lanes, rather than FasTrak on the survey day), a consistently traffic insensitive group, did not share this perception.

Despite some lack of knowledge and understanding, the project was considered a success by an increasing number of FasTrak Customers and I-15 Carpoolers. In Fall 1999, more than half of I-15 Carpoolers and over 90 percent of FasTrak Customers judged the program a success. I-15 Solo Drivers continuously developed concrete opinions about the project, with 39 percent thinking it was a success by Fall 1999. Few respondents knew that FasTrak revenue had been used to fund the Inland Breeze express bus service. FasTrak Customers and I-15 Carpoolers favored the opinion that FasTrak revenue should be used to add or extend and maintain the carpool lanes.

Most FasTrak Customers strongly agreed that the program was effective in reducing congestion, and the majority of Other I-15 Users also agreed but less strongly. FasTrak Customers were convinced that the program positively impacted their travel time. The great majority of all other travelers reported no impact.

The majority of all I-15 respondents agreed that solo drivers should be allowed to use the Express Lanes for a fee. About 95 percent of FasTrak Customers, 70 percent of I-15 Solo Drivers, and about 65 percent of I-15 Carpoolers agreed with the concept. Most importantly, the majority of all respondents believed the project to be fair to travelers in both the main lanes and the Express Lanes.

There continued to be support for the pricing policy. The majority of customers were satisfied with dynamic per-trip pricing, and this preference had increased. Furthermore, the majority of all I-15 respondents favored increasing the per-trip charge over other solutions to prevent the Express Lanes from becoming too crowded.

Key findings lend support to the view that in the I-15 corridor, the use of congestion pricing to better utilize the Express Lanes is a policy that has received considerable support. While the majority of I-15 Solo Drivers did not see the project as a success, they nevertheless supported the principle of charging solo drivers for the use of the Express Lanes.

Several factors are likely to play a role in explaining this positive support for congestion pricing. Most importantly, there appears to have been a lack of significant negative impacts. FasTrak offered all travelers on I-15 a choice whether to pay for the use of the Express Lanes, an option available to overcome the possibility of being in a traffic jam. FasTrak users saved time and increased their travel predictability by using the Express Lanes, and carpoolers did not experience a worsening of their commute experience. Also, commuters believed the congestion pricing policies were fair, and equity issues did not emerge as a problem despite that FasTrak Users came from the highest income groups.

Business Impact Study

The intent of this study was to monitor the level of awareness of the I-15 pricing project in the local business community, to evaluate their views about the project, to monitor business use of the program, and to assess potential impact of the project on businesses. The study was aimed to evaluate whether local businesses considered the ExpressPass/FasTrak program important to their employees, their customers, or their own business operations. Therefore, the SDSU team surveyed businesses by phone over three waves in Fall 1997, Fall 1998, and Fall 1999.

Businesses were selected by random sampling methods from the *Pacific Bell Yellow Pages*. The survey sample included two types of businesses (site-based and delivery-based) located in three general areas of the San Diego region: (1) along the I-15 study corridor; (2) along the I-8 control corridor; and (3) in downtown San Diego (served by the I-15 and I-8 corridors). The samples were split equally between the six categories that are defined by crossing the three locations with the two business types.

Awareness of the I-15 pricing project can be expected to grow among local businesses during the project's early years, leading eventually to saturation of the program's potential market. By Fall 1999, 75 percent of site-based businesses along I-15 indicated that they were aware of the I-15 FasTrak program, as did 50 percent of delivery-based

businesses located in all three areas surveyed. This surge in awareness took place almost entirely in the second year of the project when the FasTrak program was launched to replace the ExpressPass program (which was much smaller in size), and no significant changes occurred in the project's third year.

Also, program use by employees was not common, and employers perceived the impact of the program as low during all three study years.

Potential business interest in FasTrak primarily hinges on the company's perceived dependence on a travel corridor where the program is installed (I-15, in this case). Site-based businesses located along the corridor, as well as delivery-based businesses in the greater metropolitan area, most likely perceive themselves as highly corridor dependent and are therefore most likely to express interest in such a program.

Businesses may prefer unlimited use permits to pay-per-use systems. The I-15 surveys indicate that FasTrak was better known but perceived as somewhat less important for businesses than ExpressPass. Businesses saw the FasTrak per-trip pricing system as somewhat less attractive (because it is more costly) for frequent use than the moderately priced ExpressPass fixed monthly fee system that entitled subscribers to unlimited use of the facility.

There are indications that Congestion Pricing projects may experience a decline in perceived importance over time simply because programs lose their novelty or because their actual effects ultimately do not match expectations set at the projects' early stages. These are alternative explanations for the observed decline in perceived importance of the I-15 FasTrak program.

Land Use Study

The intent of this study was to examine the possibility that the housing decisions for residents along I-15 are partially influenced by the existence of the I-15 pricing project. To control for possible non-project-related effects, Interstate 8 (I-8) was selected as the control corridor. Respondents from about 100 residential units each along the I-15 and I-8 corridors were surveyed using either a pick-up or mail-back questionnaire technique. SDSU conducted two surveys in Spring 1998 and Spring 1999.

The surveys inquired about the importance of nine factors in housing choice. These included the I-15 Express Lanes and the I-15 ExpressPass/FasTrak program, as well as the cost of residence, proximity to good schools, quality of neighborhood, and demographics.

All efforts were made to match developments along I-15 and I-8 in terms of average home size and price, but available homes along I-15 were considerably larger and more expensive. Responding households along the I-15 study corridor and the I-8 control corridor differed significantly in all household and individual characteristics, except in homeownership. I-15 households had higher proportions of male respondents, generally higher household income, and less variation in the distributions of respondent age and number of vehicles available for household use. Also, and in contrast to I-8

respondents, none of the I-15 respondents in either year belonged to a household with only one person or one licensed driver.

Despite the demographic differences, rankings of the factors of importance in housing choice were found to be virtually identical for respondents along both I-15 and I-8 corridors. Differences between I-15 and I-8 respondents were not significant for ratings of the importance of the following categories: cost of residence, quality of neighborhood, proximity to freeway, size of home/yard, and design/layout of home.

Not surprisingly, responding households along the I-15 corridor are significantly more likely than I-8 households to assign greater importance to the I-15 pricing program as a factor in their recent housing decision. The vast majority of I-15 respondents knew about the program. Between 1998 and 1999, awareness of the program increased significantly. However, there is no evidence that the perceived importance of the program has been increasing over time among new I-15 corridor residents.

The lack of an adequate control group does limit somewhat the strength of these conclusions. If I-15 responding cases could be matched to newly relocated residents in other areas that are comparable in average home size and price, then further modeling and analysis could be undertaken to assess the relative strength of factors in the housing decision. Nevertheless, the survey results are consistent in both years: the availability of the I-15 Express Lanes and the I-15 ExpressPass/FasTrak program were considered by homeowners as secondary factors in their decisions to relocate along the I-15 corridor.

Other Issues

The third major group of studies includes three supplemental studies on a variety of topics, which are described below.

Implementation Procedures, Policies, Agreements and Barriers[8]

The intent of this study was to assess the institutional relationships and related policies, procedures and agreements associated with the I-15 pricing project. The study reviewed the multi-party agreements, examined the changing institutional roles and opinions in response to the transition from ExpressPass to FasTrak, periodically interviewed key-stakeholders, and described the decision-making required to implement the project.

Study results show that many involved in implementing the project perceived it matched or exceeded their expectations and that it was a success by virtue of people's acceptance of pricing. They stated that the project had proved pricing was technically and politically viable. The importance of an influential political champion at the beginning of the project was emphasized.

[8] *The study report for of the third evaluation year was prepared independently by Eric N. Schreffler, ETC.*

Many stated that it proved pricing was technically and politically viable. Some felt, however, that the project did not represent a full test of pricing since the price was not allowed to fluctuate in a truly dynamic fashion to any level.

There was general consensus that the right organizations were involved in the project and that the PMT was successful in getting key decisions made on a tight project schedule.

The single objective that was cited by a majority of stakeholders as being fulfilled and as being important to the project and to the corridor was the more efficient use of existing capacity in the HOV facility. The reduction of congestion in the I-15 main lanes was seen as unrealized and perhaps unrealistic.

The continued operation of FasTrak beyond the pilot period is testimony to the success and public acceptance of the pricing concept as an option for SOVs willing to pay for reliable travel times and timesavings on I-15.

During the last evaluation year, the project moved into on-going operations with less oversight from the PMT and funding agencies. Planning was undertaken to move the project beyond the federal demonstration period. The continued operation of FasTrak beyond the pilot period is testimony to the success and public acceptance of the pricing concept as an option to single occupant motorists willing to pay a fee for reliable travel times on I-15.

Enforcement Effectiveness and Violation Assessment

This intent of this study was to assess the enforcement effectiveness and violation rates on the I-15 Express Lanes. In Fall 1996, SANDAG and CHP established an enforcement plan, funded by the project, that specified varying levels of patrol vehicle and motorcycle enforcement,[9] corresponding to project milestones.

SOV violations on the I-15 Express Lanes decreased significantly from a pre-project rate of 15 percent to an average rate of three percent that was maintained during Phase I ExpressPass. After the transition to Phase II FasTrak, SOV violation rates increased modestly but significantly to approximately five percent. However, FasTrak violation rates remained stable and significantly lower than pre-project violations.

A factor found to be most strongly and positively correlated with SOV violations rates is the number of citations issued. This finding indicates that more citations are issued simply in response to more frequent violations and that the acts of enforcement and citation do not exert a simultaneous influence on commuter behavior along the Express Lanes in the current FasTrak program. Moreover, the results suggest that although some level of enforcement constitutes the necessary condition to maintain the integrity of the I-15 pricing program, a more excessive enforcement is not cost effective, particularly over a longer period.

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[9] *Before the project started, CHP enforcement of the Express Lanes occurred no more than four days per month. Since the project started, enforcement has generally occurred daily at varying levels.*

Overall, the evidence suggests that the enforcement of the Express Lanes was adequate, since average SOV violation rates of the range between three percent and five percent are considered low and remained significantly lower during the monitoring period than during the pre-project period. However, since cost effectiveness of the extended CHP enforcement appears to have declined, alternative ways of enforcement should be explored, including the possible use of cameras in combination with CHP enforcement.

Media Relations and Coverage, Marketing, and Public Response

The intent of this study was to summarize all available media, marketing, and public response data on the project in order to assess the impact of the media coverage and marketing efforts on awareness of and attitudes towards the project.

For the media coverage, print articles and electronic news coverage were classified as informational or opinion pieces to assess the general tone of the media coverage. The marketing efforts evaluated include the work completed by Frank Wilson & Associates (FWA), the marketing subcontractor for the project, and SANDAG, which also promoted the project and provides communications to the public and local media. Public response included telephone calls, faxes, e-mails, letters, and personal comments by customers and other interested individuals at the FasTrak Customer Service Center (CSC). Two major outreach efforts were organized by SANDAG in compliance with the Environmental Justice legislation.

The SDSU evaluating team found that the media satisfactorily informed the public about the project and provided a forum for expressing opinions about project-related issues. SANDAG developed constructive media relations from the beginning and was able to maintain them throughout the life of the project. Both print and electronic media coverage have been informative, balanced, timely, and accurate throughout the life of the project. Informational pieces were much more common than opinion pieces. Strong negative views generally were not expressed. Most importantly, issues such as the elitist character of the project and price concerns, both potentially sensitive issues, appeared only during the first year of the project and rarely during the second year.

The 25 marketing and promotional efforts undertaken mainly addressed providing correct and up-to-date information for program participants and interested individuals. Media events and press/news releases were timely, accurate, and informative in tone. The SDSU team believes the marketing and promotional efforts undertaken were successful, considering the generally favorable views about the project by the public and the media, and the continuing request of interested individuals to join the program.

Overall public response towards the project in general and the customer service was overwhelmingly positive. Sporadic negative comments included concerns about the merging into the FasTrak-only lane, which was removed in July 1999, violation rates, the CHP, and the extension of the Express Lanes' hours of operation. SANDAG and the CSC received and implemented customer suggestions whenever possible.

CONCLUSIONS

This section summarizes the most important study findings from the three-year evaluation period and examines if findings from the various studies performed for the I-15 Congestion Pricing Project are congruent. Moreover, compliance of the pricing project's goals is also assessed.

One of the major and most obvious findings of the evaluation effort is that traffic volumes in the I-15 Express Lanes increased steadily and substantially over the entire study period between 1996 and 1999. The magnitude of changes indicates that these changes were physically significant and noticeable to I-15 Express Lane users. The transition from ExpressPass to FasTrak did not affect the monthly rate of total Express Lanes volume increase that was constant over both project phases. By the end of 1999, the Express Lanes were much better utilized than before the start of the project, which represents an important step towards one of the primary project objectives to maximize the use of the I-15 Express Lanes.

The contributing factors to improved Express Lanes utilization were increases in both HOVs and ExpressPass/FasTrak vehicles. HOV volume on the I-15 Express Lanes, however, surged during the ExpressPass period and subsequently moderated during the FasTrak period. Program subscriber volume was virtually flat during the ExpressPass phase, and then accelerated substantially during the FasTrak phase. Violator volume was generally higher during the FasTrak phase than during the ExpressPass phase, yet substantially smaller than during the pre-project period.

Furthermore, the proportion of HOV volume was higher during the p.m. peak period that during the a.m. peak period, whereas the proportion of FasTrak volume was higher during the a.m. peak period. This finding is supported by surveyed FasTrak customers who most frequently cited on-time arrival as the reason for joining FasTrak. On-time arrival, naturally, is a more predominant issue during the morning than during the afternoon, especially since trip purposes of FasTrak users were predominantly work-related. As many FasTrak customers mentioned they could not be late for work without consequences, or they had only a 10-minute window or less for being on time. On-time arrival can indeed be cited the most important benefit of the I-15 pricing program, which is supported by potential timesavings of up to 20 minutes at worst congestion, combining both delay on the I-15 main lanes and delay on the ramp to the main lanes.

Additionally, the importance of on-time arrival is demonstrated by the fact that the I-15 pricing program was able to attract enough program participants to the Express Lanes to reduce delay costs during the a.m. peak period, most probably because of the need of on-time arrival. On-time arrival is not as critical in the p.m. peak period, during which more travelers decided to use the main lanes rather than FasTrak, thus contributing to increased cost of delay on the I-15 main lanes. Cost of delay also increased along I-8, yet only half as much as along I-15.

There is no apparent explanation for the slight decline in Express Lane carpool volume during FasTrak, though not during ExpressPass, especially since findings from the

Attitudinal Panel Study report an increase in carpooling from Spring 1998 to Spring 1999, and no change in carpooling between the last Fall waves 1998 and 1999. These results do not support the notion that FasTrak customers were drawn disproportionately from former carpoolers. The majority of carpoolers did not feel adversely impacted by the FasTrak program and therefore had no reason to object to its continuation. Carpoolers, as well as program participants, continuously perceived traffic conditions on the Express Lanes as satisfactory and showed growing support for the I-15 pricing project.

Another important finding is that, in contrast to ExpressPass, FasTrak was able to redistribute part of the peak period traffic volume from the middle of the peak period towards the peak period shoulders, a desirable outcome that complies with one of the main project objectives and which may partly be due to the shoulder fee adjustments in August 1998. This redistribution was driven mostly by the redistribution of FasTrak volumes rather than carpool volumes, and is supported by the changes in departure time of FasTrak users who preferred to leave later rather than earlier.

The redistribution of carpool volumes was generally significant, yet difficult to explain, unless carpoolers perceived worsening traffic conditions during the middle of the peak. As mentioned, however, carpoolers were continuously satisfied with their travel conditions and did not feel that their travel time was impacted by the program. The carpoolers' positive view is supported by the fact that LOS C, required by law to be maintained at all times, was indeed sustained at virtually all times throughout the project duration. This constitutes an important and desirable project outcome that specifically relates to the dynamic nature of fee adjustment, never tested elsewhere, as it demonstrates that the goal of better facility utilization does not need to be accompanied by a diminishing level of service.

The substantial increase in Express Lanes volume over the evaluation period constituted the main contributor to the volume increase in the entire I-15 corridor. Furthermore, the project appears to have alleviated traffic on the I-15 main lanes. Average peak period volumes on the I-15 main lanes generally decreased, though slightly, especially when comparing volumes in the last study wave in Fall 1999 to volumes in the pre-project period in Fall 1996. Support for this view is also provided by changes in traffic volumes along the I-8 control corridor, which increased substantially over the same period.

Moreover, carpool volumes along I-8 also continuously increased over the study period, which may be due to travelers' reaction to the substantial and most likely physically noticeable increases in overall traffic volume, and a parallel perception of seriously worsening traffic conditions on I-8. On the I-15 main lanes, this was not the case. Carpool volumes on the main lanes declined substantially, maybe due to a relaxed perception of traffic conditions on the main lanes. This explanation, however, is not quite supported by Attitudinal Panel respondents' nor Land Use Study respondents' rating of traffic conditions in the respective corridors. By Fall 1999, however, satisfaction with travel conditions was at its lowest for I-8 respondents but not for I-15 respondents.

These changes in traffic volumes along both corridors are congruent with other important finding of the evaluation effort. Changes in average emission levels show the influence of the FasTrak program in displacing traffic from the main lanes to the Express Lanes, where emission levels increased substantially. Furthermore, relative increases in emission levels along I-8 were three times larger than along I-15. No factors other than the FasTrak program have been identified that could be expected to reduce or mitigate emission increases along I-15. Therefore, one can reasonably conclude that the FasTrak program moderated emission levels along I-15 during the study period.

The I-15 pricing program affected yet another aspect of travel in the I-15 corridor. The Inland Breeze express bus service, funded by project revenues to provide additional transit in the corridor, was quite effective in attracting ridership, but did not meet expected goals. The high proportion of riders depending on public transit for their travel on the Inland Breeze, however, suggests that the service is primarily reaching market saturation in segments of the population with traditional bus riders of relatively low household incomes and without access to automobiles. Although it is important for the Inland Breeze service to retain and perhaps expand this traditional customer base, the program's highest growth potential would appear to be in continuing to attract nontraditional bus riders.

Further findings suggest that potential business interest in FasTrak primarily hinges on the company's perceived travel dependency on the corridor where the program is installed and that businesses found the FasTrak per-trip pricing system as somewhat less attractive (because it is more costly) for frequent use than the moderately priced fixed-fee monthly ExpressPass system that allowed unlimited use of the facility. The I-15 pricing program has not emerged as a significant factor in influencing park and ride lot occupancy along the I-15 corridor, and demonstrated that FasTrak was considered by homeowners as a secondary factor in their decision to relocate along the I-15 corridor.

The study team believes enforcement of the Express Lanes adequate, cost effectiveness of the extended CHP enforcement appears to have declined, and alternative ways of enforcement possibly using cameras in combination with CHP enforcement should be explored.

Overall, results show a general support for the view that the use of congestion pricing to better utilize the I-15 Express Lanes is a policy that has the support and acceptance of the FasTrak customers and the public at large. Most importantly, issues such as the elitist character of the project and price concerns appeared only during the first year of the project and rarely during the second year. Many involved in the project implementation perceived the project matched or exceeded their expectations and that it was a success on all levels of implementation, including operations, technology, and finance. The program proved pricing was technically and politically viable.

Several elements that played an important role in the San Diego demonstration project need to be acknowledged. They are: constructive media relations, the presence of a

political champion, good inter-agency collaboration and, perhaps most importantly, a lack of perceived negative implications for any of the affected constituencies.

I-15 CONGESTION PRICING PROJECT: A BROADER CONTEXT

In this section, an attempt is made to assess the results of the I-15 Congestion Pricing Project from a somewhat broader perspective. This allows examination of the extent to which this particular project confirmed “conventional wisdom” about congestion pricing in general, and high occupancy toll (HOT) in particular.

It should be emphasized that the traffic and travel behavior findings appear to support some broader conclusions. However, the conclusions in this report are limited to the specific version of congestion pricing utilizing separate HOV lanes on an urban freeway. The three years of the I-15 project have shown the following.

Congestion pricing can be successfully implemented on an existing HOV lane on a major urban freeway. Both fixed monthly fee based and dynamic per-trip based versions of congestion pricing proved feasible, operationally successful, capable to generate measurable and statistically significant system-wide traffic impacts within the affected corridor, and capable to cause measurable and significant changes in travel behavior, at least among the program participants.

Congestion pricing can be an effective tool to better utilize HOV lanes. However, the fixed monthly pricing proved unable to contribute to spreading traffic throughout the peak period; instead, it might delay morning departures for work and increase trip concentration in the middle of the peak period. In contrast, the dynamic per-trip pricing can effectively redistribute part of the traffic from the middle of the peak period to the peak period shoulders.

Both versions of congestion pricing create an identifiable new travel option, which is highly valued by the participants and can be designed in a way that protects the interest of carpoolers and keeps them satisfied. In contrast to fixed monthly pricing, dynamic per-trip pricing offers a customized use of the HOT facility, which allows participants limited use of the facility.

The main incentives to become a program participant are perceptions of increased reliability of free-flow traveling, travel timesavings, and improved safety.

Congestion pricing does not appear to be a policy that adversely impacts HOV use in the HOT facility. It may even have the potential to increase carpooling, if it remains a non-fee travel option.

The fixed monthly pricing can create strong reactions to fee levels. This does not appear to be the case for the dynamic per-trip pricing.

Finally, widespread public concerns about fairness of a pricing policies may not necessarily arise, at least where revenue use is not perceived as favoring privileged groups, when a lane is not taken away from the main lanes to create HOT lanes, and

when better utilization of the previously underutilized HOV facility can be perceived as benefiting all corridor users.

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APPENDIX A

List of Available Reports

www.sandag.cog.ca.us/i-15fastrak/library.html

No.	Task(s)	Description
1	1.1	Worldwide Experience with Congestion Pricing
2	1.2	Up-To-Date Results of the SR 91 Congestion Pricing Experiment
3	1.3	Background In\formation on I-15 Corridor based on HOV Assessment Study
4	1.4-1.5	Detailed List of Key Issues and Study Design and Schedule
5	2.1-2.4	Control Factors
6	3.1.1 - 3.1.6	Phase I Traffic Study
7	3.1.8	Phase I Truck Use Study
8	3.1.9	Phase I Bus Study
9	3.1.10	Phase I Park and Ride Study
10	3.1.11	Phase I Land Use Study Methodology
11	3.1.12	Phase I Cost of Delay Study
12	3.1.13	Phase I Air Quality Study
13	3.2.1 - 3.2.3	Phase I Attitudinal Panel Study
14	3.2.4	Phase I Business Impact Study
15	3.3.1	Phase I Implementation Procedures, Policies, Agreements and Barriers
16	3.3.2	Phase I Enforcement Effectiveness and Violation Assessment
17	3.3.3	Phase I Safety-Related Issues
18	3.3.4	Phase I Marketing and Promotional Efforts
19	3.3.5	Phase I Community Outreach and Impacts
20	3.3.6	Phase I Media Relations and Coverage
21	3.3.7	Phase I Acceptance of the Project and the Pricing Concept
22	3.3.8	Phase I Technical Assessment of the Congestion Pricing System
23/34	1	Phase II Year Two & Phase II Year Three Traffic Study
24/35	2	Phase II Year Two Bus Study
25/36	3	Phase II Year Two & Phase II Year Three Park and Ride Lot Study
26/37	4	Phase II Year Two & Phase II Year Three Land Use Study
27/38	5	Phase II Year Two & Phase II Year Three Cost of Delay Study
28/39	6	Phase II Year Two & Phase II Year Three Air Quality Study
29/40	8*	Phase II Year Two & Phase II Year Three Attitudinal Panel Study
30/41	9	Phase II Year Two & Phase II Year Three Business Impact Study
31/42	10	Phase II Year Two Implementation Procedures, Policies, Agreements and Barriers
32/43	11	Phase II Year Two & Phase II Year Three Enforcement Effectiveness and Violation Assessment
33/44	12	Phase II Year Two & Phase II Year Three Media Relations and Coverage, Marketing, and Public Response

* Task 7 is the Attitudinal Panel Survey instrument included as Appendix in Task 8.