

Monitoring the Cost Effectiveness of the Caltrans Freeway Service Patrol (FSP) SB 1 Funded Expansion

A Research Report from the University of California Institute of Transportation Studies

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16. Abstract California's Freeway Service Patrol (FSP) is a congestion mitigation program managed in partnership with metropolitan planning organizations (MPOs), CHP and Caltrans on California's urban freeways. The program utilizes a fleet of roving tow and service trucks designed to reduce traffic congestion by efficiently getting disabled vehicles running again, or by quickly towing those vehicles off of the freeway to a designated safe location. Quickly removing motorists and their disabled vehicles from the freeway reduces the chances of further incidents caused by onlookers and impatient drivers. In addition, FSP helps save fuel and reduce air polluting emissions by reducing stop-and-go traffic. California's Road Repair and Accountability Act (SB 1) invests \$5.4 billion annually over the next decade to help fix and repair California's transportation system. It will address a backlog of repairs and upgrades, while ensuring a cleaner and more sustainable travel network for the future. California's Freeway Service Patrol received SB 1 funding to expand its service to motorist across California's congested freeways. In its first year of implementation (fiscal year 2018-19), the SB 1 funded FSP program expansion provided over 118,000 assists to California's motorists. The SB 1 funded FSP expansions provided almost \$47M dollars in benefits to motorists, while costing the State under \$9M. On average, the SB 1 funded FSP expansions provided 5 times as much benefit to California's motorists as these expansions cost the State.			
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UNIVERSITY OF CALIFORNIA INSTITUTE OF TRANSPORTATION STUDIES

July 2019

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TABLE OF CONTENTS

Executive Summary.....	ii
Introduction	1
FY 2018-19 SB 1 Funding and FSP Expansions	2
Research Objectives.....	3
Research Methodology	4
Freeway Service Patrol Evaluation (FSPE) Model	5
Data Sources	6
Findings – Results from the FSP Performance Evaluation	8
References	10
Appendix 1: SB 1 Funded FSP Beat Descriptions (FY: 2018-19).....	11
Appendix 2: SB 1 Funded FSP Costs and Benefits (FY: 2018-19)	20
Appendix 3: Memorandum – Three Month FSP Evaluation	29

List of Tables

Table 1. California’s FSP Programs, Counties, and Managing Agency.....	1
Table 2. FY 2018-19 SB 1 Funded FSP Expansion – Delay, Fuel, and Emission Savings	8
Table 3. FY 2018-19 SB 1 Funded FSP Expansion – Total Costs and Monetized Benefits	9

Executive Summary

The Freeway Service Patrol (FSP) is a program run jointly by Caltrans, the California Highway Patrol (CHP) and regional transportation agencies. Whether fixing a flat tire, towing a disabled vehicle to a safe location, clearing debris from a lane of traffic, or providing a gallon of gasoline to a motorist that has run out of fuel, California's fleet of FSP roving tow trucks have two primary benefits. First, the patrolling trucks of the FSP find congestion-causing incidents and clear them quickly. Second, tow truck drivers provide direct assistance to stranded motorists, increasing safety and security for them in a moment of need. This service reduces delay for other motorists by maintaining the capacity of our highway system and increases safety for motorists by clearing hazards that may cause secondary incidents.

California's Road Repair and Accountability Act (SB 1) invests \$5.4 billion annually over the next decade to help fix and repair California's transportation system. It will address a backlog of repairs and upgrades, while ensuring a cleaner and more sustainable travel network for the future. California's Freeway Service Patrol received SB 1 funding to expand its service to motorist across California's congested freeways.

As part of the SB 1 accountability requirements, the University of California at Berkeley's Institute of Transportation Studies (ITS) forecasted the cost effectiveness of the SB 1 funded FSP program expansion.

The ITS researchers found that in its first year of implementation (fiscal year 2018-19), the SB 1 funded FSP program expansion provided over 118,000 assists to California's motorists.

The SB 1 funded FSP expansions provided almost \$47M dollars in benefits to motorists, while costing the State under \$9M. On average, the SB 1 funded FSP expansions provided 5 times as much benefit to California's motorists as these expansions cost the State.

Overall, the weekday peak period FSP expansions (with a benefit-to-cost ratio of 6.0) were more cost effective than the midday and weekend FSP expansions. This is most likely due to the fact that the weekday peak periods are when California's freeways tend to be the most congested. Even with that, the weekend and midday FSP expansions still paid back 3 times more benefit to motorists as these services cost the State.

Introduction

The FSP program is a free motorist assistance service using contracted tow trucks that patrol designated routes on congested urban California freeways. Typically, the FSP operates Monday through Friday during peak commute hours. In heavily congested freeway corridors, FSP service is provided during the midday and on weekends/holidays in addition to the weekday peak period service.

The goal of the FSP is to maximize the efficiency of the freeway transportation system. The FSP is a traffic congestion management tool that strategically addresses non-recurring traffic problems by quickly finding and removing disabled/stranded vehicles or roadway obstructions from the freeway system. Deployment of FSP trucks is driven by congestion windows and traffic patterns in major metropolitan areas.

The rapid removal of freeway obstructions has a positive effect on traffic conditions by reducing incident durations and removal of other obstructions that directly contribute to non-recurrent congestion. In fiscal year 2017-18, the FSP program provided over 686,000 assists from the fourteen FSP programs across nine of the twelve Caltrans districts. The fourteen FSP programs in California are managed by the region’s Metropolitan Planning Organizations (MPOs) or County agency. California’s FSP programs and managing program partners are listed in Table 1.

Table 1. California’s FSP Programs, Counties, and Managing Agency

Caltrans District	Counties With FSP Services	FSP Program’s Managing Agency
3	Sacramento, Yolo	Sacramento Transportation Authority (STA)
3	El Dorado	El Dorado County Transportation Commission (EDCTC)
3	Placer	Placer County Transportation Planning Agency (PCTPA)
4	Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma	Metropolitan Transportation Commission (MTC)
5	Santa Cruz	Santa Cruz County Regional Transportation Commission (SCRTC)
5	Monterey	Transportation Agency for Monterey County (TAMC)

Caltrans District	Counties With FSP Services	FSP Program's Managing Agency
5	Santa Barbara	Santa Barbara County Association of Governments (SBCAG)
6	Fresno	Fresno Council of Governments (Fresno COG)
7	Los Angeles	Metropolitan Transportation Authority (MTA)
8	San Bernardino	San Bernardino County Transportation Authority (SBCTA)
8	Riverside	Riverside County Transportation Commission (RCTC)
10	San Joaquin	San Joaquin Council of Governments (SJCOG)
11	San Diego	San Diego Association of Governments (SANDAG)
12	Orange	Orange County Transportation Authority (OCTA)

As per the FSP Stateline Guidelines (November 2007): Caltrans has two major roles related to the FSP Program, which are: to develop and administer state annual funding specifically earmarked for FSP and to conduct special studies in support of each region's objective to maintain an ongoing cost-effective operation.

FY 2018-19 SB 1 Funding and FSP Expansions

The state funding allocated to regional transportation agencies for the Caltrans FSP program in FY 2016-17 was \$21.25 million. SB 1 directs an additional \$25 million per year to the FSP Program in FY 2017-18 and thereafter. Of this \$25 million, \$9.05 million is available (to regional transportation agencies) for allocation to support new or expanded service. If the entire \$9.05 million of available 2017-18 SB 1 funds are used to expand Caltrans' FSP program, this would constitute over a 40% growth in the overall program's size in a single year.

The State's FSP programs were not able to expand services by 40% in one year's time. The work associated with an expansion of this magnitude will most probably take multiple years. During fiscal year 2018-19 (July 1, 2018 through June 30, 2019), there were five FSP programs that were able to implement SB 1 funded expansions and received SB 1 funding for these expansions:

- Metropolitan Transportation Commission (MTC)
- Riverside County Transportation Commission (RCTC)
- Jan Joaquin Council of Governments (SJCOG)
- San Diego Association of Governments (SANDAG)
- Orange County Transportation Authority (OCTA)

The cost effectiveness of the SB 1 funded (new or expanded) FSP beats were reviewed and evaluated in this performance evaluation research effort.

The Bay Area's MTC was allocated \$2,392,070 in SB 1 funding for new or expanded FSP service for FY 2018-19. MTC, in Caltrans District 4, used the SB 1 funding to add additional tow-trucks on 3 weekday peak period beats, extend the weekday peak period hours of operation on 16 beats, and add new weekday midday FSP service on 2 beats. These SB 1 funded expansions provided better FSP service on 272.5 centerline miles of the Bay Area's freeway system. The SB 1 funded expansion FSP services were implemented as of July 2018.

RCTC was allocated \$627,310 in SB 1 funding for new or expanded FSP service for FY 2018-19. In Caltrans District 8, RCTC expanded their FSP program by providing new weekday peak period FSP service on 3 new beats. This provided FSP coverage on an additional 38.6 centerline miles of Riverside's freeway system. The new FSP beats were implemented as of September 2018.

SJCOG was allocated \$194,163 in SB 1 funding for new or expanded FSP service for FY 2018-19. The SJCOG FSP program, in Caltrans District 10, used the SB 1 funding to create 3 new weekday peak period FSP beats, providing FSP service on an additional 26.4 centerline miles of San Joaquin's freeway system. Two of the new FSP beats were implemented as of September 2018, and the third new beat was implemented as of November 2018.

SANDAG was allocated \$1,024,129 in SB 1 funding for new or expanded FSP service for FY 2018-19. In San Diego County, Caltrans District 11, SANDAG used the SB 1 funding to provide new weekday midday FSP service on 12 beats; and new weekend FSP service on 8 beats. These new beats provided midday FSP service on 174.8 centerline miles and weekend service on 213.7 centerline miles. The new SB 1 funded midday FSP services were implemented in July 2018, and the new weekend FSP services were implemented in August 2018.

OCTA was allocated \$991,890 in SB 1 funding for new or expanded FSP service for FY 2018-19. In Caltrans District 12, OCTA used the SB 1 funding to overlay 3 new beats onto their existing FSP beat structure, thereby providing more complete FSP service on 35.6 centerline miles of Orange County's freeway system. One of the SB 1 funded FSP services were implemented in August 2018, the other two new beats were implemented in December 2018.

A more detailed listing of the SB 1 funded FSP beats are listed in Appendix 1 of this report.

Research Objectives

This research proposes to perform a near-term cost effectiveness evaluation of the SB 1 funded FSP program expansion, quantifying the direct costs associated with the SB 1 funded expansions, and their associated benefits in terms of:

- delay savings (congestion reduction),

- motorist fuel savings, and
- mobile source emissions reduction.

This near-term cost effectiveness evaluation would provide Caltrans with valuable information on the congestion and air quality gains from the initial SB 1 expansion – which, in turn, could be used by Caltrans to adjust the allocation of FSP and SB 1 resources, thereby assuring that the SB 1 funding are indeed bringing about real-world benefits and being used wisely.

This research project provides a quantitative assessment of the SB 1 funded expansion of the California FSP program. More importantly, it provides the cost effectiveness assessment very early in the program – after only three months of implementation (using the July-September 2018 Caltrans FSP data on incidents, and traffic volumes provided from detectors through the Freeway Performance Measurement System (PeMS)).

This research provides Caltrans and the California FSP program managers with valuable decision-making information for the management of their FSP program. In turn, this information facilitates the fine-tuning or re-allocating FSP resources: placement of the FSP service/trucks and/or changes to the hours of operation to better match demands and increase efficiencies. More importantly, this early evaluation provides this critical information very early in the program’s expansion – just four months after initiation of the FSP expansion.

This research will estimate the monetized delay and fuel savings (benefits) to motorist, and mobile source emissions reductions attributable to the SB 1 funded expansion of California’s FSP program. Further, it provides the cost effectiveness assessment very early in the program – after only three months of implementation.

This research project’s findings and conclusions directly show decision makers and the California voters that the SB 1 funds are indeed improving travel conditions (reducing congestion and improving air quality) for California motorists.

A three-month performance evaluation was completed prior to California’s November 6, 2018 election. The findings from this evaluation are in Appendix 3 of the report.

Subsequently, an annual performance evaluation was performed using the first nine months (July 2018 through March 2019) of data. The last three months of the fiscal year (April – June 2019) were extrapolated, such that an annual performance evaluation and the final project deliverables could be completed before a June 30, 2019 project deadline.

Research Methodology

The primary tool used to evaluate the cost effectiveness of the SB 1 funded FSP services was the Caltrans Freeway Service Patrol Evaluation (FSPE) model. The FSPE model, its data inputs, model parameters, and the resulting outputs are described next.

Freeway Service Patrol Evaluation (FSPE) Model

Research studies conducted from 1995 through 2000 by the University of California at Berkeley, as part of the PATH Program, evaluated the effectiveness of FSP on a section of the I-880 freeway (Bay Area “Beat 3”) [1] and a section of I-10 freeway in Los Angeles (“Beat 8”) [2].

Detailed evaluation studies at these two test sites found that FSP is cost effective based on extensive field measurements “before” and “after” the FSP deployment [3]. Additionally, a simple to use spreadsheet based methodology has been developed to estimate the benefit/cost (B/C) ratio of each FSP beat using data commonly available to Caltrans and regional transportation agency operations staff. The model estimated delay-saving benefits depend on the beat’s geometric and traffic characteristics and the frequency and type of FSP-assisted freeway incidents. The FSP evaluation (FSPE) model was developed in close collaboration with FSP program partners who reviewed interim study products and participated in user and training workshops. The resulting spreadsheet based beat evaluation model has been used by Caltrans and regional transportation agency staff to calculate the B/C ratio of existing FSP beats since year 2000. These FSP model has also been used to assist in the assessment of and the better allocation of resources for the FSP program.

This research employed the FSP beat evaluation model (FSPE), developed by the research team [4,5] to evaluate the cost effectiveness of the SB 1 funded FSP service. The FSP Evaluation (FSPE) model is a deterministic queueing based planning level model that was developed specifically to evaluate the costs and benefits of California’s FSP program. The model has been used by several states nationwide to assess the performance of incident management measures (Florida, Virginia, Maryland, and Texas). The FSPE evaluation model produces estimates of:

- Vehicular delay savings to motorists: vehicle hours of delay (per day and/or per year)
- Fuel savings to motorist (gallons of fuel per day and/or per year)
- Mobile source emission reductions:
 - ROG (kg per day and/or per year)
 - CO (kg per day and/or per year)
 - NOx (kg per day and/or per year)
 - PM10 (kg per day and/or per year)
 - CO2 (kg per day and/or per year)
 - N2O (kg per day and/or per year)
 - CH4 (kg per day and/or per year)
 - CO2e (kg per day and/or per year)
- Delay Benefits (\$ per day and/or per year)
- Fuel Benefits (\$ per day and/or per year)
- Total Benefits (\$ per day and/or per year)

- Cost of the FSP Service

There are other or additional benefits of providing FSP service on California's freeways that are not accounted for in the FSPE model:

- **Benefits to motorists assisted by FSP:** Drivers and passengers of the vehicles assisted by FSP receive time savings due to FSP's faster response times and direct cost savings from the free FSP service. The cost of a tow-truck attending a disabled vehicle can range from \$5 for refueling to over \$60 for towing service.
- **Benefits to CHP:** The FSP service results in a fewer number of incidents attended by CHP and reduction in CHP's time spent assisting motorists with vehicle breakdowns.
- **Benefits to the freeway operators:** FSP service provides faster recovery of the freeway to normal conditions when freeway incidents occur, and improves Caltrans/CHP's incident detection capabilities. The roving FSP trucks are able to identify and locate collisions, freeway incidents and other traffic hazards, and then promptly report them to traffic management centers (TMC) and CHP.
- **Improved safety:** FSP vehicles provide motorist with faster clearance of incidents that may contribute to reducing secondary accidents. The determination of the safety improvements, however, requires data on accident rates and traffic volumes on the FSP beats over long time periods.

Data Sources

UC Berkeley researchers worked directly with the Caltrans FSP program manager on data collection and on quality control of the evaluation process and interpretation and review of findings. Further, the UC Berkeley research team collaborated with California's fourteen FSP program managers to assure that the research findings are meaningful to the FSP programs operational management decision process.

Various datasets and supplemental information from multiple sources were required to complete the FSP performance evaluation. These included information on the levels of SB 1 funding to California's FSP program for fiscal year 2018-19, detailed information on the SB 1 funded FSP beats and the freeway corridors traffic volumes and levels of congestion, and how the provided FSP service assisted motorists in need.

SB-1 Funding for California's FSP Program: The SB-1 funding data for California's FSP Program were provided by the statewide FSP program manager at Caltrans HQ, Division of Traffic Operations.

FSP Beat Geometry, Cost and Motorist Assist Data: The FSP beat geometry and FSP contractor cost data were directly provided by the regional FSP program managers. Likewise, the FSP motorist assist data were directly provided by the regional FSP program managers.

The hourly FSP tow contracted rates (\$ per tow-truck hour) were provided and used in this FSP performance evaluation to directly measure the costs of providing FSP service on the evaluated FSP beats. Hourly pro-rated cost indirect and/or overhead cost factors were estimated to account for the FSP program's program overhead costs and other program costs (like the agency's administrative costs and CHP oversight costs). These overhead costs were incorporated into the estimated hourly costs of providing the SB 1 funded FSP service for each beat evaluated.

Freeway Traffic Volume Data: Freeway traffic hourly volume data were downloaded from the Caltrans Performance Measurement System (PeMS) website. Caltrans PeMS collects data in real-time from over 39,000 individual detectors spanning the freeway system across all major metropolitan areas of the state of California. PeMS is also an Archived Data User Service (ADUS) that provides over ten years of data for historical analysis. It integrates a wide variety of information from Caltrans and other regional transportation agency systems including:

- Traffic Detectors
- Incidents
- Lane Closures
- Toll Tags
- Census Traffic Counts
- Vehicle Classification
- Weight-In-Motion
- Roadway Inventory

The mainline freeway volume data were processed to produce annual average non-holiday weekday hourly mainline freeway traffic profiles for a selected set of locations along each FSP beat to be evaluated. Since weekend traffic patterns are quite different than non-holiday weekday traffic patterns, separate hourly traffic profiles were created for evaluating weekend FSP service.

Motorist's Value of Time, Emission Factors, and FSPE Model Cost Parameters: The motorist value of time was valued at \$21.79 per vehicle hour based on Vehicle Operation Cost Parameters obtained from the Caltrans Economic Analysis Branch website [6]. The \$21.79 per vehicle-hour was calculated using the Caltrans published:

- Auto/Truck Composite (Weighted-Average) = \$18.95 per person hour, and
- Average Vehicle Occupancy = 1.15 occupants per vehicle.

The annual average fuel costs (\$3.42 per gallon) was estimated using weekly retail gasoline prices from the California Energy Commission website for the weeks in the July 2018 through March 2019 timeframe [7].

The fuel consumption rate was updated as 1.719 gallons of fuel saved for each vehicle hour of delay saved, based on the Caltrans Mobility Performance Report 2011. Air Pollutant Emission Rates of ROG, CO, NOx and PM10 were estimated using the current CARB/EMFAC factors (2010). The amount of extra vehicle emissions of CO2 is derived from the figure of 19.4 pounds of CO2 produced for each gallon of gasoline burned based on the Caltrans Mobility Performance Report 2011. The N2O and CH4 emission rates were calculated based on (i) the running emission rate of trucks and autos obtained from the Update of Methane and Nitrous Oxide Emission Factors for On-Highway Vehicles (U.S. Environmental Protection Agency, 2004)

and (ii) the percentage of truck obtained from the 2017 Annual Average Daily Truck Traffic on the California State Highway System.

Upon completion of the technical evaluation of the SB 1 funded expansion to California’s FSP program using the July 2018 – March 2019 FSP assist data and freeway traffic volume data, the delay savings and emission reduction benefits along with the overall benefit-to-cost ratio were summarized in this final report and in an accompanying policy brief. The results of the performance evaluation of the SB 1 funded FSP expansions are discussed next.

Findings – Results from the FSP Performance Evaluation

Overall, the SB 1 funded FSP expansion were successful, cost effective and did prove to return more benefit to California tax payers and motorist than it cost the State to provide these services. A summary of the results of the SB 1 funded FSP expansion is contained in Table 2.

Table 2. FY 2018-19 SB 1 Funded FSP Expansion – Delay, Fuel, and Emission Savings

Caltrans District & Regional Agency	Number of FSP Beats (or FSP Shifts)	Number of FSP Assists (assists/year)	Delay Savings (veh-hrs/year)	Fuel Savings (gallons/year)	CO2 Savings (Tons/year)
4-MTC	18	79,876	1,238,888	2,129,649	20,658
8-RCTC	3	10,361	195,162	335,483	3,254
10-SJCOG	3	869	39,225	67,428	654
11-SANDAG	24	21,336	142,389	244,766	2,374
12-OCTA	4	6,129	110,452	189,868	1,842
Statewide	52	118,571	1,726,116	2,967,194	28,783

Overall, the SB 1 funded FSP expansion provided over 118,000 assists to motorists during its first year of implementation. These freeway-incident assists saved California’s motorists over 1.7 million vehicle hours (which is almost 2 million person hours) in the current 2018-19 fiscal year.

Likewise, the SB 1 funded FSP expansion saved motorists over 2.9 million gallons of fuel in its first year of implementation, and should continue to reduce fuel consumption by at least this amount every year that these FSP services are provided.

The FSP expansions also reduced the mobile source CO2 emissions by over 28 tons during the same time one year period.

The FY 2018-19 annualized costs of providing the SB 1 funded FSP expansion along with the monetized motorist’s delay and fuel savings benefits, and the resulting benefit-to-cost ratios are listed in Table 3.

Table 3. FY 2018-19 SB 1 Funded FSP Expansion – Total Costs and Monetized Benefits

Caltrans District & Regional Agency	Total Annual Benefit (\$/year)	Total Annual Cost (\$/year)	Annual Benefit-to-Cost Ratio		
			Weekday Peak Period	Midday and/or Weekend	Overall Annual Average
4-MTC	\$34,278,770	\$5,501,397	6.0	3.0	6.0
8-RCTC	\$5,399,929	\$790,054	7.0	-	7.0
10-SJCOG	\$1,085,327	\$496,096	2.0	-	2.0
11-SANDAG	\$3,939,749	\$1,213,347	-	3.0	3.0
12-OCTA	\$3,056,103	\$806,970	-	4.0	4.0
Statewide	\$47,759,878	\$8,807,863	6.0	3.0	5.0

The SB 1 funded FSP expansions provided over \$47M dollars in benefits to motorists, while costing the State under \$9M. On average, the SB 1 funded FSP expansions provided 5 times as much benefit to California’s motorists as these expansions cost the State.

The FY 2018-19 annual costs, monetized benefits and the benefit-to-cost ratios for the individual beats are listed in Appendix 2 of this report. Appendix 2 also lists the annual number of assists, annual truck hours of operation and the overall annual assist rates (assists per truck hour) for the individual beats that were SB 1 funded in FY 2018-19.

Overall, the weekday peak period FSP expansions (with a benefit-to-cost ratio of 6.0) were more cost effective than the midday and weekend FSP expansions. This is most likely due to the fact that the weekday peak periods are when California’s freeways tend to be the most congested. Even with that, the weekend and midday FSP expansions still paid back 3 times more benefit to motorists as these services cost the State.

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Appendix 1: SB 1 Funded FSP Beat Descriptions (FY: 2018-19)

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 4, Metropolitan Transportation Commission (MTC)

Beat ID	County	Route	Beat Limits	Centerline Miles	Hours of FSP Operation			Number of FSP Trucks		
					Weekday Peak Period	Weekday Midday	Weekend	Peak Period	Midday	Weekend
1	ALA	I-980	Interstate 580 to Interstate 880	2.03	06:30-10:00 14:30-19:30			2		
	ALA/CC	SR-24	Interstate 580 to Oak Hill Road	10.64						
5	CC	I-680	Stone Valley Road to Marina Vista Road	14.20	06:00-10:00 15:00-19:00			3		
	CC	SR-24	Acalanes Road to Interstate 680	4.70						
6	SM	US-101	SR-92 to San Francisco City Limit	14.10	06:30-10:30 14:00-19:00	10:30-14:00		3	1	
15	SON	US-101	SR-116 to River Road	21.40	06:30-10:30 14:00-19:00			2		
16	SCL	SR-17	SR-9 to Summit Road	7.07	06:00-10:00 15:00-19:00			1		
19	SCL	I-880	SR-237 to Interstate 280	8.42	06:00-10:00 15:00-19:00	10:00-15:00		3	1	
	SCL	SR-17	Interstate 280 to SR-9	6.88						
	SCL	SR-237	Interstate 880 to Maude Ave.	7.50						
20	SM	I-280	Geneva/Ocean Ave to Interstate 380	8.18	06:00-10:00 15:00-19:00			1		
	SM	I-380	Interstate 280 to Highway 101	1.67						
21	ALA	I-680	SR-238/N. Mission Blvd. to Alcosta Blvd.	15.00	06:00-10:00 15:00-19:00			2		

Beat ID	County	Route	Beat Limits	Centerline Miles	Hours of FSP Operation			Number of FSP Trucks		
					Weekday Peak Period	Weekday Midday	Weekend	Peak Period	Midday	Weekend
22	ALA	I-580	Foothill Road to Grant Line Road	20.00	05:30-09:30 15:00-19:00 (M-Th) 15:30-20:00 (F)			3		
23	SCL/ALA	I-680	Highway 101 to SR-238/N. Mission Bl.	10.17	06:00-10:00 15:00-19:00			2		
25	CC	SR-4	Hillcrest Avenue to Interstate 680	16.10	05:30-09:30 15:00-19:00			3		
	CC	SR-242	SR-4 to Interstate 680	3.60						
26	ALA	I-580	Harrison St/Oakland Ave to I-238	13.47	06:00-10:00 15:00-19:00			2		
27	ALA	I-580	Foothill Road to Interstate 238	9.30	06:00-10:00 15:00-19:00			2		
29	SOL	I-80	Magazine Street to Abernathy Road	14.04	06:00-10:00 15:00-19:00 (M-Th) 14:30-19:00 (F)			2		
32	SCL	SR-85	El Camino Real to Cottle Road	19.78	06:00-10:00 15:00-19:00			2		
33	SCL/SM	I-280	State Route 92 to El Monte Road	16.90	06:00-10:00 15:00-19:00			1		
34	SOL	I-80	Abernathy Road to Midway Road	17.00	06:00-10:00 15:00-19:00			2		
35	CC	I-680	Alcosta Boulevard to Stone Valley Road	10.36	06:00-10:00 15:00-19:00			1		

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 8, Riverside County Transportation Commission (RCTC)

Beat ID	County	Route	Beat Limits	Centerline Miles	Hours of FSP Operation			Number of FSP Trucks		
					Weekday Peak Period	Weekday Midday	Weekend	Peak Period	Midday	Weekend
20	RIV	I-215	Murrieta Hot Springs to Ethanac Rd.	12.40	05:30-08:30 14:30-18:30			2		
34	RIV	I-15	Indian Truck Trail to Bundy Canyon Rd.	14.10	05:30-08:30 14:30-18:30			2		
35	RIV	I-15	Bundy Canyon Rd. to Temecula Pky/SR-79	12.13	05:30-08:30 14:30-18:30			2		

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 10, San Joaquin County Council of Governments (SJCOG)

Beat ID	County	Route	Beat Limits	Centerline Miles	Hours of FSP Operation			Number of FSP Trucks		
					Weekday Peak Period	Weekday Midday	Weekend	Peak Period	Midday	Weekend
P1	SJ	SR-120	Airport Rd to State Route 99	3.50	06:00-10:00 15:00-19:00			1		
	SJ	SR-99	Yosemite Ave to Jack Tone Rd	4.20						
P2	SJ	SR-120	Airport Road to Interstate 5	2.80	06:00-10:00 15:00-19:00			1		
	SJ	I-5	French Camp Rd. to Mossdale/Manthey Rd	8.70						
P3	SJ	SR-99	Jahant Road to Harney Lane	7.20	06:00-10:00 15:00-19:00			1		

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 11, San Diego Association of Governments (SANDAG)

Beat ID	County	Route	Beat Limits	Centerline Miles	Hours of FSP Operation			Number of FSP Trucks		
					Weekday Peak Period	Weekday Midday	Weekend	Peak Period	Midday	Weekend
153	SD	I-15	Carmel Mountain Rd. to El Norte Pkwy.	10.90		10:00-14:00			1	
503	SD	I-5	Sea World Dr. to Carmel Mountain Rd	11.00		10:00-14:00			1	
		SR-52	Jct. Rte. 5 to Kearny Villa Rd.	8.40						
504	SD	I-5	Carmel Mountain Rd. to Leucadia Blvd.	10.90		10:00-14:00			1	
505	SD	I-5	Leucadia Blvd. to Harbor Dr.	11.70		10:00-14:00			1	
781	SD	SR-78	I-5 Jct. to Sycamore Ave	9.10		10:00-14:00			1	
782	SD	SR-78	Sycamore Ave. to Broadway (Escondido)	8.60		10:00-14:00			1	
125	SD	SR-125	Jamacha Blvd.to Jct. Rte. 5	11.60		10:00-14:00			1	
		SR-54	Jct. Rte. 5 to SR-125/Jamacha Blvd.	10.60						
151	SD	I-15	Main St. (S.D.) to Jct. Rte. 52	10.80		10:00-14:00			1	
		I-15	Jct. Rte. 52 to Carmel Mountain Rd.	11.30						
163	SD	SR-163	A St. (S.D.) to Kearny Villa Rd.	10.30		10:00-14:00			1	
		SR-52	Kearny Villa Rd. to Jct. Rte. 67	10.30						

Beat ID	County	Route	Beat Limits	Centerline Miles	Hours of FSP Operation			Number of FSP Trucks		
					Weekday Peak Period	Weekday Midday	Weekend	Peak Period	Midday	Weekend
801	SD	I-8	Sunset Cliffs Blvd. to Waring Road	7.50		10:00-14:00		1		
		I-8	Waring Road to Second Street	10.30						
853	SD	I-805	Murray Ridge Rd. to Jct. Rte. 5	9.60		10:00-14:00		1		
941	SD	SR-94	28th Street to Avacado Blvd.	11.90		10:00-14:00		1		
151	SD	I-15	Main St. (S.D.) to Jct. Rte. 52	10.80			10:00-18:00		1	
		I-15	Jct. Rte. 52 to Carmel Mountain Rd.	11.30						
153	SD	I-15	Carmel Mountain Rd. to El Norte Pkwy.	10.90			10:00-18:00		1	
503	SD	I-5	Sea World Dr. to Carmel Mountain Rd	11.00			10:00-18:00		1	
		SR-52	Jct. Rte. 5 to Kearny Villa Rd.	8.40						
504	SD	I-5	Carmel Mountain Rd. to Leucadia Blvd.	10.90			10:00-18:00		1	
		I-805	Murray Ridge Rd. to Jct. Rte. 5	9.60						
505		I-5	Leucadia Blvd. to Harbor Dr.	11.70			10:00-18:00		1	
781	SD	SR-78	I-5 Jct. to Sycamore Ave	9.10			10:00-18:00		1	
		SR-78	Sycamore Ave. to Broadway (Escondido)	8.60						

Beat ID	County	Route	Beat Limits	Centerline Miles	Hours of FSP Operation			Number of FSP Trucks		
					Weekday Peak Period	Weekday Midday	Weekend	Peak Period	Midday	Weekend
125	SD	SR-125	Jamacha Blvd.to Jct. Rte. 5	11.60			10:00-18:00			1
		SR-54	Jct. Rte. 5 to SR-125/Jamacha Blvd.	10.60						
163	SD	SR-163	A St. (S.D.) to Kearny Villa Rd.	10.30			10:00-18:00			1
		SR-52	Kearny Villa Rd. to Jct. Rte. 67	10.30						
501	SD	I-5	Camino de la Plaza to 24th St.	9.70			10:00-18:00			1
		I-5	24th St./Mile of Cars Way to Sea World Dr.	10.80						
801	SD	I-8	Sunset Cliffs Blvd. to Waring Road	7.50			10:00-18:00			1
		I-8	Waring Road to Second Street	10.30						
851	SD	I-805	Jct. Rte. 5 to Plaza Blvd.	9.80			10:00-18:00			1
		I-805	Plaza Blvd. to Murray Ridge Rd.	8.60						
941	SD	SR-94	28th Street to Avacado Blvd.	11.90			10:00-18:00			1

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 12, Orange County Transportation Authority (OCTA)

Beat ID	County	Route	Beat Limits	Centerline Miles	Hours of FSP Operation			Number of FSP Trucks		
					Weekday Peak Period	Weekday Midday	Weekend	Peak Period	Midday	Weekend
402	ORA	I-405	Interstate 605 to State Route 73	13.50	10:30-14:30 19:30-22:00			1		
402-WE	ORA	I-405	Interstate 605 to State Route 73	13.50			10:30-19:00			1
573	ORA	SR-57	Los Angeles County Line to I-5/SR-22 Interchange	11.70	05:30-09:30 15:30-19:30	09:30-15:30		1	1	
920	ORA	SR-91	Tustin Avenue to Green River Drive	10.40	05:30-09:30 15:30-19:30	09:30-15:30		1	1	

Appendix 2: SB 1 Funded FSP Costs and Benefits (FY: 2018-19)

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 4, Metropolitan Transportation Commission (MTC)

Beat ID	County	Route	Beat Limits	Annual Truck-Hours and Assists			Annual Benefits and Costs		
				FSP Annual Assists	FSP Annual Truck Hours	Annual Assist Rate (assists per truck-hour)	FSP Annual Costs	FSP Annual Benefits	Annual B/C Ratio
1	ALA	I-980	Interstate 580 to Interstate 880	4,165	3,776	0.91	1,189,756	323,787	4.0
	ALA/CC	SR-24	Interstate 580 to Oak Hill Road						
5	CC	I-680	Stone Valley Road to Marina Vista Road	5,880	4,980	0.85	7,326,141	484,394	15.0
	CC	SR-24	Acalanes Road to Interstate 680						
6	SM	US-101	SR-92 to San Francisco City Limit	5,268	5,001	0.95	3,180,203	379,892	8.0
15	SON	US-101	SR-116 to River Road	3,920	2,600	0.66	684,476	307,602	2.0
16	SCL	SR-17	SR-9 to Summit Road	1,960	1,920	0.98	2,147,604	136,044	16.0
19	SCL	I-880	SR-237 to Interstate 280	7,105	3,476	0.49	3,531,794	493,087	7.0
	SCL	SR-17	Interstate 280 to SR-9						
	SCL	SR-237	Interstate 880 to Maude Ave.						
20	SM	I-280	Geneva/Ocean Ave to Interstate 380	1,960	880	0.45	499,937	158,211	3.0
	SM	I-380	Interstate 280 to Highway 101						

Beat ID	County	Route	Beat Limits	Annual Truck-Hours and Assists			Annual Benefits and Costs		
				FSP Annual Assists	FSP Annual Truck Hours	Annual Assist Rate (assists per truck-hour)	FSP Annual Costs	FSP Annual Benefits	Annual B/C Ratio
21	ALA	I-680	SR-238/N. Mission Blvd. to Alcosta Blvd.	3,920	2,740	0.70	856,968	306,779	3.0
22	ALA	I-580	Foothill Road to Grant Line Road	5,880	2,605	0.44	3,369,860	434,532	8.0
23	SCL/ALA	I-680	Highway 101 to SR-238/N. Mission Bl.	3,920	1,779	0.45	904,364	307,642	3.0
25	CC	SR-4	Hillcrest Avenue to Interstate 680	5,880	3,547	0.60	3,665,057	410,130	9.0
	CC	SR-242	SR-4 to Interstate 680						
26	ALA	I-580	Harrison St/Oakland Ave to I-238	3,920	4,093	1.04	1,085,909	305,407	4.0
27	ALA	I-580	Foothill Road to Interstate 238	3,920	4,052	1.03	548,140	318,382	2.0
29	SOL	I-80	Magazine Street to Abernathy Road	3,920	4,005	1.02	594,448	272,048	2.0
32	SCL	SR-85	El Camino Real to Cottle Road	1,960	556	0.28	3,595,377	267,148	13.0
33	SCL/SM	I-280	State Route 92 to El Monte Road	3,920	1,740	0.44	96,879	150,959	1.0
34	SOL	I-80	Abernathy Road to Midway Road	1,960	1,857	0.95	728,926	279,065	3.0
35	CC	I-680	Alcosta Boulevard to Stone Valley Road	3,920	4,093	1.04	272,932	166,286	2.0
Bay Area		Total of all Beats		69,458	49,608	0.71	34,278,770	5,501,397	6.0

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 8, Riverside County Transportation Commission (RCTC)

Beat ID	County	Route	Beat Limits	Annual Truck-Hours and Assists			Annual Benefits and Costs		
				FSP Annual Assists	FSP Annual Truck Hours	Annual Assist Rate (assists per truck-hour)	FSP Annual Costs	FSP Annual Benefits	Annual B/C Ratio
20	RIV	I-215	Murrieta Hot Springs to Ethanac Rd.	3,472	3,647	1.05	2,131,325	263,351	8.0
34	RIV	I-15	Indian Truck Trail to Bundy Canyon Rd.	3,472	4,269	1.23	2,030,348	263,351	8.0
35	RIV	I-15	Bundy Canyon Rd. to Temecula Pky/SR-79	3,472	2,445	0.70	1,238,255	263,351	5.0
Riverside		Total of all Beats		10,416	10,361	0.99	5,399,929	790,054	7.0

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 10, San Joaquin County Council of Governments (SJCOG)

Beat ID	County	Route	Beat Limits	Annual Truck-Hours and Assists			Annual Benefits and Costs		
				FSP Annual Assists	FSP Annual Truck Hours	Annual Assist Rate (assists per truck-hour)	FSP Annual Costs	FSP Annual Benefits	Annual B/C Ratio
P1	SJ	SR-120	Airport Rd to State Route 99	3,472	869	0.25	419,187	172,883	2.0
	SJ	SR-99	Yosemite Ave to Jack Tone Rd						
P2	SJ	SR-120	Airport Road to Interstate 5	3,472	1,140	0.33	444,861	172,883	3.0
	SJ	I-5	French Camp Rd. to Mossdale/Manthey Rd						
P3	SJ	SR-99	Jahant Road to Harney Lane	3,472	333	0.10	221,280	150,331	1.0
San Joaquin		Total of all Beats		10,416	2,343	0.22	1,085,327	496,096	2.0

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 11, San Diego Association of Governments (SANDAG)

Beat ID	County	Route	Beat Limits	Annual Truck-Hours and Assists			Annual Benefits and Costs		
				FSP Annual Assists	FSP Annual Truck Hours	Annual Assist Rate (assists per truck-hour)	FSP Annual Costs	FSP Annual Benefits	Annual B/C Ratio
153 M	SD	I-15	Carmel Mountain Rd. to El Norte Pkwy.	976	898	0.92	9,496	53,856	0.0
503 M	SD	I-5	Sea World Dr. to Carmel Mountain Rd	976	1,645	1.69	280,165	54,471	5.0
		SR-52	Jct. Rte. 5 to Kearny Villa Rd.						
504 M	SD	I-5	Carmel Mountain Rd. to Leucadia Blvd.	976	1,300	1.33	1,602,538	54,471	29.0
505 M	SD	I-5	Leucadia Blvd. to Harbor Dr.	976	818	0.84	222,077	54,471	4.0
781 M	SD	SR-78	I-5 Jct. to Sycamore Ave	976	720	0.74	81,281	53,856	2.0
782 M	SD	SR-78	Sycamore Ave. to Broadway (Escondido)	976	743	0.76	206,601	53,856	4.0
125 M	SD	SR-125	Jamacha Blvd.to Jct. Rte. 5	976	958	0.98	68,374	54,471	1.0
		SR-54	Jct. Rte. 5 to SR-125/Jamacha Blvd.						
151 M	SD	I-15	Main St. (S.D.) to Jct. Rte. 52	976	941	0.96	102,603	54,471	2.0
		I-15	Jct. Rte. 52 to Carmel Mountain Rd.						
	SD	SR-163	A St. (S.D.) to Kearny Villa Rd.	976	942	0.97	54,194	54,471	1.0

Beat ID	County	Route	Beat Limits	Annual Truck-Hours and Assists			Annual Benefits and Costs		
				FSP Annual Assists	FSP Annual Truck Hours	Annual Assist Rate (assists per truck-hour)	FSP Annual Costs	FSP Annual Benefits	Annual B/C Ratio
163 M		SR-52	Kearny Villa Rd. to Jct. Rte. 67						
801 M	SD	I-8	Sunset Cliffs Blvd. to Waring Road	976	625	0.64	28,915	54,471	1.0
		I-8	Waring Road to Second Street						
853 M	SD	I-805	Murray Ridge Rd. to Jct. Rte. 5	976	1,375	1.41	101,002	54,471	2.0
941 M	SD	SR-94	28th Street to Avacado Blvd.	976	1,014	1.04	10,554	54,471	0.0
151 W	SD	I-15	Main St. (S.D.) to Jct. Rte. 52	776	871	1.12	21,875	43,309	1.0
		I-15	Jct. Rte. 52 to Carmel Mountain Rd.						
153 W	SD	I-15	Carmel Mountain Rd. to El Norte Pkwy.	776	750	0.97	5,288	42,820	0.0
503 W	SD	I-5	Sea World Dr. to Carmel Mountain Rd	776	1,108	1.43	77,661	43,309	2.0
		SR-52	Jct. Rte. 5 to Kearny Villa Rd.						
504 W	SD	I-5	Carmel Mountain Rd. to Leucadia Blvd.	776	866	1.12	256,280	43,309	6.0
		I-805	Murray Ridge Rd. to Jct. Rte. 5						
505 W		I-5	Leucadia Blvd. to Harbor Dr.	776	648	0.84	99,402	43,309	2.0
	SD	SR-78	I-5 Jct. to Sycamore Ave	776	608	0.78	76,286	85,639	1.0

Beat ID	County	Route	Beat Limits	Annual Truck-Hours and Assists			Annual Benefits and Costs		
				FSP Annual Assists	FSP Annual Truck Hours	Annual Assist Rate (assists per truck-hour)	FSP Annual Costs	FSP Annual Benefits	Annual B/C Ratio
781 W		SR-78	Sycamore Ave. to Broadway (Escondido)						
125 W	SD	SR-125	Jamacha Blvd.to Jct. Rte. 5	776	728	0.94	138,908	43,309	3.0
		SR-54	Jct. Rte. 5 to SR-125/Jamacha Blvd.						
163 W	SD	SR-163	A St. (S.D.) to Kearny Villa Rd.	776	644	0.83	30,956	43,309	1.0
		SR-52	Kearny Villa Rd. to Jct. Rte. 67						
501 W	SD	I-5	Camino de la Plaza to 24th St.	776	698	0.90	256,904	43,309	6.0
		I-5	24th St./Mile of Cars Way to Sea World Dr.						
801 W	SD	I-8	Sunset Cliffs Blvd. to Waring Road	776	780	1.01	144,583	43,309	3.0
		I-8	Waring Road to Second Street						
851 W	SD	I-805	Jct. Rte. 5 to Plaza Blvd.	776	961	1.24	32,158	43,309	1.0
		I-805	Plaza Blvd. to Murray Ridge Rd.						
941 W	SD	SR-94	28th Street to Avacado Blvd.	776	694	0.89	31,648	43,309	1.0
San Diego		Total of all Beats		21,024	21,024	21,024	3,939,749	1,213,347	3.0

SB-1 Funded Beats for FY: 2018-19 – Caltrans District 12, Orange County Transportation Authority (OCTA)

Beat ID	County	Route	Beat Limits	Annual Truck-Hours and Assists			Annual Benefits and Costs		
				FSP Annual Assists	FSP Annual Truck Hours	Annual Assist Rate (assists per truck-hour)	FSP Annual Costs	FSP Annual Benefits	Annual B/C Ratio
402	ORA	I-405	Interstate 605 to State Route 73	1,632	1,140	0.70	849,328	124,818	7.0
402-WE	ORA	I-405	Interstate 605 to State Route 73	832	681	0.82	402,651	67,630	6.0
573	ORA	SR-57	Los Angeles County Line to I-5/SR-22 Interchange	3,263	2,349	0.72	1,221,982	309,193	4.0
920	ORA	SR-91	Tustin Avenue to Green River Drive	3,263	1,959	0.60	582,143	305,328	2.0
Orange		Total of all Beats		8,990	6,129	0.68	3,056,103	806,970	4.0

Appendix 3: Memorandum – Three Month FSP Evaluation

The three month FSP program evaluation was performed using forecasted FSP assist data primarily because there was very limited (real-world) FSP assist data on the SB 1 funded FSP beats.

The following is the memorandum produced and delivered to Caltrans prior to the November 2018 election on the cost effectiveness of the SB 1 funded FSP program expansion.

The Freeway Service Patrol (FSP) is a program run jointly by Caltrans, the California Highway Patrol (CHP) and regional transportation transportation agencies. Whether fixing a flat tire, towing a disabled vehicle to a safe location, clearing debris from a lane of traffic, or providing a gallon of gasoline to a motorist that has run out of fuel, California’s fleet of FSP roving tow trucks have two primary benefits. First, the patrolling trucks of the FSP find congestion-causing incidents and clear them quickly. Second, tow truck drivers provide direct assistance to stranded motorists, increasing safety and security for them in a moment of need. This service reduces delay for other motorists by maintaining the capacity of our highway system and increases safety for motorists by clearing hazards that may cause secondary incidents.

California’s Road Repair and Accountability Act (SB 1) invests \$5.4 billion annually over the next decade to help fix and repair California’s transportation system. It will address a backlog of repairs and upgrades, while ensuring a cleaner and more sustainable travel network for the future. California’s Freeway Service Patrol received SB 1 funding to expand its service to motorist across California’s congested freeways.

As part of the SB 1 accountability requirements, the University of California at Berkeley’s Institute of Transportation Studies (ITS) forecasted the cost effectiveness of the SB 1 funded FSP program expansion. The ITS researchers found that in its first year of implementation, the SB 1 funded FSP program expansion should provide over 121,000 assists to California’s motorists. Furthermore, the SB 1 funded expansion of California’s FSP program should be cost effective, with an overall benefit-to-cost ratio of 7-to-1; that is California’s motorist should receive over 7 times as much benefit from this SB 1 funded expansion as it will cost California residents. The FSP program’s rapid removal of freeway obstructions (debris, disabled vehicles and collision sites) has proven to have a positive effect on traffic conditions by reducing incident durations and removal of other obstructions that directly contribute to non-recurrent congestion.

Table 1: SB 1 Funded Freeway Service Patrol (FSP) Near-term Proposed Expansions

Regional Agency	Number of SB 1 Funded FSP Beats	Annual Number Of Assists	Annual Benefit-to-Cost Ratio
Bay Area’s Metropolitan Transportation Commission (MTC)	18	30,293	6.0
Riverside County Transportation Commission (RCTC)	3	7,131	6.0
San Bernardino County Transportation Authority (SBCTA)	9	26,290	11.0
San Joaquin Council Of Governments (SJCOG)	3	6,918	5.0
San Diego Association of Governments (SANDAG)	19	25,106	4.0
Orange County Transportation Authority (OCTA)	13	25,322	4.0
California Statewide Totals	65	121,059	7.0

Table 2: Forecasted Benefits for SB 1 Funded Freeway Service Patrol (FSP) Proposed Expansions

Regional Agency	Number of SB 1 Funded FSP Beats	Delay Savings (VHD/year)	Fuel Savings (gallons/year)	CO2 Savings (tons/year)	Total Annual Benefit (\$/year)	Total Annual Costs (\$/year)	Annual Benefit-to-Cost Ratio		
							Weekday Peak Period	Off-Peak or Weekend	Overall Annual Average
MTC	18	1,306,175	2,245,315	21,780	\$ 35,803,743	\$ 5,638,107	6.0	4.0	6.0
RCTC	3	187,089	321,605	3,120	\$ 5,128,308	\$ 790,054	6.0	-	6.0
SBCTA	9	1,099,944	1,890,803	18,341	\$ 30,150,698	\$ 2,751,471	11.0	-	11.0
SJCOG	3	85,603	147,151	1,427	\$ 2,346,472	\$ 496,096	5.0	-	5.0
SANDAG	19	143,413	246,528	2,391	\$ 3,931,125	\$ 1,018,311	-	4.0	4.0
OCTA	13	16,794	28,869	280	\$ 460,347	\$ 108,596	-	4.0	4.0
California Statewide	65	2,839,018	4,880,272	47,340	\$ 77,820,693	\$ 10,802,635	8.0	4.0	7.0