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Drive-by Motor Vehicle Emissions: Immediate Feedback in Reducing Air Pollution

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Using input from the public, a new type of vehicle emissions information system has been developed which utilizes an innovative variable message sign to display individual vehicle emissions information to passing drivers. Called the Smart Sign, the system merged highway messaging and on-road vehicle emissions sensing into a cost-effective public information system. The Smart Sign used a combination of words, colors, and graphics to connect with its audience. During its operational test period the system proved to be a viable technical concept which can be operated dependably and safely in even high traffic areas (in excess of 1000 vehicles per hour). The system was subjected to a wide range of operating conditions including weather extremes (−20 to 100 °F, heavy rain, hail, snow) and between May 16, 1996 to May 15, 1997 recorded unattended emissions information of more than 3 million readings from an estimated 250 000 individuals. The ability to operate the system without constant human supervision has created a cost-effective messaging system capable of delivering real-time vehicle emissions information for a long term estimated cost of $60 000/yr or about $0.02 per test and demonstrated the potential for intelligent highways of the future to detect gross polluting vehicles. Using information from a companion license plate reading system a sample of 474 motorists (14% poor, 43% fair, and 43% good) were interviewed by telephone. Seventy-six percent of the weighted population had a favorable impression (5% unfavorable) of the Smart Sign with the majority (61%) expressing its informative nature as the main reason. Eight percent of the total sample planned to do something in response to the sign. Respondents in the "POOR" stratum (31%) were almost twice as likely to respond to the system as those in the "FAIR" stratum (16%) and five times as likely as those in the "GOOD" stratum (6%). Sixteen percent of the poor's (1.6% of the overall fleet) reported to have already taken corrective action as a result of the Smart Sign. This produces an estimate that more than 4000 voluntary repairs were made as a result of Smart Sign readings during the year.

Introduction

The Intelligent Transportation System (ITS) program has as one of its goals to contribute toward improved air quality and increased energy efficiency (*1, 2*). Both the Clean Air Act Amendments and the Intermodal Surface Transportation Efficiency Act have mandated improvements to overall transportation efficiency without adversely impacting air quality and other environmental concerns. The U.S. DOT in a report to the United States Congress adopted a goal regarding energy and environmental impacts (*2*). The National ITS goal is as follows: to reduce the environmental and energy impacts of surface transportation. Its objectives are to (1) reduce harmful vehicle emissions; (2) reduce fuel wasted by congestion and navigational inefficiencies; and (3) reduce surface transportation energy consumption per vehicle-mile and per passenger-mile traveled.

The difficulty in achieving these goals has been that most ITS programs do not differentiate, either in messages or strategies, between the most relevant population (e.g., gross polluters) and others.

Previous vehicle emissions research and I/M program data has demonstrated that less than 10% of the vehicles on the road in the United States cause more than 50% of the emissions (*3*). Excess carbon monoxide (CO) emissions are particularly indicative of poor vehicle maintenance and poor fuel economy (*4, 5*). Finding and fixing these gross polluters is the most cost-effective tool available for reducing urban air pollution. Previous emissions research has shown that through the use of a remote sensing device (RSD) gross polluting vehicles emitting excessive levels of CO could be successfully identified and repaired resulting in large reductions in all pollutants and improving fuel economy (*6*).

This operational test was conceived to exploit the potential for ITS to support cleaner air, reduce fuel consumption, and promote environmental awareness. The goals for the project were to (1) merge existing and commercially available technologies into a new travel demand management/emissions reduction tool to provide real-time vehicle emissions information to the driving public; (2) educate the public that a well tuned vehicle is the most cost-effective means to obtain and maintain clean air and that fixing broken vehicles (gross polluters) will pay for itself in fuel cost savings alone; (3) encourage the public to voluntarily have their vehicles tested often and quickly act on the information to catch maintenance problems early; and (4) demonstrate the usefulness and public acceptance of this approach for reducing harmful emissions and improving fuel economy and its applicability to the national ITS program for use in other locations.

Experimental Section

Focus Groups. Qualitative research, in the form of three focus groups, was used to help determine the most effective communications elements to enhance the variable message signs technical capabilities and to assist in their design (*1*). Depending on the driver's initial predispositions toward such things as air pollution and the importance of a well-

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FIGURE 1. A composite drawing showing many of the different design elements tested by the focus groups.

maintained vehicle, it was expected that the various properties of the sign (e.g., size, color, theme, messages, etc.) could influence driver awareness and knowledge, beliefs, and attitudes and motivate behavior. The first group was composed of 12 technology or communications experts. Its primary purpose was to explore several potential sign formats and content.

The experts felt that the communications aspects of the program and the design of the sign were the keys to success. They felt the sign should use color for attention getting purposes and to assist in conveying information. That some type of scale with pictures was preferred over words and numbers. The scale used needed to have an understandable rating system, and we needed to keep the sign simple and humorous. These suggestions were distilled into a series of graphical concepts (see Figure 1).

In February of 1995 two additional focus groups (one males and one females) of randomly selected drivers from the Denver area were assembled for a 2 h discussion of general air quality concerns and their perceptions about the Smart Sign program. Feedback from these two groups was used to determine the final format of the sign and its message content. The groups were also probed for ancillary information (e.g., brochures, radio messages, etc.) they would find useful in guiding their decision process and more importantly their actions.

Using the graphical concepts generated by the expert group the idea of a variable message emissions sign offered as a public service was viewed very favorably. This grew out of each group's interest in improving Denver air quality and the idea that current access to vehicle emissions information was too infrequent. They encouraged us to make the sign fun, emphasizing encouragement as opposed to a "big brother", big stick approach. Both groups favored an ordinal score for the emission reading (i.e., good, fair, poor) and a monetary benefit message (i.e., saving money) rather than an environmental theme. The females were especially emphatic about money being a stronger motivational message. The groups felt some type of brochure should be used to explain in more depth the concepts and ramifications of the information displayed by the sign. The groups also expressed a desire for a phone number or e-mail address in the brochure and on the variable message sign to provide a final avenue for interested parties to contact "experts".

Program Features. The Smart Sign design that emerged from the focus groups was one which involved a multicolored variable message sign which would provide emissions information to drivers on several different levels. It was widely acknowledged that all of the information on the sign would be difficult to comprehend in a single exposure and our exposure experiments showed that different people were drawn to different elements in the sign. The sign design team took all of these suggestions to mean that we needed to convey the emissions information in as many ways as possible.

One dilemma we faced was how many emissions categories to use. All of the groups preferred only two categories because of its unambiguous nature. Acceptable CO emission levels for U.S. vehicle fleets is dictated by model year. There are clear cutpoints for low emissions and excessive emissions for all cars, but the area between may indicate a properly operating 1971 vehicle or a 1989 vehicle with a failing emissions control system. The compromise was to include three emissions categories of GOOD (%CO $\leq$ 1.3 or 121 g/L), FAIR (1.3 $>$ %CO $\leq$ 4.5), and POOR (%CO $>$ 4.5 or 391 g/L) with the idea that pre-1980 vehicles may only have fair fuel economy and CO emissions even when properly tuned.

Supporting materials the groups thought important include a three color brochure and a hotline phone number. The brochure included educational information about the program, answers to frequently asked vehicle emissions questions, a map of the site, a list of all of the sponsoring agencies, and how to contact us. The brochure was available at more than 50 Conoco gas stations located throughout the Denver area. The hotline was setup at the university and provided the public the opportunity to request additional information not provided by the brochure.

Smart Sign Implementation. The final design included a declarative statement of "Your Cars Health" at the top of the sign to frame the information being provided. We hoped to link the idea of good health/low emissions and poor health/high emissions in the drivers mind. In the middle would be our cartoon car whose facial expression would change with changing emission levels. This would be supplemented with a painted emissions plume into which the "GOOD/FAIR/POOR" colored coded messages (GOOD/green, FAIR/amber, and POOR/red) would be displayed. At the bottom of the sign would be a motivational message of "$aving You Money" for "GOOD" readings and "Co$ting You Money" for "FAIR/POOR" readings. Cost constraints dictated that the motivational messages had to be a single color. We chose to use green for its natural link with both money and the environment.

An 11 ft $\times$8 ft sign was constructed (Skyline Products Inc., Colorado Springs, CO) with an all aluminum cabinet and sign face (approximate weight of 800 lbs). To improve the nighttime viewing the declarative statement and the cartoon car were back lit using standard fluorescent bulbs. This was accomplished by machining the outline of the characters and the car into the aluminum face plate. All of the lettering used 8 in. characters. To improve the nighttime viewing of the remaining sign features diamond grade Scotchbrite (3M Corp. Minneapolis, MN) reflective sheeting was used for the white plume outline and the blue background. All of the LED segments were masked against a black background except for the radiator area of the cartoon car. This area was masked in a grayish white to give it a more carlike appearance. Finally the entire sign was covered with a single sheet of polycarbonate sheeting, vented at the top and bottom, to protect

FIGURE 2. Photographs of the Smart Sign as deployed. The GOOD message and car smile are green led's, the FAIR message and car ooh are amber led's, and the POOR message and car frown are red led's. The bottom message is display in green led's for both messages.

the facing from vandalism. The final design is shown in Figure 2. GOOD and the car's smile appear in green. FAIR and the car's "ooh" appear in amber. POOR and the car's frown are both in red. The variable text at the bottom is always in green.

Operational Test Site. The Smart Sign operational test was located in Denver Colorado at Interstate 25 exit number 112A. This is a single-lane uphill (4% grade) off-ramp which connects to southbound Speer Blvd. This ramp is located in the central Platte valley near downtown Denver. Speer Blvd is a major arterial feed and experiences some of the heaviest traffic in all of the Rocky Mountain region with access to sporting, arts, and entertainment venues in Denver.

This site has one of the longest remote sensing monitoring histories in the world, dating back to 1989 (*7*). This location in the Denver freeway system ensures that all of the vehicles arrive at the site with their engines and emission control systems at operational temperatures and the grade provides a consistent engine load which has resulted in successful measurement rates in excess of 98%. In addition the Denver area includes all the major types of weather, which can be used to evaluate the program's suitability for other locations nationwide.

The Smart Sign system was composed of five subsystems: (1) the remote automobile exhaust sensor (RSD1000, Environmental Systems Products, Inc. formerly Remote Sensing Technology Inc. Tucson, AZ); (2) the master computer system; (3) the license plate reading/recognition system (LPR-SL9000 Perceptics Corp., Knoxville TN); (4) vehicle position sensing and sign control system; and (5) the Smart Sign. The overall layout is shown in Figure 3.

The RSD1000 remote automobile exhaust sensor is a commercial version of technology invented by the University of Denver and has been described in detail elsewhere (*3, 8*). This instrument was capable of measuring carbon dioxide (CO_2), carbon monoxide (CO), and hydrocarbons (HC), and the resulting CO/CO_2 and HC/CO_2 ratios can be determined independent of gas path length, wind, temperature, and turbulence in 0.9 s per passing car. The technique for CO and HC has been verified by means of double-blind studies of vehicles both on the road and on dynamometers (*4, 9, 10*). The detector was calibrated as needed using a certified CO/CO_2/propane in nitrogen mixture (Scott Specialty Gases, Inc., Plumsteadville, PA).

Because the remote sensing system needed to be installed within the crash zone of a busy interstate highway, the RSD1000 and infrared source were housed below ground within roadside manholes (see Figure 3). Each manhole was approximately 5 ft deep (the detector manhole had a 31.5 in. opening and the source a 24 in. opening) with a gravel bottom for drainage and locking aluminum rings and lids. Light entered the RSD1000 via a custom-made periscope assembly made of two square 6" × 6" front surface aluminized mirrors fitted into a 4" diameter PVC pipe. The source was mounted vertically, and its periscope was made of lightweight steel stove pipe and used a single 6" × 6" front surface aluminized turning mirror. All of the above ground items were designed to be break away or crushable in the event of a crash. Filtered flow through ventilation was provided by internal fans with air being brought in via an inverted air duct and forced out of each optical periscope.

The vehicle position sensing and sign control system consisted of a dedicated microprocessor control unit (Micro-440e, Blue Earth Research, Mankota, MN) and two retro-reflective vehicle position sensors (MAXI-BEAM RSBLV, Banner Engineering Corp., Minneapolis, MN). This system was responsible for correlating vehicle emissions measurements, relayed from the RSD1000, with the proper vehicle and displaying the Smart Sign's GOOD/FAIR/POOR emissions message at the appropriate time.

All of the control computers, power conditioners, and central wiring junction were rack mounted outside the crash zone in a standard traffic control cabinet (model 336, Safetran Traffic Systems, Inc., Colorado Springs, CO). A dedicated phone line was installed at the site to enable most day-to-day operations to be performed via a dial-up remote control software package (Close-Up v6.0, Norton-Lambert Corp., Santa Barbara, CA).

The research design for this project's evaluation dictated that we contact a sample of drivers who frequented this exit ramp. The LPR system was used to obtain the vehicle's license number, information which was used to contact vehicle owners. The LPR system was used extensively during the first 3 months of the test after which it was used sparingly because its use slowed the system response time from about 0.9 to 1.3 s. Future deployments of the Smart Sign will not need the LPR system which will completely eliminate any potential privacy issues.

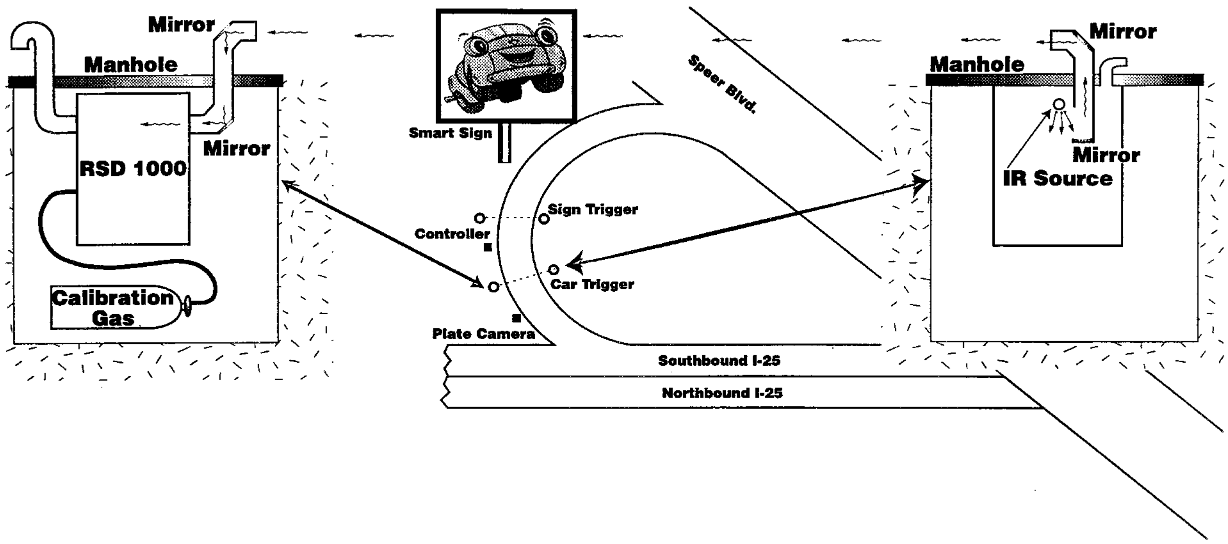

FIGURE 3. The site layout at Interstate 25 and Speer Blvd. The enlarged views give a schematic representation of the detector and source manholes with the optical periscopes.

Results

The Smart Sign began operations on the afternoon of Thursday May 16, 1996. Traffic volume at the site averaged 10 010 vehicles per weekday and 8186 per weekend day. For the year the system attempted measurements on 3 189 281 vehicles and successfully recorded CO emissions on 3 009 897 (a 94% success rate) vehicles. This includes attempted measurements on vehicles such as heavy-duty diesel trucks which have elevated exhaust and are not capable of being measured by the current low-level monitoring system and all of the periods of bad weather. The LPR system reported 145 523 (70% of which were collected before October 1996) license plates for which it had a high confidence level. Covert and overt testing of the emissions monitor and the sign display were performed at various times during the year using instrumented vehicles (vehicles which can simultaneously alter and record their CO emissions) with no observable malfunctions (*1, 11*).

The system was successfully operated in all types of weather conditions and extreme temperature ranges of −20 to 101 °F. For the year, the system was operational for more than 91% of its potential operational hours. This value increases by 3−94% if hours lost to power outages in October and December caused by nearby construction are eliminated. Table 1 details the hours of system operation, traffic volume, number of high confidence LPR license plates reported, and the mean CO emissions by month. We obtained Colorado Department of Motor Vehicle (DMV) records for 88 029 of the identified vehicles, and the average model year was found to be 1989.5. These values are operational upper limits since there were periods when the system was operating, but the sign was not due to weather and/or congestion. We recorded no instances of vandalism; however, the utility pole holding the LPR camera and strobe was felled by impact with a truck. This required replacement of the utility pole, wiring, and remounting the strobe and camera which were bent but undamaged.

The fleet emissions are dominated by the emissions of FAIR and POOR vehicles. The percentage breakdown of Smart Sign readings by category was 86.7% GOOD (23.8% of total emissions), 9.9% FAIR (42.8% of the total emissions), and 3.4% POOR (33.4% of the total emissions). The percentage of POOR readings decreased, as did the mean CO emissions, during the test. Figure 4 provides three different views of the emissions breakdown using the 88 029 vehicle DMV matched fleet.

TABLE 1. Monthly Smart Sign Statistics

month/year	percent of hours operational	vehicle volume (LPR plates)	mean %CO
May/96[a]	70	218 169 (26 223)	0.72
June/96	95	263 933 (34 726)	0.65
July/96	89	253 539 (29 655)	0.63
Aug/96	87	262 044 (11 318)	0.62
Sept/96[b]	93	99 363 (0)	0.65
Oct/96	88[c]	300 370 (8497)	0.62
Nov/96	95	292 729 (0)	0.6
Dec/96	68[c]	188 420 (0)	0.55
Jan/97	96	282 077 (3599)	0.59
Feb/97	100	259 806 (3435)	0.58
March/97	100	318 381 (6635)	0.6
April/97	95	283 886 (12 456)	0.62
May/97[d]	100	166 564 (8457)	0.56
totals	91	3 189 281 (145 001)	0.61

[a] Data from May 16 to the end of the month. [b] Lost data. [c] Operational hours lost due to loss of power caused by local construction. [d] Data from May 1−May 15.

The emissions distribution for the DMV matched fleet is very similar to the total fleet with 86% receiving GOOD readings, 10.7% receiving FAIR, and 3.3% receiving POOR. Figure 4a shows how the GOOD/FAIR/POOR readings vary with age with very few poor readings in the newest four or five model years. Figure 4b shows the fleet numerical distributions and highlights the fact that 12 year old and newer vehicles were the most common vehicles measured. Figure 4c is a product of the average emissions by model year and the number of vehicles per model year producing the fraction of emissions. It might be surprising to some that the majority of CO emissions are contributed by vehicles (1983 and newer) which all were originally equipped with

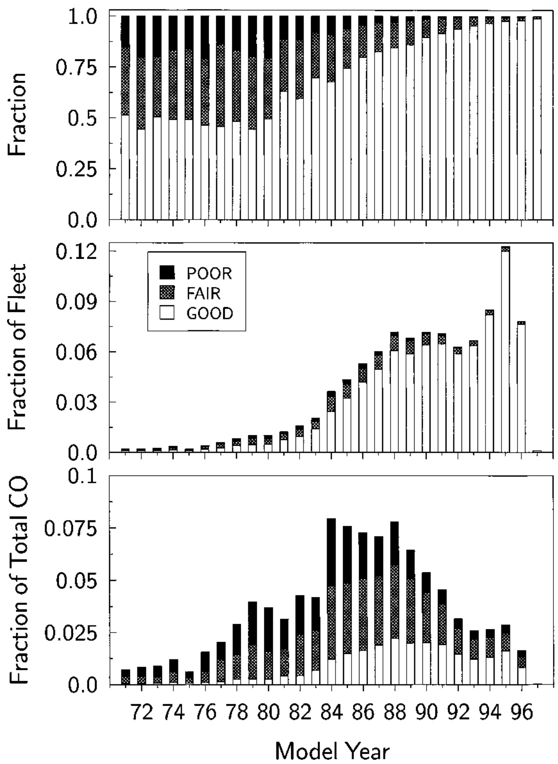

FIGURE 4. Fraction plots for 88,029 vehicles by model year. The top plot (a) details the distribution fraction of GOOD/FAIR/POOR readings by model year. The middle plot (b) shows the fleet distribution, and the bottom plot (c) shows the fleet weighted CO contribution by model year.

the most advanced emissions control equipment. This is due to the large number of these vehicles which are on the road and the fact that a small fraction have nonfunctional emission control systems.

Using information from the LPR system 474 motorists (14% poor, 43% fair, and 43% good) were interviewed by telephone for the ITS evaluation project designed by The National Center for Vehicle Emissions Control and Safety (*1*). An additional 20 drivers were surveyed using in-depth case studies. The "POOR" emissions category had fewer respondents due to the combination of fewer vehicles (3 to 4% of the fleet) and a high number of refusals to the phone survey. The sample analysis was weighted to reflect the actual population passing the sign. Seventy-six percent of the weighted population had a favorable impression (5% unfavorable) of the Smart Sign with the majority (61%) expressing its informative nature as the main reason. Eight percent of those polled planned to do something in response to the sign. Respondents in the "POOR" stratum (31%) were almost twice as likely to respond to the system as those in the "FAIR" stratum (16%) and five times as likely as those in the "GOOD" stratum (6%). Sixteen percent of the poor's (1.6% of the overall fleet) reported to have already taken corrective action as a result of the Smart Sign (*1*).

Service visits averaged 2−3 per month with the activities changing with the seasons. With every visit we would routinely clean the above-ground optics on the source, detector, and vehicle position sensors. During the winter it was sometimes necessary to remove snow from around the vehicle position sensors. The only service matter which required more than one person was to remove the RSD1000 from its bunker to clean the below-ground optics. This task was performed once a month until the discovery of a Teflon sheeting which is used as a mold release by the fiberglass industry (DeComp. Composites, Cleveland, OK). This sheeting, which is transparent in the infrared region which the RSD1000 operates, was used to cover the outside opening of the detector periscope. This reduced the necessary cleaning to once or twice a year and improved its operational performance.

Discussion

Remote sensing emission records at the Speer Blvd location date back to 1989 with studies having been conducted in 1989, 1992−1993, 1994, and 1995 (*7, 12, 13*). Table 2 details the results of these studies and several additional studies in Denver at 6th Avenue and I-25 which is a few miles south of the Smart Sign for comparisons (*14*). Since 1989 the average on-road CO emissions have decreased 50% as fleet turnover has introduced new and more durable emissions control technologies into the light-duty fleet. Identical reductions have taken place regardless of the fuel being used. Also notice that coupled with the emissions decline the age of the fleet has increased.

The I-25 and Speer Blvd site was expected to be a site that would have a large number of repeat commuter vehicles. The wide variety of venues served by this entrance to the city, however, proved to attract an equally large number of nonrepeat vehicles. The plate reader data provided license plates for more than 145 000 unique vehicles alone. Modeling based on this observed statistic along with the fact that the LPR operated only 20% of the time during which it was only 12% successful at producing a quality plate reading predicts that more than 250 000 unique vehicles actually received at least one Smart Sign reading (*11*). This value compares favorably with an estimate produced from responses to the telephone survey. Bohren and Williams recorded the number of trips past the sign given by the respondents to estimate that 232 000 unique vehicles had visited the site (*1*). Using

TABLE 2. Summary of Study Results from Two Denver Locations

location/date	vehicles	mean %CO_{oxy}	mean %CO_{nonoxy}	% measurements responsible for 50% of emissions	mean age
Speer/Jan 89	2011	1.04		8.7	6.8
Speer/May 89	962		1.21	8.8	6.9
Speer/Nov 91 and Feb 92	19 933	0.60		6.1	6.8
Speer/Oct 91 and April 92	20 086		0.80	7.3	6.9
Speer/Jan 94	2787	0.55		6.2	7.3
Speer/July 95	3176		0.51	6.9	6.6
6th Ave/Jan 96	30 675	0.53		6.4	7.1
Speer/Nov 96−Feb 97	1 023 032	0.54		5.2	7.4
6th Ave/Jan 97	46 348	0.51		5.6	7.0
Speer/May 96−Oct 96 and March 97−May 97	2 166 249		0.61	5.8	7.5
6th Ave/April 97	39 319		0.65	6.3	7.2
6th Ave/Jan 99	26 709	0.45		5.6	7.1

the smaller estimate of the two numbers (232 000 unique vehicles) and that 16% of the "POOR'S" had performed some type of repairs we can estimate that more than 4000 voluntary repairs were made during the operational test year.

These repair estimates are supported with anecdotal evidence we received by phone and e-mail. Our correspondences and the last set of focus groups showed that owners of vehicles which routinely received "GOOD" readings were especially influenced to repair their vehicles upon receiving a FAIR or POOR reading. Several callers reported being able to uncover emissions problems with their vehicles with the help of the Smart Sign and corroborate the effect of the repairs. Several other drivers who observed a negative status change and did not commit to immediate repairs also contacted us and told us of the extra expense of towing costs they could have avoided.

The operating and capital costs of this project were approximately $300 000. Our experience with the operational test suggests that operating costs alone for the system should not exceed $30 000/yr. The permanent nature of the installation and components would allow one to amortize the construction costs over 10 years for $30 000/yr. Therefore if we use the 3 million readings made at our site for the test year and the amortized construction cost of $30 000/yr plus an additional $30 000/yr operating cost this results in a costs of $0.02 per test.

Driver Response Focus Groups. The high refusal rate to the telephone survey by drivers identified in the "POOR" category caused us to question whether the results were bias due to a systemic reason. To investigate this concern and to validate the findings of the telephone survey we assembled three groups of drivers who had passed the sign at least once: two groups of drivers that had received a POOR rating, one of females and one of males, and a third group made up of males and females who had received either a GOOD or a FAIR reading. The groups were composed of individuals selected to span the entire spectrum of the emissions category and to produce a group whose characteristics matched the population of drivers which had visited the site. The drivers were not informed as to how they had been selected and grouped.

The groups reacted to the topics in much the same way they had on the telephone survey with the GOOD/FAIR group easily recalling the Smart Sign and very willing to talk about the sign and their readings. The POOR groups were reluctant to admit that they had received any POOR readings from the system. With time both POOR groups "remembered" the Smart Sign and that they had received various readings including POOR. The feedback from the three groups mirrored the telephone responses and led us to conclude that the POOR groups refusal rate to the telephone survey was not a result of systemic factors and was in fact a random event validating the survey findings.

Criticisms provided by the group participants included the lack of any useful connection between the sign and its supporting information, namely the brochure and the hotline. While the brochure was viewed very positively, the fact that most of the group participants had never seen it before the focus group highlighted a lack of its availability. This reinforced a similar complaint about the lack of technical information expressed by the telephone respondents (*1*). One suggestion was to explore the use of a local radio transmitter as a means to connect with the drivers more directly. All of the groups expressed an interest in using additional incentives to reinforce the smart sign message. In addition the groups felt that the sign title of "Your Car's Health" was vague and misleading and needed to be changed to "Your Car's Emissions". It was also felt that if the sponsorship of the sign was made known it would lend credibility to the entire program. The use of the license plate reader was not seen as a negative to the program. These groups supported the major conclusions of the telephone survey, namely the education, awareness, and action items were successful.

The Smart Sign system proved to be a reliable and robust system capable of delivering accurate emissions information in a high volume setting. It achieved a high approval rate from the driving public and provided information which could be understood. It demonstrates one approach for intelligent highways of the future to detect gross polluting vehicles. The underground mounting of the sensing components proved to be weather resistant and did not create a road hazard for drivers.

We recommend implementation of this technology for any area which is contemplating using on-road emissions measurements as a local enforcement tool prior to the start of the enforcement program. Public access to emissions information is an important step to build support for any new program and provides a means by which emissions problems can be rectified voluntarily without additional government action. The sign is uniquely suited to be used as a tool to increase personal responsibility of drivers. The Smart Sign can also be used to reach drivers who for whatever reason are not influenced by current command and control inspection and maintenance program (*15*). Future plans involve mounting the current sign on a trailer and making the system portable to allow its use in other localities.

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