

The Valley CAN Tune In & Tune Up 2006 Program

Stockton, California

Sponsored by Valley CAN

**With Assistance from
The Advanced Transportation Technology and Energy Initiative Center
San Joaquin Delta College
and
California Bureau of Automotive Repair
Breathe Easier Program**

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INTRODUCTION

The Valley CAN Tune In & Tune Up 2006 (TI&TU) Program was conducted in Stockton, California on Saturday, November 4, 2006. The objectives of the Program were to use remote sensing to quickly identify high-emitting vehicles in need of repairs and based on the cost of the repairs, to determine the cost-effectiveness of the 2006 Stockton TI&TU Program. Relationships established between Valley CAN and the Advanced Transportation Technology and Energy Initiative (ATTEi) Center at San Joaquin Delta College and the State Bureau of Automotive Repair (BAR) contributed to the program's success. With the assistance of publicity on the radio and other means, 350 vehicle owners volunteered to have their vehicles tested. Motorists were asked to drive past two remote sensing devices (RSD) in series, which were operated by staff from the BAR. Candidate vehicles were driven past the remote sensors by the vehicle owners. RSD readings were made for carbon monoxide (CO), exhaust hydrocarbons (HC), and nitric oxide (NO), the pollutants of interest in this program.

Remote sensing measurements were performed by BAR staff. The remote sensing high emitter cutpoints for CO, HC, and NO_x were 5%, 1000 ppm, and 1000 ppm, respectively. A small, but not quantified number, of motorists received repair vouchers even though their RSD emission readings were not proven to exceed the BAR high emitter cutpoints. In these cases, it was judged likely that these cars were high emitters, based in part on paperwork showing that they had previously failed the Smog Check inspection.

TI&TU Program staff provided repair vouchers worth up to \$500 in emission-related repair costs to the owners of 300 vehicles that volunteered to participate in the Program after they failed the remote sensing emissions test. One hundred twenty-four vehicle owners actually participated in the repair portion of the program. Vehicle repairs were performed at Pro Care Automotive in Stockton

In addition to the RSD testing, motorists were directed to an on-site diagnostic testing station, where ATTEi automotive program students from San Joaquin Delta College provided written information regarding possible causes of their vehicles' emission problems. At that station, underhood inspections were conducted to provide vehicle owners with more information regarding the condition of their vehicle.

The following sections describe data collected during the 2006 Stockton TI&TU Program and emission reductions resulting from repairs to the high-emitting vehicles.

VEHICLE AND REPAIR DATA

One hundred twenty-four vehicles began the repair program, where vehicles were first given a California Smog Check test and inspection at Pro Care Automotive in Stockton. The model year distribution of all vehicles participating in the program is shown in Figure 1.

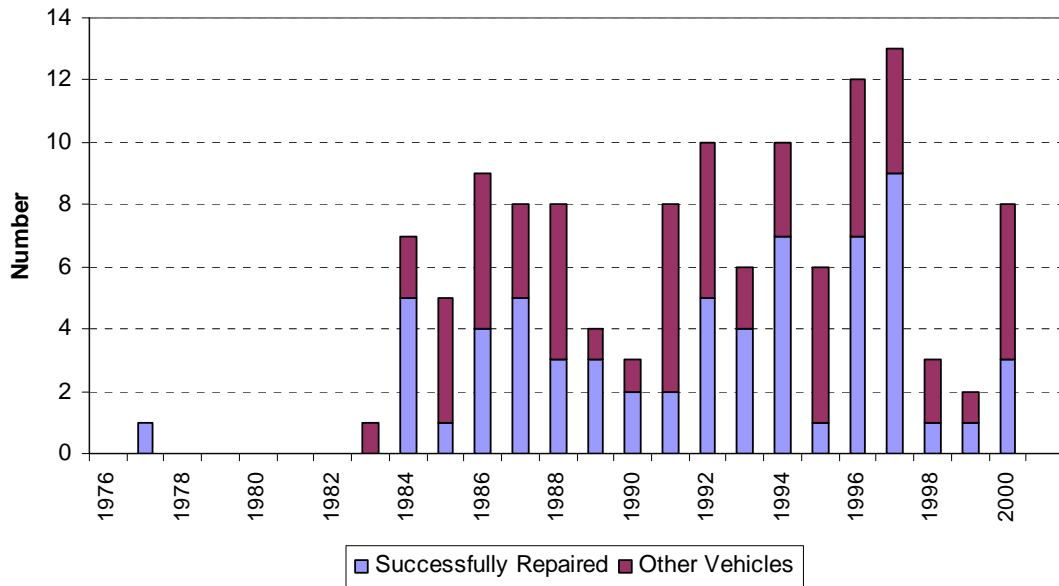


Figure 1. Model year distribution of the vehicles entering the 2006 Stockton Tune In & Tune Up Program.

Vehicles were given both emissions tests in the Smog Check program, the ASM5015 and the ASM2525, which are steady-state loaded mode tests conducted on a dynamometer. Table 1 provides the status of the vehicles that entered the repair program and their average costs of repair.

Table 1. Status of vehicles that failed the Smog Check inspection in the 2006 Stockton TI&TU Program.

Vehicle Class	Average Repair/Diagnosis Cost/Vehicle
Successfully repaired, n = 64	\$450
Partial repairs/Left program, n = 24	\$313
No NOx requirements, n = 4	\$606
Not testable, n = 7	Incomplete data

Sixty-four vehicles that initially failed the Smog Check test were successfully repaired according to Smog Check criteria. The average repair cost was \$450; the minimum cost was \$45, and the maximum repair cost was \$1167. Twenty vehicles' repair expenses exceeded the \$500 voucher amount. An additional twenty-four vehicles were partially repaired, but for a number of reasons, their repairs were not completed according to Smog Check criteria. The average cost of partial repairs for this group was \$313. Four vehicles were repaired according to Smog Check criteria, but because they were registered outside the Stockton area, there were Smog Check emission standards for nitrogen oxides (NOx). Seven vehicles were in such bad state of maintenance that they were judged as not testable. Twenty-five vehicles that entered the program passed the initial Smog Check at the repair station, but several of them required repairs as judged by the repair technicians.

SMOG CHECK EMISSION REDUCTIONS

Table 2 summarizes the pre- and post-ASM emissions data for the 112 vehicles that were successfully repaired according to Smog Check criteria for those individual vehicles. The values shown in the table are the average of the ASM5015 and ASM2525 emission tests. Emission reductions of 84%, 69%, and 64% were achieved for CO, HC, and NOx, respectively, for the successfully repaired group of vehicle vehicles.

Table 2. Pre- and post-repair emissions data for the 2006 Stockton TI&TU vehicles.

Vehicle Class	Ave. Before-Repair ASM Emissions			Ave. After-Repair ASM Emissions		
	CO, %	HC, ppm	NOx, ppm	CO, %	HC, ppm	NOx, ppm
Successfully repaired, n = 64	0.98	127	666	0.18	51	221
Partial repairs/Left program, n = 24	2.50	284	668	--	--	--
No NOx requirements, n = 4	3.35	715	--	--	--	--
Not testable, n = 7	--	--	--	--	--	--

Also shown above are pre-repair average ASM readings for the vehicles in each subgroup, where emissions data were available. Notable are the higher average pre-repair CO and HC emissions for the 24 vehicles for which the motorists chose not to participate fully in the 2006 Stockton TI&TU repair program. Had these vehicles been repaired according to Smog Check criteria, the total emission reduction obtained in the Stockton program would have been significantly larger.

Figure 2 illustrates the average pre- and post-repair ASM emissions for the 64 vehicles that were successfully repaired according to Smog Check criteria, resulting in average ASM emission reductions of 82, 60, and 67% for CO, HC, and NOx, respectively.

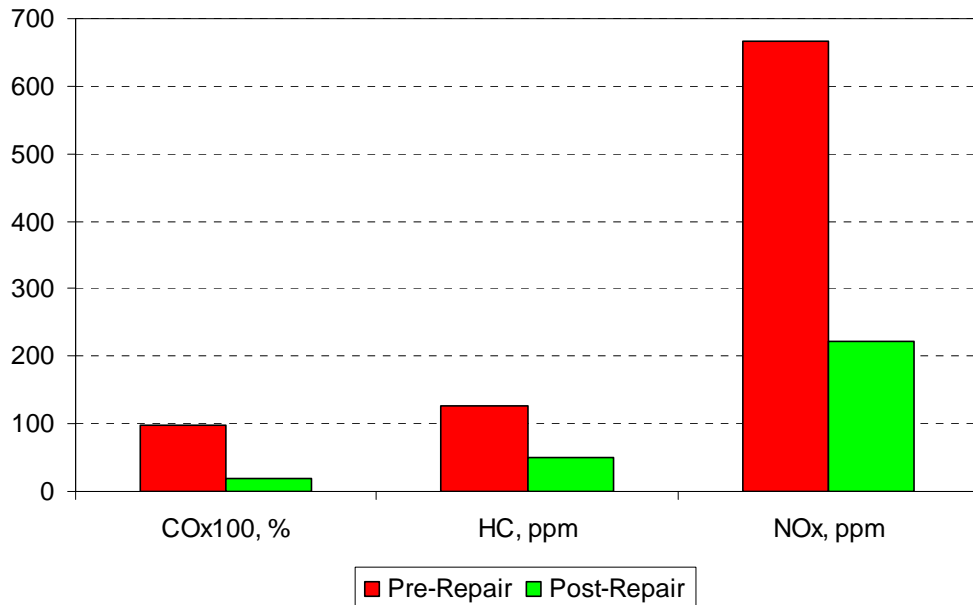


Figure 2. Pre- and post-repair average ASM emissions for the successfully-repaired 64 vehicles.

COMPARISON WITH THE 1995 CALIFORNIA I/M PILOT PROGRAM

In 1995, the California Air Resources Board tested a set of more than 600 vehicles using the Federal Test Procedure (FTP), IM240, ASM 5015, ASM2525, and two-speed idle tests using the BAR90 analyzer. In that unique study, the vehicles that failed the IM240 or the ASM test were repaired according to emissions criteria using the test that they failed. BAR-employed technicians repaired the failing vehicles, and their pre- and post-repair emissions data were collected at State of California-operated facilities. The California I/M Pilot Study provided the maximum possible repair benefit obtainable in an inspection and maintenance (I/M) program, as the mechanics were employed by the State, and their performance was monitored in a centralized I/M program format with no motorist intervention. The emissions reductions obtained in the Valley CAN Fresno 2005, Bakersfield 2006 and Stockton 2006 TI&TU programs are compared with those from the California Pilot Program in Table 3.

Table 3. Pre- and post-repair emissions data from the 2005 Fresno, 2006 Bakersfield, and 2006 Stockton TI&TU Programs and the 1995 California I/M Pilot Program.

Program	Pre-/Post-Repair Ave. ASM Emissions			Percent Reduction		
	CO, %	HC, ppm	NOx, ppm	CO	HC	NOx
Fresno TI&TU 2005	1.39/0.09	131/46	710/335	94	65	53
Bakersfield TI&TU 2006	1.68/0.27	210/67	923/333	84	69	64
Stockton TI&TU 2006	0.98/0.18	127/51	666/221	82	60	67
CA I/M Pilot Program 1995	1.36/0.22	160/50	884/419	84	69	52

Although there is a ten-year difference and vehicle model years/technologies are different for the Valley CAN and California I/M Pilot programs, the similarities between pre- and post-repair emissions levels, along with percent emission reductions, are quite similar. The emission reductions obtained in the Fresno, Bakersfield, and Stockton TI&TU programs are comparable to or higher than those obtained in the government-run California I/M Pilot Program.

COSTS OF EMISSION REDUCTIONS

Using statistical relationships derived from the California I/M Pilot Study, where regression relationships were calculated between ASM emission reductions and corresponding FTP data, it is possible to derive rough approximations of tons/year of emission reductions from this Program. Although there is scatter among the different emission test types regarding emission reduction relationships, we used these statistical relationships to estimate total emission reductions for the 64-vehicle fleet, assuming that the repairs are effective for 10,000 miles. Estimated reductions would be different if the duration of repairs differs from the 10,000-mile assumption for repair effectiveness. These estimates are provided in Table 4.

Table 4. Emission reductions from the 64 successfully-repaired vehicles, assuming repair effectiveness for 10,000 miles.

Emission Reductions	CO	HC	NOx
Pounds per vehicle	434	47	28
Pounds from 64 vehicles	27,763	3,016	1,799
Tons from 64 vehicles	13.9	1.51	0.90

The 64 vehicles were repaired according to Smog Check criteria at a total cost of \$28,787, or \$450 per vehicle. Because it is not possible to apportion the repair types to specific emission reductions, we can provide two calculations in terms of dollars/ton for Stockton TI&TU 2006 Program effectiveness. If we sum the pollutants CO + HC + NO_x, the cost-effectiveness of the program is \$1767/ton for exhaust emission reductions. The cost-effectiveness for HC + NO_x emissions combined is \$11,950/ton. Because Smog Check repairs include those that reduce evaporative or nontailpipe HC, these costs are upper limit costs for the three pollutants. If evaporative or nontailpipe HC emission reductions could have been measured in this program, the true cost-effectiveness values would be lower than the ones given here. At the time of the 2006 TI&TU Program, California's Smog Check program did not test for particulate matter (PM) exhaust emissions, so it is not possible to calculate PM emission reductions that might have been obtained in this program.

SUMMARY

The Valley CAN Tune In & Tune Up Program event was conducted on November 4, 2006 in Stockton, California, where high-emitting vehicles identified by remote sensing devices were repaired according to Smog Check criteria. Remote sensing cutpoints of 5%, 1000 ppm, and 1000 ppm for CO, HC, and NO were used to determine whether a vehicle was identified as a high emitter and therefore qualified for repairs at Pro Care Automotive. Three hundred vehicle owners of high-polluting vehicles that failed the RSD test were given a \$500 voucher to assist in repairing their high-emitting vehicles. One hundred twenty-four vehicles entered the repair program; 64 that initially failed the emissions portion of the Smog Check inspection were successfully repaired to Smog Check criteria at an average cost of \$450 per vehicle. Owners of 24 vehicles decided not to complete the repair program. The pre-repairs emissions of those vehicles were significantly higher than those that were successfully repaired.

Large emission reductions were obtained from the effectively-repaired 64 vehicles having complete data in this program; their emission reductions were comparable to those obtained from repaired vehicles in the 1995 California I/M Pilot Program. The 2006 Stockton Tune In & Tune Up Program achieved average ASM emission reductions of 82, 60, and 67% for CO, HC, and NO_x, respectively, for the successfully repaired vehicles. If each of these vehicles was driven 10,000 miles per year and the repairs lasted for 10,000 miles, each vehicle's emissions would be reduced by a total of 434, 47, and 28 pounds per year of CO, HC, and NO_x, respectively. In one year, the 64 successfully-repaired vehicles' emissions would be reduced by 14, 1.5, and 0.9 tons for CO, HC, and NO_x, respectively.

The cost-effectiveness of the 2006 Stockton Tune In & Tune Up Program for the 64 successfully-repaired vehicles was \$1767/ton for the sum of carbon monoxide, exhaust hydrocarbons, and nitrogen oxide emissions. For exhaust hydrocarbons and nitrogen oxides combined, the cost of emission reductions was \$11,950/ton. These are upper-limit values, because reductions of evaporative or nontailpipe hydrocarbons emissions obtained by performing Smog Check repairs were not measured in this program.

The vehicles that failed the emissions portion of their initial Smog Check inspection benefited from the largest emission reductions in the repair program. Also, additional program benefit would have been obtained if all participating vehicles had been completely repaired.

ACKNOWLEDGMENTS

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