NHTSA
www.nhtsa.gov

2007 National Roadside Survey of Alcohol and Drug Use by Drivers

METHODOLOGY

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT HS 811 237		

4. Title and Subtitle	5. Report Date
2007 National Roadside Survey of Alcohol and Drug Use by Drivers: Methodology	December 2009
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
John H. Lacey, Tara Kelley-Baker, Debra Furr-Holden, Robert Voas, Christine Moore, Katharine Brainard, A. Scott Tippetts, Eduardo Romano, Pedro Torres, and Amy Berning	

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Pacific Institute for Research and Evaluation 11720 Beltsville Drive, Ste. 900, Calverton, MD 20705 Phone: 301-755-2700 Fax: 301-755-2799	11. Contract or Grant No. DTNH22-06-C-00040

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
DOT/National Highway Traffic Safety Administration Office of Behavioral Safety Research, NTI-130 1200 New Jersey Avenue SE. Washington, DC 20590	Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

Amy Berning served as the project Contracting Officer's Technical Representative.
The National Institute on Alcohol Abuse and Alcoholism (NIAAA) provided funding and support for the assessment of alcohol use disorders.
The National Institute on Drug Abuse (NIDA) provided funding for the assessment of drug use disorders.
The National Institute of Justice (NIJ) provided support for querying participants about intervention with the Criminal Justice System.

16. Abstract

This report describes the methodology for the 2007 U.S. national field study to estimate the prevalence of alcohol-, drug-, and alcohol-and-drug-involved driving, primarily among nighttime weekend drivers, but also daytime Friday drivers. This study involved randomly stopping drivers at 300 locations across the continental United States; sites were selected through a stratified random sampling procedure. Data were collected during a 2-hour Friday daytime session at 60 locations, and during four 2-hour nighttime periods (10 p.m. to midnight and 1 a.m. to 3 a.m. on both Friday and Saturday nights) at 240 locations. Both self-report and biological measures were taken. An objective was to obtain at least 7,500 oral fluid samples for analysis. Biological measures included breath alcohol measurements on 9,413 respondents, oral fluid samples from 7,719 respondents, and blood samples from 3,276 respondents. Oral fluid and blood samples were subjected to laboratory screening and LC/MS-MS and GC/MS confirmation respectively for both alcohol and 20 categories of drugs. These data are being analyzed to develop the first national prevalence estimate of alcohol- and drug-involved driving. This first report describes the field methods used to conduct this study, including data collection procedures. Overall response rates are also presented. Two other reports will present the results of the data collection and analyses; one will focus on alcohol use prevalence estimates among drivers and compare them with previous National Roadside Surveys conducted in 1973, 1986, and 1996; the other report will provide drug use prevalence estimates among drivers.

17. Key Words	18. Distribution Statement
Alcohol and driving, drugs and driving, roadside survey, impaired driving, drugged driving, alcohol-involved driving, drug-involved driving	Document is available to the public from the National Technical Information Service www.ntis.gov

19 Security Classif. (of this report)	20. Security Classif. (of this page)	21 No. of Pages	22. Price
Unclassified	Unclassified	96	

Form DOT F 1700.7 (8/72) **Reproduction of completed page authorized**

Acknowledgements

The authors would like to acknowledge the extensive assistance we received from State and local officials in the conduct of this project. Our data collection procedures were not routine by any means and the willingness of State officials to help us identify local police agencies and the agencies' willingness to participate in the project were essential to our success.

To all of the persons who helped in the conduct of this study, the authors express their sincere gratitude.

Table of Contents

Tables

Figures

Executive Summary

Background

Three prior national roadside surveys of drivers to estimate prevalence of drinking and driving and determine changes over time have been conducted in the United States. These surveys, which included a brief verbal survey and a breath sample to determine blood alcohol concentration (BAC), were based on a national probability sample from the 48 contiguous States. All three used the same basic methodology.

The first national roadside survey (NRS) was sponsored by the National Highway Traffic Safety Administration (NHTSA) and was conducted in 1973 (Wolfe, 1974). The second NRS was sponsored by the Insurance Institute for Highway Safety (IIHS) in 1986 (Lund & Wolfe, 1991), and the third was jointly funded by IIHS and NHTSA in 1996 (Voas, Wells, Lestina, Williams, & Greene, 1998). NHTSA also sponsored the 2007 NRS described in this report, with additional funding from the National Institute on Alcohol Abuse and Alcoholism (NIAAA), the National Institute on Drug Abuse (NIDA), and the National Institute of Justice (NIJ).

New to this survey was the collection of additional types of biological samples (oral fluid and blood) to determine the extent of the presence of drugs other than alcohol in the driving population. This 2007 NRS is more extensive than any previous such survey, and provides a much broader perspective on alcohol and drugs present in the driving population than previously known. These data are essential to developing more precise estimates of the presence of alcohol and other drugs in drivers, and measuring the prevalence of alcohol- and drug-impaired driving.

Objective

The overall objective of this study was to estimate the prevalence of alcohol and drugs in drivers on our Nation's roadways. More than 9,000 drivers were interviewed to (1) determine the prevalence of drivers at various BACs, and (2) determine the prevalence of drivers having various (over-the-counter, prescription, and illegal) drugs in their system.

Methodology

In this national study, the Pacific Institute for Research and Evaluation (PIRE) conducted a roadside survey that recruited over 9,000 drivers from across the United States and collected data (self-report, breath, oral fluid, and blood) from those drivers as well as self-report data from some of their passengers. This included oral fluid samples from approximately 125 drivers at each of 60 jurisdictions across the country.

The survey sites were selected from the primary sampling units (PSUs) of the National Analysis Sampling System / General Estimates System (NASS/GES) of NHTSA. The NASS/GES PSUs are cities, large counties, or groups of counties from within four regions of the country and three levels of population density. We recruited assistance from law enforcement agencies in 60 PSUs. Within each PSU we randomly selected 30 specific square-mile grid areas, and identified appropriate data collection sites (a safe area large enough to accommodate the survey operation and with sufficient traffic flow to generate an adequate number of subjects). Drivers were

randomly selected from the traffic flow at those sites during specified timeframes and recruited for participation in the survey. This multistage sampling system replicated that used in the three prior national roadside surveys.

We also employed a self-report screening instrument designed to detect alcohol use disorders (AUD) among the driving population, funded through a grant from the National Institute on Alcohol Abuse and Alcoholism (NIAAA); a similar instrument for drug use disorders (DUD) was also used. The completed dataset will be used to estimate the prevalence of drivers with alcohol and/or drugs in their bodies while operating vehicles on our Nation's roadways.

In the field, the roadside survey typically proceeded in the following sequence:

- A law enforcement officer directed a randomly selected driver into the research site. Generally, one or two uniformed police officers were on-hand to assist with traffic.
- A traffic director directed the vehicle into a specific research bay (usually five bays operated at each site) marked out by orange traffic cones.
- ***Observational data:*** The interviewer noted easily observable information about the driver and vehicle and recorded those data (e.g., type of vehicle, number of passengers, seat belt usage, gender of driver, and likely age range of driver) into an electronic handheld Personal Digital Assistant (PDA).
- ***First PAS reading:*** The interviewer obtained an initial passive alcohol sensor (PAS) reading for the driver and recorded the result into the PDA.
- ***Consent for interview:*** The interviewer briefly explained the purpose of the interview and that it was both voluntary and anonymous. The interviewer attempted to obtain verbal consent for continuing. If the driver refused, he/she was counted as a refusal and the interviewer asked for a breath sample before leaving the site. Drivers were offered financial incentives to provide oral fluid and blood samples, and for completing an alcohol use disorder (AUD) screening. Additionally, at each site, a small sample of those who initially refused were offered an additional incentive of $100 to participate in the study.
- ***Survey interview questions:*** The interviewer asked the driver a few questions regarding the subject's general drinking behavior, driving patterns, and driving on that particular night; this information was entered into the PDA.
- ***Second PAS reading:*** The interviewer obtained a second PAS reading for the driver and recorded the result in the PDA.
- ***Breath test:*** The interviewer requested a breath sample from the driver and the sample was taken using a preliminary breath test (PBT) device.
- ***Oral fluid test:*** The interviewer requested an oral fluid sample from the driver. The oral fluid collection swab was in the subject's mouth for approximately 3 to 5 minutes, until an indicator changed colors, indicating approximately 1 ml of saliva had been collected.

- ***AUD questions:*** The driver filled out a self-administered paper-and-pencil alcohol use disorder screening instrument while the oral fluid swab was in his/her mouth.
- ***DUD questions:*** The driver filled out a self-administered paper-and-pencil drug use disorder screening instrument while the oral fluid swab was in his/her mouth.
- ***Passenger survey:*** If a front-row passenger was present, he/she was asked to fill out a paper-and-pencil self-report form while the driver was responding to the self-administered surveys.
- ***Payment:*** The participant was then paid for compliance with the preceding phase of the survey ($10 oral fluid sample, $5 AUD).
- ***Blood sample:*** The interviewer then requested a blood sample (only during nighttime surveys). If the driver consented, an interviewer led the subject to a nearby blood draw station in the phlebotomy van, where the blood sample was drawn by a certified phlebotomist and according to Occupation Safety and Health Administration (OSHA) standards. The subject then received a $50 money order.
- ***Completion:*** The driver was directed out of the research bay and back onto the roadway.
- ***Driver information card:*** The interviewer completed this form to facilitate tracking and merging data.
- ***Impaired driver protocol:*** If the interviewer suspected the driver had been drinking to any degree, a supervisor intervened and obtained a PBT reading. If the driver had a BAC above .05, we insured he/she got safely home.

Findings

As indicated in Table 1, over 13,000 vehicles were selected to participate in the 2007 NRS; of these, 10,909 entered the data collection site and the drivers were determined to be eligible for survey participation (for example, commercial vehicles such as pizza delivery cars, drivers under the age of 16, and drivers who could not communicate with us either in English or Spanish were not eligible to participate). Eighty-three percent of eligible drivers participated in the survey, and because some of those that refused the survey did agree to provide a breath sample, BACs from the PBTs were available on 86% of the eligible drivers. Among eligible drivers, 71% provided an oral fluid sample, 72% completed a drug questionnaire and/or the AUD questionnaire, and 39% of eligible nighttime drivers provided a blood sample. The number of drivers we attempted to contact in the 2007 NRS at nighttime was about 50% larger than in the 1996 NRS (9,553 versus 6,480).

Table 1. Participating Drivers (Percentages in Parentheses)

	1973	1986	1996	2007		
				Daytime	Nighttime	Total
Signaled to enter site	Not reported	3,260	6,480	3,516	9,553	13,069
Did not enter site	Not reported	217	182	933	1,016	1,949
Stopped and entered site	–	–	–	2,583	8,537	11,120
Eligible	3,698	3,043	6,298	2,525	8,384	10,909
Entered site and interviewed	3,353 (90.7)	2,971 (97.6)	6,045 (96.0)	2,174 (86.1) *	6,920 (82.5) *	9,094 (83.4) *
Valid breath sample	3,192 (86.3)	2,850 (93.7)	6,028 (95.7)	2,254 (89.3) *	7,159 (85.4) *	9,413 (86.3) *
Oral fluid sample	–	–	–	1,850(73.3)*	5,869 (70.0)*	7,719 (70.7)*
Blood sample	–	–	–	NA	3,276 (39.1)*	NA
AUD and/or drug questionnaire	–	–	–	1,889 (75.2)*	5,983 (71.4) *	7,882 (72.2)*
Passenger questionnaire	–	–	–	220 (8.7)*	1,393 (16.6)*	1,613 (14.8)*

NA (not applicable): Blood samples were not collected in daytime.
* Percent of eligible.

It was somewhat surprising that the proportion of drivers who were signaled to enter the site for the survey but refused to enter the site was much higher in the nighttime 2007 NRS (11%) than in the 1996 NRS (3%). The proportion of refusing drivers in the daytime 2007 NRS was even higher (27%) than the nighttime refusers. A small-scale survey replicating the procedures used in the 1996 NRS was conducted to determine if participation differences from the 1996 NRS to the 2007 NRS were as result of methodological differences. These differences were principally associated with collecting more data (question responses, oral fluid, blood samples, etc.) from each driver in the 2007 NRS than in the 1996 NRS. Results indicated that both approaches, when implemented in 2007, yielded lower participation rates than those achieved in 1996. This finding suggests that in the past decade there may have been a decline in the willingness of drivers to cooperate with roadside surveys.

To better understand the characteristics of those who declined to participate, a subset of the "refusing" drivers who entered the survey site were offered an additional financial incentive to participate. Of these 444 drivers who initially refused when approached, 50% changed their minds, accepted the incentive, and provided at least a breath test. To determine if the initial refusers were different in important ways, the measures from the "converted" participants will be compared with those who were initially compliant.

Despite a lower survey participation than in the 1996 NRS, provision of other biological samples was very high (70% and 73% of all eligible drivers at nighttime and daytime, respectively, provided oral fluid samples). Oral fluid (7,719) and blood (3,276) samples were screened using enzyme-linked immunosorbent assay (ELISA) micro-plate technology. Approximately 14% of all tests required confirmation for drugs and 5% for alcohol. The study examined drug categories that can impair driving skills. Drug categories tested for included cocaine, opiates, amphetamines, methylenedioxymethamphetamine (MDMA or Ecstasy), cannabinoids,

phencyclidine (PCP), benzodiazepines, barbiturates, methadone, ethyl alcohol, non-opiate painkillers, antidepressants (e.g., fluoxetine [e.g., Prozac®]; sertraline [e.g., Zoloft®]) or sleep aids (e.g., Ambien®) and other stimulants, such as methylphenidate (e.g., Ritalin®), dextromethorphan (a synthetic analog of codeine widely used in cough medicines such as Robitussin®, Sucrets®, Vicks Formula 44®, and in high doses in recreational use), and ketamine, primarily a veterinary tranquilizer that is used recreationally as a psychedelic and would likely be associated with decrements in skills related to driving).

This report presents the methodology for the 2007 NRS. Prevalence estimates and other more detailed analyses will appear in two subsequent reports: one will focus on alcohol use and driving prevalence estimates and will also compare the alcohol findings from the 2007 NRS with those obtained in the previous three NRS studies; the other report will provide prevalence estimates for drug- and drug-and-alcohol-related driving.

Introduction

Purpose

This report is one of three that summarize the results of a study conducted by the Pacific Institute for Research and Evaluation (PIRE) under the sponsorship of the National Highway Traffic Safety Administration (NHTSA) under Contract DTNH22-06-C-0040, "2007 National Roadside Survey of Alcohol and Drugged Driving." The study also received support through the National Institute on Drug Abuse (NIDA), the Department of Justice (DOJ), and through a National Institute on Alcohol Abuse and Alcoholism (NIAAA) grant R-01 AA16407-01, "Estimating the Prevalence of Alcohol Use Disorders Among At-Risk Drivers."

This report describes the sampling plan and data collection methodology, and summarizes the response rates at various stages of this multi-part survey. A second report will follow which will present the prevalence estimates for alcohol-positive driving derived from this study and compare them with the three previous National Roadside Survey (NRS) studies. A third report, based on analyses of oral fluid and blood specimens, as well as self-report of drug use, will present the first national prevalence estimate of drug-involved drivers.

Background

Three prior national roadside surveys of drivers on our Nation's roads have been conducted. The first NRS was sponsored by NHTSA and was conducted in 1973 (Wolfe, 1974). The second NRS was sponsored by the Insurance Institute for Highway Safety (IIHS) in 1986 (Lund & Wolfe, 1991), and the third was jointly funded by IIHS and NHTSA in 1996 (Voas et al., 1998). NHTSA sponsored the 2007 NRS described in this report, with supplemental funding from NIAAA, NIDA, and the National Institute of Justice (NIJ).

Historically, the NRS has been a survey conducted during weekend nights. Drivers were randomly selected from the traffic stream on representative roadways across the 48 contiguous United States. Once the vehicle pulled to the side of the road, a brief interview on drinking and driving behavior was conducted and a breath sample was requested to determine the driver's blood alcohol concentration (BAC).

The three previous NRS studies have provided critical information regarding the proportion of drivers at various BAC levels on the Nation's roads over the last three decades. For example, the 1996 NRS indicated that 17% of nighttime weekend drivers had a positive BAC compared to 26% in 1986, and 36% in 1973. In 1996, there was a significant decrease in drivers with BACs of .05 or lower compared to 1986, but little or no change in drivers with higher BACs. In 1996, there was also a significant decline in drivers under the age of 21 with BAC $\geq$ .10 compared to the previous surveys (4% in 1973, to 2.7% in 1986, to .3% in 1996) (Voas, Wells, Lestina, Williams, & Greene, 2000).

Although the proportion of drivers with positive BACs has been well documented, much less is known about the prevalence of drugs other than alcohol in drivers. Much of the current information on drivers using drugs comes from self-report surveys, such as the National Household Survey on Drug Abuse (Townsend, Lane, Dewa, & Brittingham, 1998), and from

studies of the prevalence of drugs in fatal crashes (Terhune et al., 1992) and in injury-producing crashes (Soderstrom et al., 2001). Although these data collection strategies obtain information on drug use by drivers, each has its weaknesses. Self-report data on controversial issues, such as drug use and driving, are often underreported. For example, in the pilot study preceding the current study (Lacey, Kelley-Baker, Furr-Holden, Brainard, & Moore, 2007), only about a third of the persons who tested positive for drugs other than alcohol reported they had used drugs within the past year, and only 2% reported such drug use on the night of the survey. This underreporting occurred even though the respondents knew they were being tested for the presence of drugs. Thus, self-report data may be useful in tracking trends in driver reports of drug use, but may underestimate actual activity and, therefore, be an insufficient basis for estimating the crash risk posed by drugs. Fatal crash studies (such as the Terhune study cited above) have been useful, although they rely on a responsibility analysis of the crashes to attribute presumed causation. This presumed causation is then retrospectively related to the presence or absence of drugs in the fatally injured drivers. This provides some potential insight, but is methodologically weaker than if measures from the population at risk (but not crash-involved), such as those obtained from roadside surveys, could be obtained and then related to those from the crash-involved population. Such data have long been desired, but the technology for practical and cost-effective drug testing at the roadside did not exist until fairly recently.

Since 1996, the technology for collecting and analyzing saliva to detect drugs (including alcohol) has greatly improved. In recent years, new devices have become available for collecting oral fluid samples, and new methods are available for analyzing drug concentrations. Tests, which yield only screening results at the roadside or in the police station, have not yet proven to be sufficiently accurate for scientific studies (Verstraete & Raes, 2006). However, sample collection devices are available that can be used to collect and store oral fluid specimens, which can then be sent to a laboratory for subsequent analysis. These tests yield more valid and reliable results comparable to established blood testing technologies (Lacey et al., 2007; Moore, C. & Lacey, J., 2007). Blood analyses remain the gold standard of drug testing; however, and are a useful basis for evaluating oral fluid results. Blood analyses offer ongoing validation of the utility of oral fluid testing.

In 2005, NHSTA sponsored a pilot study as a precursor to this full decennial 2007 NRS (Lacey et al., 2007). The primary objective of the pilot test was to develop and test methods for the collection and analysis of biological samples to determine the extent of the presence of drugs other than alcohol in the nighttime driving population. The specific objective was to determine whether it was feasible to collect data for drugs other than alcohol through oral fluid and blood samples at the roadside. Another aspect of the pilot study, funded by NIAAA, was to develop and pilot-test a self-report screening instrument to determine the prevalence of drivers with alcohol use disorders (AUDs) in the nighttime driving population. In the pilot study, we conducted nighttime data collection in six locations across the country, recruiting over 800 drivers into the survey; of those, 78% (over 600 drivers) agreed to provide an oral fluid sample and almost 50% of those who gave oral fluid provided blood. Based on the work conducted for NHTSA in the pilot study, it was clearly feasible to conduct a survey that included drugs other than alcohol.

This current report describes the methods used in the sampling and data collection and biological specimen analysis portions of the 2007 NRS. Subsequent reports will describe the analytic

approach taken and summarize the alcohol and other drug prevalence estimates derived from those analyses.

Project Objectives

The overall objective of this study was to estimate the prevalence of alcohol and drugs in drivers on our Nation's roadways. More than 9,000 drivers were interviewed to:

1. Determine the prevalence of drivers at various BACs; and
2. Determine the prevalence of drivers having various types of drugs (i.e., over-the-counter, prescription, and illegal) in their system.

This methodology report describes the steps PIRE took to collect self-report data and biological specimens which, when analyzed, will answer the following key research questions, among others:

- What is the prevalence of alcohol-positive nighttime weekend (and Friday daytime) drivers on the road?
- What is the BAC distribution for those drivers?
- What percentage of those drivers have a BAC of .08 or higher?
- What is the prevalence and concentrations of selected over-the-counter, prescription, and illegal drugs in drivers on the road?
- What percentage of drivers are both alcohol-positive and drug-positive?
- What percentage of .08 and higher BAC drivers are also drug-positive?
- What information is available to characterize the drivers who "refuse" to participate in the interview and to provide a breath and/or oral fluid sample (e.g., what are the demographics of these drivers, what percentage of these drivers are alcohol-positive as determined by a passive alcohol sensor [PAS] reading)? To what extent do such data reveal potential biases in the data and to what extent can such measures be used to correct the results for such biases?
- Do the drivers who provide oral fluid samples, but not blood samples, differ in a systematic way from those who provide both?
- How does the prevalence of alcohol in drivers in the 2007 survey compare to those of the 1973, 1986, and 1996 surveys?
- What is the prevalence of alcohol use disorders (AUDs) among the sampled driver population?
- How does the large amount of driver self-report information and the observations of drivers relate to drinking and drug use patterns?

In the following sections of this document, we detail the procedures employed for collecting data and analyzing specimens to create a dataset to enhance our understanding of drinking and drugged driving on our Nation's roadways.

This report is organized as follows: this introductory section is followed by a discussion of the survey sampling approach, and then a description of basic data collection instruments and tools used in the data collection process. The next section describes the development and training of the survey research teams. Basic project operations and procedures are then discussed, followed by a step-by-step description of the actual survey administration process. The analytic procedures used in testing the oral fluid and blood samples for drugs are then described, followed by a description of how the collected data were handled in the field, downloaded, and assembled into an analysis dataset. The report concludes with a summary of the response rates at major points in the survey process, and the implications for the interpretation of the data to be presented in the forthcoming reports on alcohol results alone and then in combination with findings about other drugs as well.

Survey Sampling Procedures

This section of the report describes the sampling approach that was followed in conducting the 2007 NRS. This section discusses the selection of (1) primary sampling units (PSUs), (2) square mile grid areas (GA), (3) specific survey sites (SS), and (4) vehicle recruitment.

Because it is not feasible to conduct surveys on all the roads in the United States, it is necessary to construct a sampling system that is nationally representative. This will require interviewing only a few thousand of the more than 203 million licensed drivers using U.S. roads (Federal Highway Administration, 2006; Lunn et al., 1979). All three prior national roadside surveys limited the area of coverage to the 48 contiguous States. All three surveys were conducted between 10 p.m. and midnight, and between 1 a.m. and 3 a.m. on both Friday and Saturday nights, when heavy drinking was most likely to occur and alcohol-involved crashes were most frequent (Lestina, Greene, Voas, & Wells, 1999). From a practical standpoint, these national surveys had to limit survey locations to roadways with sufficient traffic to provide enough interviews to justify the expense of employing a survey crew. Thus, counties with populations of less than 20,000 were not surveyed, and in counties with larger populations, only roadways with 2,000 to 4,000 average daily traffic counts were surveyed. Finally, commercial vehicle operators and motorcycles were excluded. Thus, the past three national roadside surveys provided information on private four-wheel vehicle operators at randomly selected locations during periods when drinking and driving is most prevalent.

The primary objective of the current location sampling plan was also to select a representative sample of locations in the contiguous United States that would provide an adequate number of drivers for analysis and a safe environment for both the drivers and the research team to collect roadside survey data. This was done for both the Friday daytime data collection period (either 9:30 a.m. to 11:30 a.m. or 1:30 p.m. to 3:30 p.m.) randomly selected for each primary sampling unit (PSU),[1] and the weekend evening data collection periods covered in the previous NRS. Although the 1996 survey did not include counties with populations of fewer than 20,000 people, and in larger counties it included only roadways with 2,000 to 4,000 average daily traffic counts, the current 2007 survey did not exactly follow these guidelines because the number of drivers who could feasibly be surveyed at the sites was smaller. However, we did consider traffic flow when identifying survey site locations. Also, for the 2007 survey, motorcycles were included in the sampling frame.

Generally, the basic sampling plan of the 2007 study mirrored that of the 1996 survey (see Lestina et al., 1999). However, the 1996 survey collected data from the 24 Primary Sampling Units (PSUs) from NHTSA's National Automotive Sampling System/Crashworthiness Data System[2] (NASS/CDS), whereas the 2007 study used the 60 PSUs from NHTSA's larger National Automotive Sampling System/General Estimates System (NASS/GES) (NHTSA, 1991), which provides a more comprehensive sample of the continental United States.

[1] PSUs are cities, large counties, or groups of counties from within four regions of the country and three levels of population density.

[2] The NASS/CDS is a nationwide crash data collection program sponsored by the U.S. Department of Transportation. It is operated by the National Center for Statistics and Analysis (NCSA) of NHTSA.

Site identification and recruitment for this survey was conducted in several stages, using the following procedures (from the most general to the most specific):

1. **Select Primary Sampling Units (PSUs).** The 60 NASS/GES PSUs are comprised of cities, large counties, or groups of counties from within four regions of the country and three levels of population density. We attempted to recruit cooperation in all 60 of these PSUs.
2. **Select Square-Mile Grid Areas (GAs).** A selected GA consisted of a square-mile area within the PSU within which a survey site would be selected. To determine these, we created a grid identifying every square mile within a PSU, and then randomly selected 30 specific GAs. These randomly selected GAs where then examined in sequential order for feasible survey sites.
3. **Identify Survey Sites (SSs).** Beginning with the first randomly selected GA in the sequence, we identified appropriate survey sites. These were safe areas large enough to accommodate the survey operation and with sufficient traffic flow to generate an adequate number of subjects. The result was at least five data collection sites within each PSU. Typically, each GA yielded only one SS. So, there would be five SSs in five different GAs.
4. **Select Vehicles.** Vehicles were randomly selected from the traffic stream for their drivers to be interviewed.

This multistage sampling system (detailed in Figure 1), which attempted to replicate the protocol used in the three prior national roadside surveys (see Lestina et al., 1999), produced a valid comparable estimate of the national level of drinking and driving for the study.

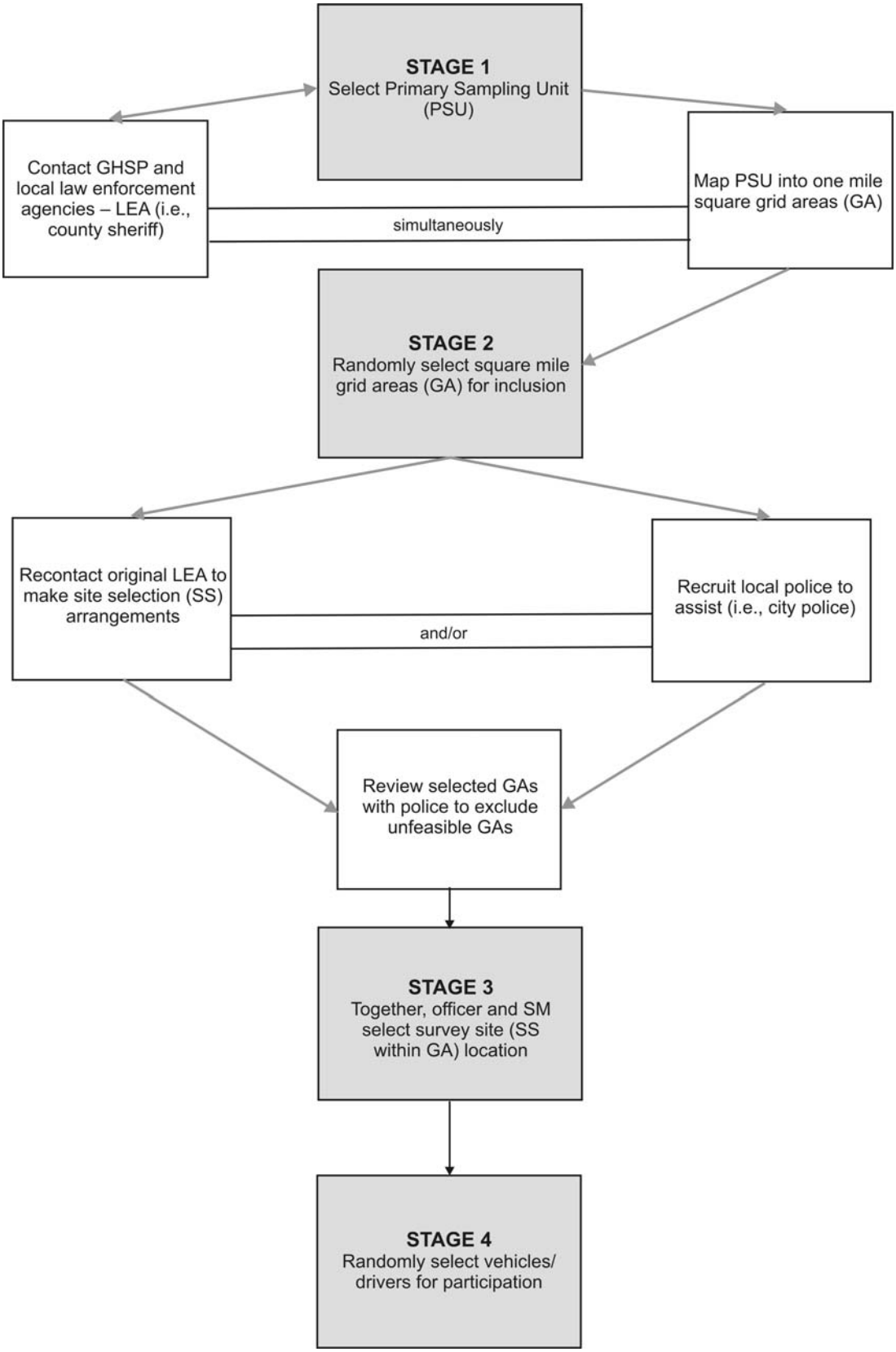

Figure 1. Multistage Sampling System Flowchart

Selection of Primary Sampling Units (PSUs)

Because obtaining a random sample of all United States drivers would be extremely expensive and unfeasible, the multistage sampling system outlined more briefly above was applied. The first stage was defined by Primary Sampling Units (PSUs).

As described by the National Automotive Sampling System (NASS) in 2006 (NHTSA, 2006), the 60 PSUs in the NASS/GES have been sampled using a probability proportion to size (PPS) procedure from a nationwide stratification by NHTSA of 1,195 city/county regions. The number of fatal and serious injury crashes within a PSU serves as the measure of size in terms of PPS sampling. Thus, data collected from these PSUs may be interpolated to reflect population parameters of crash injury in the United States.

Extensive crash data extracted by NHTSA from local law enforcement records are available for these PSUs. Crash frequency data may be used to weight the sample (as an alternative to using population counts), as these may produce a smaller sampling variance (NHTSA, 1995).

In addition to being representative of the national population, the 60 NASS/GES PSUs provide ideal sampling units because some police agencies in those regions are already cooperating with NHTSA, which we hoped would assist with their participation.

To obtain cooperation of local law enforcement, we began by contacting NHTSA's regional offices for assistance in obtaining cooperation from the individual States' Governor's Highway Safety Programs (GHSP). Then we asked the GHSPs for assistance to gain the cooperation of, or provide contact information for, local law enforcement agencies in the State's PSUs. We attempted to gain cooperation from law enforcement agencies that had broad jurisdiction, such as sheriff's departments or county police agencies, and then other agencies within the PSU. Typically, not all agencies in the PSU were successfully recruited to participate, but we endeavored to obtain as broad a geographic coverage of the PSU as possible. Our experience in the pilot study was that the barrier to access, if any, was primarily at the State level; in every instance in the pilot study where we obtained cooperation of State-level authorities, we also were able to obtain cooperation at the local level. However, in this full-scale study, we encountered many obstacles and challenges in securing participation at the State and local levels, and thus had to seek replacement PSUs. In both the 1996 and 2007 surveys, approximately 25 to 30% of those intended PSUs could not be used due to lack of agreement by local officials and were replaced by alternate sites not included within the 24 NASS/CDS sites and 60 NASS/GES sites, respectively.

The major barrier to carrying out this staged sampling scheme was obtaining police department support for the study. In some localities, city attorneys or the police leadership believed that legal limitations to randomly stopping vehicles, including potential liability, prevented their participation in the surveys. In other cases, the police departments reported that they lacked the personnel resources to support the effort. These types of objections resulted in the necessity of making substitutions for initially selected PSUs where enforcement assistance was not available. As discussed earlier, similar substitutions were also required in the three previous national roadside surveys.[3] The effect of these departures from the original structure of the sample was minimized by ensuring that the substitute was selected from the same geographical and

[3] Substitutions were required for 5 PSUs out of 24 in the 1973 survey, 9 out of 24 in the 1986 survey, 5 out of 24 in the 1996 survey, and 17 out of 60 in the current study.

population stratum. For example, if cooperation was not forthcoming from State or local officials for the initially selected PSU, we replaced the unavailable PSU with a similar alternate PSU taken from the population of 1,195 candidate PSUs from which the 60 final NASS/GES PSUs were selected. Replacement PSUs were selected to be as similar as possible to the unavailable PSU. Replacement PSUs were chosen from within the same geographic region (GES defines four geographic strata: Northeast, South, Midwest, and West) and the same GES category of PSU type (city, large suburban area, all others) as the unavailable PSU. Further, the replacement PSU had other similar characteristics, including:

- Average population density and the percentage of PSU population that is contained within an urban area (which is largely implicit already within the three PSU types);
- Number of fatal crashes occurring over the most recent 5-year period prior to the current survey (while this addresses factors such as volume of travel and other roadway safety/access factors, it also serves as a surrogate for the unknown number of total crashes, as the number of fatal crashes correlates well with injury crashes);
- Number of injury crashes (and to a lesser extent, property-damage-only crashes) in the data used by NHTSA's National Center for Statistics and Analysis (NCSA) to select the current NASS/GES PSUs;[4] and
- Current socioeconomic conditions (e.g., median household income, unemployment rate, etc.).

Scores for all of the PSUs on each of these variables were standardized in terms of the metric of that measure, separately within region and PSU type. We tabulated the standardized measures for each of these factors for the smaller subset of potential PSUs within that region and PSU category, and we ranked the similarity (or proximity) scores for each candidate PSU from the most similar to the least similar.

[4] Based on 1992 data (NHTSA, NASS/GES Analytical User's Manual, 1988-1999).

The map in Figure 2 shows the final PSU locations that were selected for this study, and Table 2 names the locations.

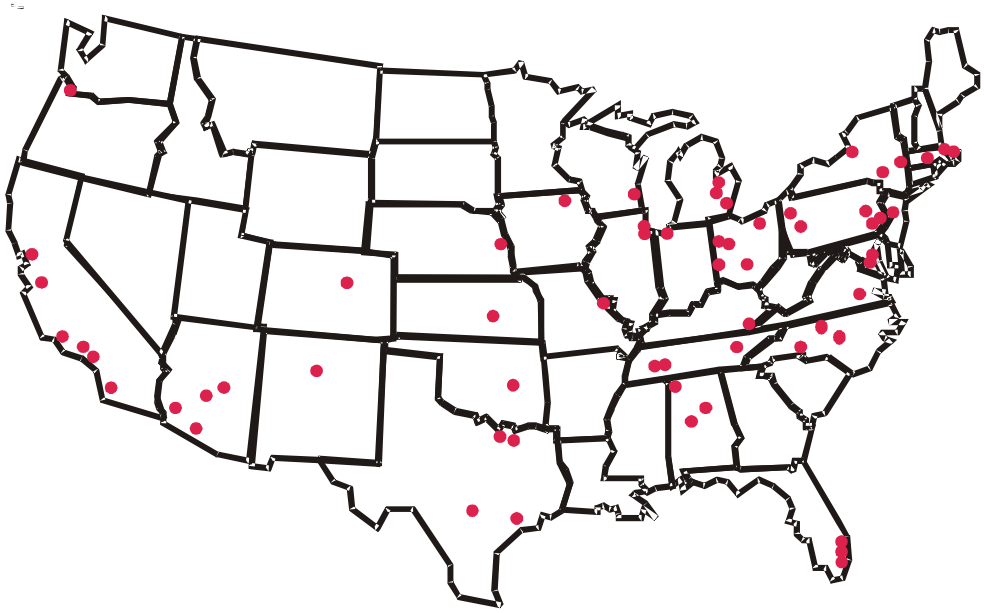

Figure 2. 2007 National Roadside Survey Primary Sampling Unit (PSU) Locations

Table 2. 2007 National Roadside Survey: Sixty Sites by Four Regions

South	Midwest	Northeast	West
Alabama	**Illinois**	**Massachusetts**	**Arizona**
Bibb County	Chicago (city)	Hampshire County	Gila & Graham Counties
Shelby & St. Claire Counties	Cook County	Middlesex County	Pima County
		Plymouth County	Phoenix (city)
Florida	**Indiana**		Yuma & La Paz Counties
Fort Lauderdale & Hollywood	Lake County	**New Jersey**	
Dade County		Newark (city)	**California**
Palm Beach County	**Iowa**		Contra Costa County
	Floyd & Howard Counties	**New York**	Los Angeles County
Kentucky		Monroe County	Orange County (Anaheim)
Harlan & Letcher Counties	**Kansas**	Schenectady County	San Jose (city)
	Wichita County	Ulster County	Ventura County
Maryland	**Michigan**	**Pennsylvania**	**Colorado**
Baltimore (city)	Genesee County	Westmoreland County	Gilpin & Jefferson Counties
Charles & Prince George's Counties	Oakland County	Delaware County	
	Wayne County	Philadelphia (city)	**New Mexico**
		Montgomery County	Bernalillo & Sandoval Counties
North Carolina	**Missouri**	Allegheny County	
Cleveland & Rutherford Counties	St. Louis County		**Oklahoma**
Orange County			Oklahoma City (city)
Wake County	**Nebraska**		
	Douglas County		**Oregon**
			Washington County
Tennessee	**Ohio**		
Memphis (city)	Cleveland (city)		**Texas**
Knox County	Clark County		Brazoria County
Shelby & Tipton Counties	Butler County		San Antonio (city)
	Logan & Shelby Counties		Dallas (city)
Virginia	Preble & Warren Counties		Dallas County
Henrico County & Richmond			
	Wisconsin		
	Waukesha County		

Selection of Square-Mile Grid Areas (GAs)

Within each PSU, we randomly selected 30 specific square-mile grid areas (GAs) where site survey locations could be selected (see Figure 3). Our goal was to identify and select geographic locations within the PSU that were representative of the PSU as a whole. To accomplish this, we created a map for each PSU. We then divided the map of the PSU into a grid of approximately 1-square-mile squares. Squares containing fields, parks, airports, harbors, and the like, which contained few road segments, were eliminated from our sampling frame. Using simple random sampling procedure (without replacement) of all the eligible "survey squares," we identified 30 possible square-mile GAs for potential survey site (SS) locations. One SS location would potentially be selected from each sampled GA. Typically, we selected GAs from the total PSU area, and if cooperation was not forthcoming from a law enforcement agency which had jurisdiction for a particular selected GA, we excluded that GA from further consideration.

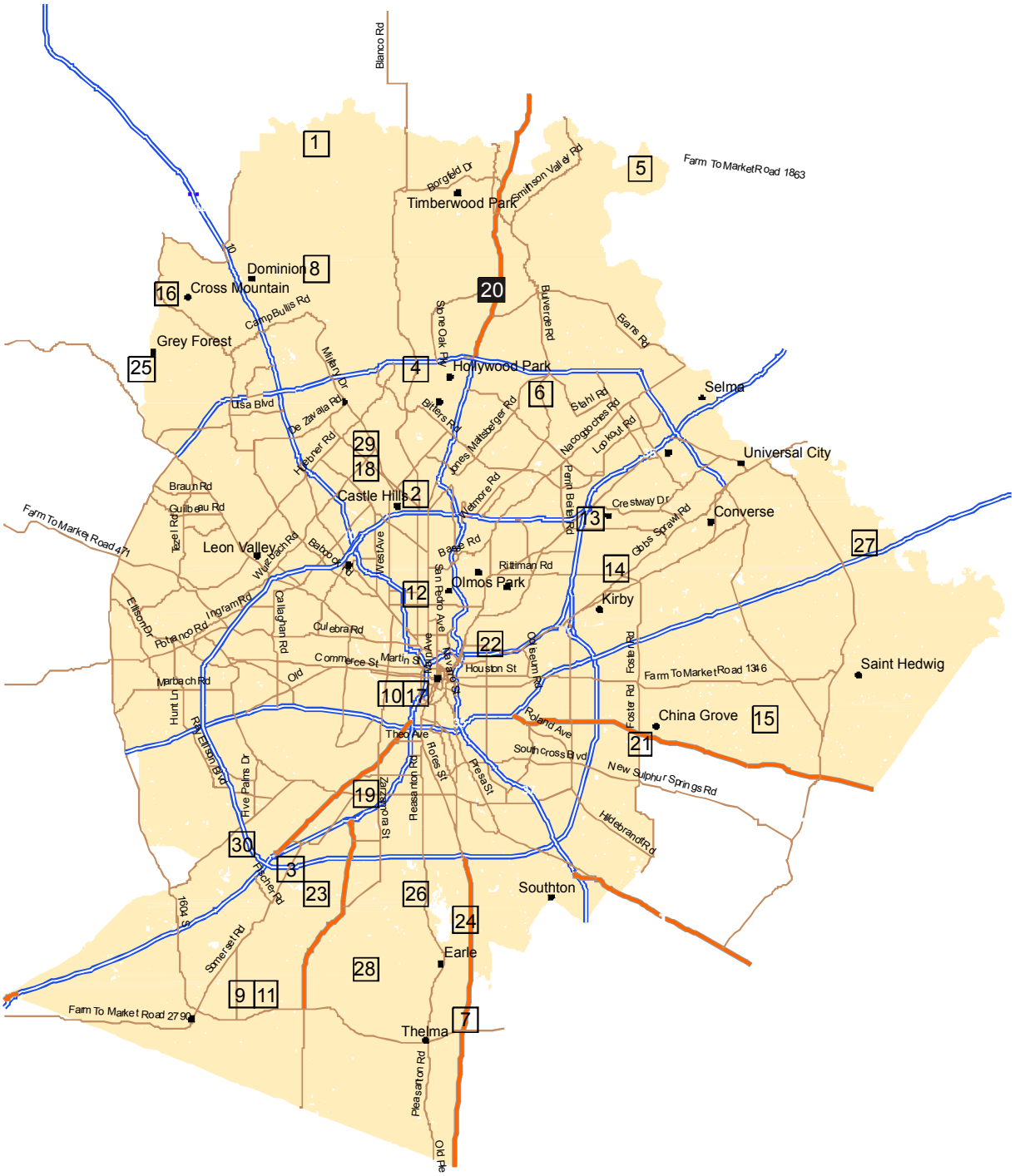

Figure 3. Square Mile Grid Area of City of San Antonio, Bexar County, Texas, Showing 30 Randomly Selected Grid Areas

We recorded the number of geographic squares within police jurisdictions from which the sites were sampled. This allowed adjusting the collected sample values by traffic volume based on an estimate of the PSU's total traffic volume.[5]

Thus, for the overall study, each PSU was then appropriately weighted as we generalized to the driving population as a whole. Within each PSU, we randomly selected five "survey squares" along with five additional sets of five replacement areas for a total of 30 possible GAs.

Once a geographic area was selected, we either recontacted the initial law enforcement agency that was originally identified (i.e., county police/sheriff), and/or contacted the local police department (i.e., city police) with jurisdiction over that area and solicited its support. In several instances, multiple police departments were involved within a PSU. In practice, we only investigated feasibility of specific GAs in areas where we were able to obtain police cooperation. The police department and survey manager would then review the selected GAs and select the actual survey sites. We used the replacement areas if there were no viable survey sites (i.e., roads with sufficient traffic where the survey could be conducted safely, or when it was apparent that no potential survey site was available in an area of parkland, military reservation, or waterway) within the GA or if the associated police department would not cooperate or did not have jurisdiction over that area.

Identification of Survey Sites (SSs)

As noted above, once the GAs were selected and reviewed, the survey managers and local police officers found a safe and effective SS within the selected square area (with a back-up survey site if available). To be considered safe, the site had to provide enough viewing distance of the roadway to permit an officer to signal oncoming vehicles to stop. This distance varied with the typical speed of the traffic on the roadway. The best locations were lighted, off-road parking areas into which selected drivers were directed (e.g., a gas station, church parking lot). Sites to be used for daytime data collection were identified based on whether the parking area would be vacant during the day. In some cases, more than one such location was available within a GA. In that instance, the survey manager exercised his/her judgment to select the optimal location for safe data collection. In all cases, it was necessary to have police department approval of the SS.

Figure 4 illustrates a GA (number 20) in the PSU within which a SS was identified.

[5] Traffic volume was estimated at each survey site by a PIRE survey staff person or officer recording the number of passing vehicles using a hand-held counter.

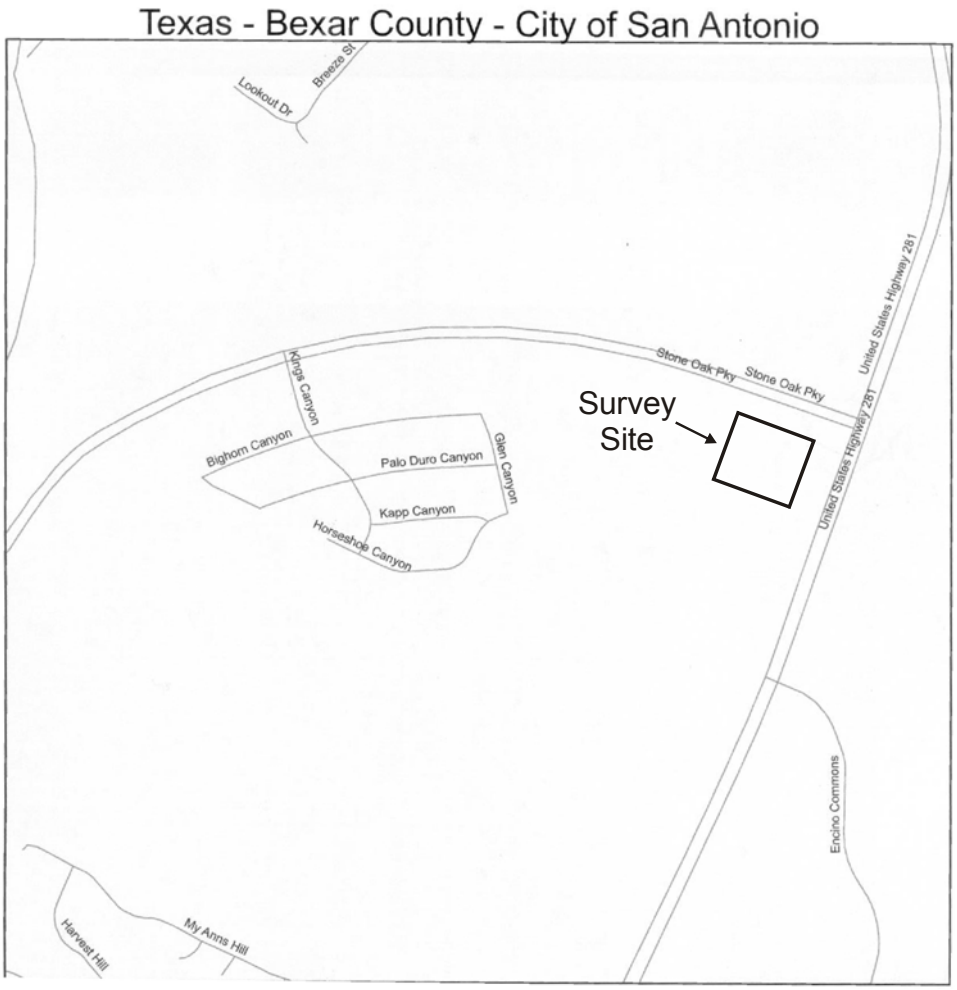

Figure 4. Grid Area 20 in Bexar County, Texas

When the survey manager and police officer agreed on the survey location, the survey manager sketched a detailed map of the survey site setup. These maps outlined entrances and exits, the position of interview bay areas for data collection, the position of officers on the roadway to conduct traffic in and out of the site, and the position of the phlebotomy van. The layout sketch for the SS in GA 20 is shown as Figure 5.

This procedure for selecting specific survey sites was repeated to yield 5 survey sites plus 2 backups. Typically, each SS came from a different GA.

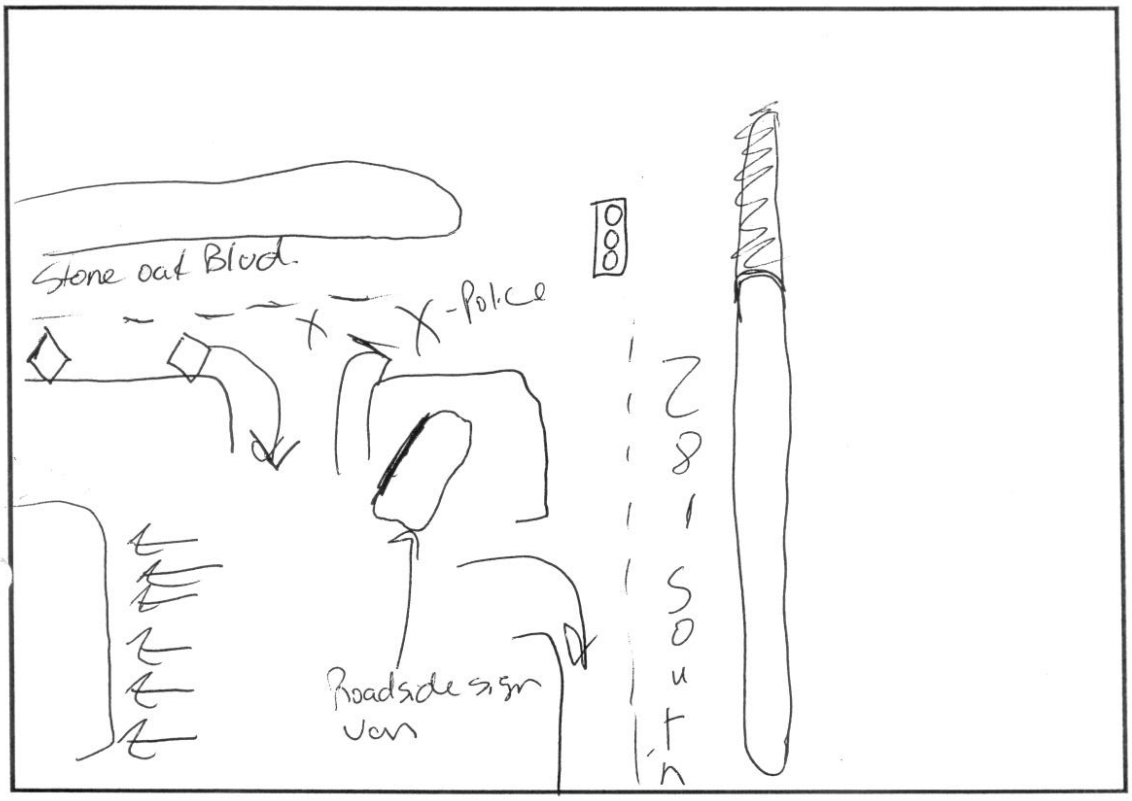

Figure 5. Survey Manager's Sketch of Site Layout

In summary, the study included 60 overall survey locations (PSUs), with 5 separate data collection SSs within each location, for a total of 300 SSs (each of which were used for data collection for a 2-hour time period.

Vehicle Recruitment

The next sampling step, which involved the sampling of drivers, took place once the survey began. To randomly select drivers for this study, data collection teams were dispatched to survey locations and readied themselves to collect data at the specified time (described in the section of the report "Project Operations and Procedures"). The formal protocol for recruiting vehicles entailed having the uniformed officer or traffic director stationed at the roadway to begin driver selection for the survey activity once the data collectors were ready and the "go-ahead" was received from the survey manager. When necessary, a portable two-way radio was used to communicate between the survey manager and the police officer. The officer's role was to direct drivers from the traffic flow and safely into the site. To ensure unbiased selection of the first vehicle at each site, the officer waved in the third vehicle passing the site after initiation of the survey. Each time an interviewer completed a survey the officer was notified and would then signal the next car approaching the survey site. This procedure is typically used in roadside surveys and results in a random selection of eligible vehicles that is not biased toward any particular class of driver.

In some instances, police officers were unable (due to liability issues) to direct vehicles into the survey sites. In these instances, a surveyor was selected by the survey manager for traffic control and to lead the vehicle selection process. The identical procedures for selecting a vehicle used by the police were also used by the traffic director/surveyor. In almost all of these cases, although the police could not direct traffic, they were situated nearby in their vehicle to assist if any problems arose.

Police officers were provided with handheld counters to record all vehicles passing the site during an interview period so that driver selection probabilities could be estimated. In the 1973 and 1986 surveys, data were initially weighted based on both the traffic volume and average traffic speed (Wolfe, 1974; Lund & Wolfe, 1991). The use of average speed at the survey sites is intended to be a correction for the fact that motorists driving at higher average speeds were more likely to be selected in the survey. However, the correction was found to have only a minor effect. In any case, the desire was to estimate the probability of encountering a driver at a given BAC rather than record the absolute number of such motorists on the highways. The speed correction was not applied in the Lund and Wolfe (1991) report on the 1973 or 1986 surveys, or in the analysis of the 1996 survey. Only the traffic counts were used in the weighting of data in the 1996 survey[6] and in comparisons across surveys.

We did make an effort to recruit as many drivers as possible during each data collection period. That is, data collectors were encouraged to be as productive as possible while being courteous to the driver and accurate in data entry. A basic goal of obtaining a minimum of 25 oral fluid samples per survey site was set in order to have an overall sample size of oral fluid specimens of 7,500. This procedure resulted in even more breath samples and somewhat fewer blood samples since drivers were most willing to provide breath samples and least willing to provide blood samples. The one departure from the random-sampling procedure was that, because motorcycles were rarely encountered, traffic directors were instructed to direct every passing motorcyclist they could into the survey site. If an interviewer was not immediately available, the survey manager would ask the rider if she/he was willing to wait for the next available interviewer.

It is important to note that in order to ensure that a random sample of motorists was selected for the survey, the next available vehicle was directed into the survey site when an interviewer was ready for a subject. In practice, a small percentage of the selected motorists were missed because they turned away from the site, the officer was unable to signal them in time, or the officer allowed the individual to proceed without entering the site after speaking with him/her, which sometimes happened if the driver indicated that he/she was in a hurry (e.g., on the way to a hospital or to work). Once the officer directed the vehicle off the road and into the survey site, the officer had no further contact with the driver. Interviewers took over from there, directing vehicles into interview bays marked off by orange traffic cones.

One challenge that arose was drivers or passengers using cell phones to alert family and friends to the survey and the incentives. Although this only happened a few times, such behavior posed a threat to the ability to maintain random selection of drivers on the road. To lessen the likelihood of this occurring, we asked subjects during our greeting if they had heard about the survey and, if so, how. Subjects who had been summoned to the survey site by acquaintances were then excluded from the study. Additionally, when this was discovered to be commonplace, sites were

[6] Counts were conducted by PIRE staff, generally a research assistant/surveyor.

shut down and the location was moved to the next SS. This was a rare occurrence, happening only twice during the 2007 NRS.

Equipment / Instruments / Surveys / Measures

The equipment and instruments used to conduct the 2007 NRS were extensive, and were carefully researched and field-tested in the pilot study (Lacey et al., 2007). A detailed description of the field data collection protocol is in the Survey Administration section of this report.

Driver Information Cards (Blue Cards)

Driver Information Cards (Blue Cards, see Appendix A) were forms on which data collectors indicated which elements of the survey were conducted with an individual driver. This tool, though it contained no identifying information, was used to help merge drivers' data across the project's numerous data collection components.

Personal Digital Assistant (PDA)

The interviewer recorded observational data, responses to survey questions, and results from a PAS into the personal digital assistant (PDA).

After researching PDAs for ease of use, backlighting, battery power, cost, and method of charging, we used the Tungsten E2™ manufactured by Palm, Inc. (Figure 6; see Appendix B for more information).

Figure 6. The Tungsten E2™ Personal Digital Assistant (PDA)

Passive Alcohol Sensor (PAS) Device

To obtain valid data on alcohol-involved driving, it was important to obtain as high a percentage of alcohol tests as possible. One way to accomplish this—even if the active breath test was refused or if some subjects could not blow sufficient air to provide a valid breath sample—was through a PAS reading. Correlating PAS readings with the BACs of those drivers on whom the PBT measure was also obtained provided a basis for the imputation of BAC measures for other subjects for whom a PBT reading was not obtained.

For passive readings, we used the PAS Vr.™ manufactured by PAS International, Inc. of Fredericksburg, Virginia (Figure 7; see Appendix C for more information). The PAS was attached to the PDA with Velcro. This small handheld unit was used because it was less obvious and intimidating than the larger flashlight-based passive sensors. We researched three available styles of PASs, including: (1) the handheld unit that was used in the

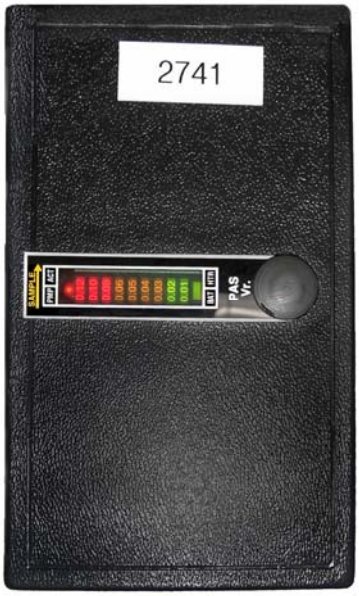

Figure 7. The PAS Vr. Passive Alcohol Sensor (PAS)

pilot study, (2) the flashlight PAS, and (3) a clipboard device with the alcohol sensor built into one corner. We tested the devices for accuracy, ease of use, and reliability, and found that the PAS Vr.™ best suited the needs of this study.

The PAS unit can detect alcohol in expired air around the face (Kiger, Lestina, & Lund, 1993). When the subject spoke, the interviewer held the PAS within six inches of the subject's face, and activated the small electrical pump, which pulled in air from in front of the face (Cammisa, Ferguson, & Wells, 1996; Fiorentino, 1997). The air captured by the PAS was fed into the unit's internal fuel cell alcohol detector, which measured alcohol content and provided a rough indication of the individual's BAC on a color-coded 9-element LED bar graph and numeric display of the approximate alcohol level. After viewing the PAS level, the interviewer entered the number of lighted colored bars into the PDA.

Preliminary Breath Test (PBT) Device

The interviewer obtained breath samples from drivers using a preliminary breath test (PBT) device. We used the Intoxilyzer SD-400^{TM}, a handheld device manufactured by CMI, Inc., of Owensboro, Kentucky (Figure 8; see Appendix D for more information). This device has been tested by NHTSA and placed on its Conforming Products List for Evidential Breath-Test Devices (NHTSA, 2007). The PBT uses an internal fuel cell (as does the PAS unit) to measure BAC when a subject blows directly into the blow tube.

To help ensure subjects' anonymity, the PBTs were programmed to store test results internally and, thus, did not display BACs at the survey site. Rather, the results were stored in the unit's memory and were downloaded later, after data collection activities ended.

Figure 8. Portable Breath Alcohol Test (PBT) Device, Intoxilyzer SD-400 ^{TM}

Roadside Survey Questionnaire

The interviewer asked the subject to verbally answer questions that replicated the 1996 national roadside survey. Two additional questions were added to the 2007 NRS. To ensure correspondence with the 1996 NRS questionnaire (e.g., to avoid the introduction of bias in the classical NRS questions due to any new lead-in or anchoring problem), the two additional questions were appended to the end of the survey. The survey included questions covering topics such as annual mileage driven, the origin and destination of the current trip, drinking, drinking and driving, and whether the subject was acting as a designated driver. The interviewer logged the responses directly into the PDA., Interviewers were also trained to, during the interview, estimate the intoxication level of the driver. This would ensure that the Impaired Driver Protocol (Appendix E) was activated when appropriate.

The self-reported interview items that comprised the survey questionnaire are detailed in Table 3 and are also included in Appendix F.

Table 3. 2007 National Roadside Survey Interview Questions

Item #	Survey Interview Questions
1	The average driver drives about 15,000 miles a year. What would you say you drive?
2	About what percent of your total driving takes place at night?
3	About how many miles away are you now from where you live?
	[PROMPT TO TAKE SECOND PASSIVE SENSOR READING]
4	Where are you coming from? Where are you going to?
5	About how many miles is it between those two places?
	[ASSESS ESTIMATED INTOXICATION LEVEL]
	[PROMPT TO ENTER PASSIVE SENSOR READING INTO PDA]
6	Now I have a question about your use of alcohol. Do you ever drink alcoholic beverages such as beer, wine, or liquor – or are you a total abstainer?
7	In general, would you describe yourself as: a very light drinker, a fairly light drinker, a moderate drinker, a fairly heavy drinker, a very heavy drinker?
8	About how many alcoholic beverages do you consume in an average week?
9	Have you had anything to drink today?
10	How long ago did you finish your last drink? _____Hours _____Minutes
11	Was that beer, wine, liquor, or a combination?
12	In the past 12 months, did you ever drive after drinking enough that you might be considered to be legally under the influence of alcohol?
13	Tonight/Today, are you, or have you been, a designated driver?
14	What is your age?
15	What is your ZIP code?
16	How far have you gone in school?
17	Are you currently employed, unemployed, retired, on disability, a homemaker, a student, or other?
18	Are you Hispanic or Latino?
19	To which racial group would you say you belong?
20	How many total miles will you have driven by the end of the day?
21	In the past 4 weeks, have you been driving at about this same time on a Friday/Saturday?
22	Have you ever been involved in a nighttime crash as a driver?

Oral Fluid Sample

After the brief survey had been completed and a breath sample was obtained, the interviewer then requested an oral fluid sample and offered a $10 incentive for providing one. We used the Quantisal™ (manufactured by Immunalysis Corporation, Pomona, California) oral fluid collection device (see Appendix G). The subject placed this device under his/her tongue; the pad changed color (blue) when 1 ml of oral fluid was collected, indicating that an adequate sample volume had been acquired. The subject then placed the collection device into a tube containing 3 ml of a stabilizing buffer solution. The interviewer capped the tube. The steps are illustrated in Figure 9.

Figure 9. Collecting an Oral Fluid Sample With the Quantisal™ Oral Fluid Collection Device[7]

Although less invasive than the collection of blood or urine, the collection of oral fluid does have some associated difficulties (O'Neal, Crouch, Rollins, & Fatah, 2000). Various researchers have noted that the method of collection and the medium itself (oral fluid) significantly impacts the concentration of drug in the specimen and, thus, whether some drugs can be detected at all. However, while some collection devices give no indication of the amount of oral fluid collected, rendering a quantitative result meaningless, the Quantisal™ oral fluid collection device collects 1 ml (+/-10%) of clear oral fluid from the donor. Researchers have studied the device to assess the efficiency of drug release from the collection pad (Quintela, Crouch, & Andrenyak, 2006; Moore et al., 2006; Moore, Rana, & Coulter, 2007a) and have found a high rate of extraction efficiency. Tables 4 and 5 summarize the effectiveness of the Quantisal™ oral fluid collection device across a range of drugs by two different research groups. Findings above 100% are due to slight variations in the amount of the substances added to the scientific control samples (scientific error).

Table 4. Effectiveness of Quantisal™ Oral Fluid Collection Device Over a Range of Drugs: Quintela

Drug	Target value (ng/ml)*	Mean recovery from the pad (%)
Amphetamine	50	94.3
Methamphetamine	50	103.8
Cocaine	20	91.2
Benzoylecgonine	20	86.9
Codeine	40	95.6
Morphine	40	92.6
6-acetylmorphine	4	92.2
THC	4	91.4
Methadone	50	99.7
Oxazepam	20	101.3

Source: Quintela et al., 2006.
Note: ng/ml = nanograms per milliliter.

[7] Quantisal saliva collecting device distributed by Immunalysis, Inc., Pomona, CA. www.immunalysis.com/quantisal_procedure.htm

Table 5. Effectiveness of Quantisal™ Oral Fluid Collection Device Over a Range of Drugs: Moore

Drug	Target value (ng/ml)	Mean recovery from the pad (%)
Meperidine	25	86.7
Tramadol	25	87.7
Oxycodone	20	96.6

Source: (Moore, Rana et al., 2007a); (Moore et al., 2006): THC recovery from the pad > 80%.
Note: ng/ml = nanograms per milliliter.

Based on these findings, we selected the Quantisal device for this study. For a more thorough discussion of the Quantisal device, see Lacey et al. (2007).

Booklet: Drug Use, Experience With Criminal Justice System, Drug Use Disorder (DUD), and Alcohol Use Disorder (AUD)

The Booklet

While the participant had a Quantisal™ oral fluid collection device in his/her mouth, he/she also filled out a confidential and anonymous 4-page booklet that contained several surveys: (1) a drug questionnaire, (2) a drug use disorder (DUD) questionnaire, and (3) an alcohol use disorder (AUD) questionnaire. The survey instrument itself appears in Appendix H.

Drug Questionnaire

The survey collected data on over-the-counter, prescription, and illegal drug use.

The first 23 items on the drug questionnaire (Table 6) comprised a list of drugs, including tobacco and cough medicine, other over-the-counter drugs, and prescribed and illegal drugs. Subjects indicated the last time they used a particular medication/drug by responding "*Tonight*," "*Past 2 days*," "*Past month*," *Past year*," "*Over a year ago*," or "*Never*." Items 24 through 27 are specific to drug use and driving. Items 28 through 32 (Tables 7 and 8) were questions relating to the subject's interaction with the Criminal Justice System and any previous treatment experiences.

Table 6. Drug Questions

Item #	Drugs
1	Tobacco (e.g., cigarettes, cigars)
2	Cough medicines (e.g., Robitussin, Vicks 44, etc.)
3	Other over-the-counter medicines
4	Prescription pain killers (e.g., Percocet, Oxycontin, Oxycodone, Demerol, Darvon)
5	Ambien or other sleep aids
6	ADHD medications (e.g., Ritalin, Aderall, Concerta)
7	Muscle relaxants (e.g., Soma, Miltown)
8	Prescription dietary supplements (e.g., Phentermine)
9	Anti-depressants (e.g., Prozac, Zoloft)
10	Marijuana (e.g., pot, hash, weed)
11	Cocaine (e.g., crack or coke)
12	Heroin
13	Methadone
14	LSD (acid)
15	Morphine or Codeine (e.g., Tylenol with Codeine)
16	Ecstasy (e.g., “E”, Extc, MDMA, “X”)
17	Amphetamine or Methamphetamine (e.g., speed, crank, crystal meth)
18	GHB
19	PCP (Angeldust)
20	Rohypnol (Ruffies)
21	Ketamine (Special K)
22	Benzodiazepines (e.g., Valium or tranquilizers)
23	Barbiturates (e.g., Phenobarbital)
24	Do you believe any of the medications/drugs you have taken (or are taking) could affect your driving?
25	Have you taken any medications or drugs in the past YEAR that you think may have affected your driving?
26	Have you taken any medications or drugs TODAY that you think may affect your driving?
27	Have you ever NOT driven because you were on a medication/drug?

Table 7. Criminal Justice Questions

28	During the past 12 months, were you arrested and booked for driving under the influence of alcohol or drugs?
29	During the past 12 months, as a result of an arrest and/or conviction for driving under the influence of alcohol or drugs:
	a. Was your license suspended?
	b. Was your license revoked?
	c. Did you serve time in jail or prison?
	d. Did you pay a fine?
	e. Were you required to perform community service?
	f. Were you placed on probation?
	g. Were you required to attend an educational program?
	h. Were you required to attend a treatment program?
	i. Other punishment (if Yes, describe below)

Table 8. Treatment Questions

30	During the past 12 months, did you ever stay at least overnight in an inpatient or residential drug or alcohol treatment program, for example, detox, rehab, a therapeutic community, or a hospital?
31	Have you ever been admitted to an outpatient drug or alcohol treatment program, NOT including meetings like AA or NA? (An "outpatient program" is meant as a drug or alcohol treatment program where you do not stay overnight.)
32	During the past 12 months, have you received treatment for your drug or alcohol use in a self-help group such as Alcoholics Anonymous or Narcotics Anonymous?

Drug Use Disorder (DUD) Questionnaire

Table 9 shows the 12 questions included on the DUD questionnaire. A copy of the survey instrument appears in Appendix H.

A screening question prior to the first survey question prompted the subject on whether or not he/she was eligible for the DUD questionnaire (i.e., reported past year use of one of the three substances assessed): *The following questions are about your use of marijuana, cocaine, and non-prescribed use or overuse of prescription painkillers in the past year. If not used in the past year, mark NO USE and turn page.*

The DUD questionnaire is fashioned after the Alcohol Use Disorders and Associated Disabilities Diagnostic Interview Schedule (AUDADIS) (Grant & Dawson, 1997; Cottler et al., 1997; Pull et al., 1997). The AUDADIS is a structured assessment that has one item per symptom on the Diagnostic and Statistical Mental Disorders (DSM) DSM-IV (American Psychiatric Association, 1994)[8] section on Alcohol Abuse and Dependence. Similarly, the DUD questionnaire is constructed to have one item per symptom on the DSM-IV section on Substance Abuse and Dependence. Diagnosis of substance (or drug) use disorders requires a separate assessment for each drug of abuse. To minimize respondent burden and capture information on multiple substances, we assessed abuse and dependence for three primary drugs of abuse, namely: marijuana, cocaine, and extra-medical use of prescription pain killers.

[8] DSM-IV: The Diagnostic and Statistical Manual of Mental Disorders, (4th ed.)

The first four items of the DUD questionnaire measured abuse of marijuana, cocaine, and prescription pain killers which were expected to be the most frequently encountered drugs in the 2007 NRS. This screener is built around statements that describe behaviors or symptoms of abuse and dependence in the Diagnostic and Statistical Manual (DSM-4) of the American Psychiatric Association (1994). Screening instruments built on the DSM-IV criteria "translate the operational criteria of the… DSM-IV classification system into questions and compile the responses into diagnoses" (Ustun et al., 2007). The DUD questionnaire, which has not yet been validated, has two sections. The first section is composed of questions 1-4, which contains the items that measure abuse. If the respondent agrees to any one of those four questions, then that signals abuse of that substance. The second section is composed of items 5 through 12. This section is designed to detect dependence on the substance indicated. Items 5 and 6 are treated as a single item because they both tap into the same domain of tolerance, a feature of dependence which results in the addict requiring more and more of the drug to obtain the high which is being sought. Items 7 through 12 are each representative of one DSM-IV diagnostic symptom of dependence. Counting an affirmative answer to either 5 or 6 or both as 1, a total of six diagnostic symptoms are represented across the items 5 through 12. A positive response to three of the six symptoms is a sign of substance dependence for the drug being assessed (Hasin, Carpenter, McCloud, Smith, & Grant, 1997).

Table 9. Drug Use Disorder (DUD) Questionnaire

Item #	Drug Questions	Marijuana	Cocaine	Prescription Pain Killers
Screener	The following questions are about your use of marijuana, cocaine, and non-prescribed use or overuse of prescription painkillers in the past year. If not used in the past year, mark NO USE and turn page.			
1	In the past year, did your use often interfere with taking care of your home or family or cause you problems at work or school?			
2	In the past year, did you more than once get into a situation while using or after using that increased your chances of getting hurt – like driving a car or other vehicle or using heavy machinery?			
3	In the past year, did you get arrested, held at a police station or have legal problems because of your use?			
4	In the past year, did you continue to use even though it was causing you trouble with your family and friends?			
5	In the past year, have you found that you have to use more than you once did to get the effect you want?			
6	In the past year, did you find that your usual amount had less effect on you than it once did?			
7	In the past year, did you more than once want to try to stop or cut down on your use, but you couldn't do it?			
8	In the past year, did you end up using more or using for a longer period than you intended?			

Item #	Drug Questions	Marijuana	Cocaine	Prescription Pain Killers
9	In the past year, did you give up or cut down on activities that were important to you or gave you pleasure in order to use?			
10	In the past year, when the medication/drug effects were wearing off, did you experience some of the bad after effects – like trouble sleeping, feeling nervous, restless, anxious, sweating or shaking, or did you have seizures or sense things that weren't really there?			
11	In the past year, did you spend a lot of time using or getting over the bad after effects of use?			
12	In the past year, did you continue to use even though it was causing you to feel depressed or anxious or causing a health problem or making one worse?			

Alcohol Use Disorder (AUD) Questionnaire

The first item of the AUD questionnaire served as a screener to determine if further AUD questions would be asked. The question was: *In the past year, how often did you have a drink containing alcohol?* Persons who had not had a drink in the past year were not administered the full AUD instrument. Table 10 shows the AUD items; a copy of the instrument appears in Appendix H. Subjects completing the AUD questionnaire received a $5 incentive.

Table 10. Alcohol Use Disorder (AUD) Questionnaire

Item #	AUD Questions
Screener	In the past year, how often did you have a drink containing alcohol?
1	In the past year, how many drinks containing alcohol did you have on a typical day when you were drinking?
2	In the past year, how often did you have six (five for a woman) or more drinks on one occasion?
3	Did your drinking often interfere with taking care of your home or family or cause you problems at work or school?
4	Did you more than once get into a situation while drinking or after drinking that increased your chances of getting hurt—like driving a car or other vehicle or using heavy machinery after having had too much to drink?
5	Did you get arrested, held at a police station or have legal problems because of your drinking?
6	Did you continue to drink even though it was causing you trouble with your family or friends?
7	Have you found that you have to drink more than you once did to get the effect you want?
8	Did you find that your usual number of drinks had less effect on you than it once did?
9	Did you more than once want to try to stop or cut down on your drinking, but you couldn't do it?
10	Did you end up drinking more or drinking for a longer period than you intended?
11	Did you give up or cut down on activities that were important to you or gave you pleasure in order to drink?
12	When the effects of alcohol were wearing off, did you experience some of the bad after effects of drinking – like trouble sleeping, feeling nervous, restless, anxious, sweating or shaking, or did you have seizures or sense things that weren't really there?

Item #	AUD Questions
13	Did you spend a lot of time drinking or getting over the bad after effects of drinking?
14	Did you continue to drink even though it was causing you to feel depressed or anxious or causing a health problem or making one worse?
15	Have you visited a medical facility in the past year (for example, seen a doctor or medical person, been to the hospital, etc.)?
16	In the past year, have you been told by a medical person you needed help for your drinking?
17	In the past year, have you sought help because of your drinking?
18	In the past year, have you been to an emergency room because of something related to your drinking?
19	In the past year, have you had 5 or more drinks (4 or more for women) in a TWO hour period?

The first three items of the AUD questionnaire (Screener plus Items 1 and 2) are derived from the Alcohol Use Disorders Identification Test (AUDIT) and represent the AUDIT consumption subscale, also known as the AUDIT-C (Chung, Colby, Barnett, & Monti, 2002; Conley, 2001; Babor, de la Fuente, Saunders, & Grant, 1992). Responses to the AUDIT-C are coded as 0, 1, 2, 3, and 4, with the first option receiving a score of 0 and the last response receiving a score of 4, thus for the three-item AUDIT-C "heavy drinking" scale the maximum score is 12. Different investigators have used different scoring methods. For this study, a score of 6 or more indicates heavy drinking for men and a score of 5 or more indicates heavy drinking for women. This follows the scoring system used by Chung, Colby, Barnett, and Monti (2002).

Items 3 through 14 on the AUD questionnaire are derived from the Alcohol Use Disorders and Associated Disabilities Diagnostic Interview Schedule (AUDADIS) (Grant & Dawson, 1997; Cottler et al., 1997; Pull et al., 1997). The AUDADIS is constructed so that there is one item per symptom on the DSM-IV section on Alcohol Abuse and Dependence. A positive response to any of these items signals alcohol abuse. Items 7 and 8 both tap into the domain of tolerance, while items 9 through 14 are each representative of one DSM-IV diagnostic symptom. A total of seven diagnostic symptoms are therefore represented across the eight items. A positive response to three of the seven symptoms signals alcohol dependence (Grant & Dawson, 1997).

The remaining five items are not part of the formal AUD questionnaire, but rather query the respondent about contact with the medical system and treatment services for drinking issues, as well as a question about binge drinking which adheres to current NIAAA measures of binge drinking.

Passenger Survey

It was our experience in the pilot study that drivers with passengers in the car were less likely to complete the entire data collection procedure. Thus, for the full-scale study, we engaged passengers as a means to retain eligible drivers in the NRS. This effort involved a survey for passengers to complete for a $5 incentive. The passenger survey contained questions that would contribute to our understanding of driving patterns across the United States. Passengers eligible for the survey had to be at least 16 years of age. The survey was available in both English and Spanish. Questions on the passenger survey are shown in Table 11. The actual instrument used, including response categories, appears in Appendix I.

Table 11. Passenger Survey Questionnaire

Item #	Passenger Survey Questions
1	What is your date of birth?
2	Are you male or female?
3	Are you Hispanic or Latino?
4	To which racial group would you say you belong?
5	Do you have a driver's license?
6	Do you have a learner's permit?
7	Do you have access to a vehicle that you can drive?
8	During the past year, how often did you drive a motor vehicle?
9	During the past year, how often did you drive in the evening (between 10 p.m. and 3 a.m.)?
10	How often during the past year have you been a passenger?
11	Who is the owner of the vehicle you are currently in?
12	Have you been a passenger with this driver before tonight?
13	How long have you known the driver?
14	What is your relationship to the driver?
15	If other than spouse, significant other, parent or child, how close are you to the driver?
16	Are there any passengers in the back seat of the vehicle you are currently in?
17	If other than spouse, significant other or child, please indicate how close you are to the passengers.
18	When was the last time you were the designated driver?
19	How many times in the past year were you the designated driver?
20	Is your driver tonight serving as the designated driver?
21	In the past year, how often did you have a drink containing alcohol?
22	In the past year, how many drinks containing alcohol did you have on a typical day when you were drinking?
23	In the past year, have you had 5 or more drinks (4 or more for women) in a TWO hour period?
24	Have you had anything to drink today?
25	(If yes, you have been drinking alcohol) How many whole drinks of alcohol have you had today/this evening?
26	How many more drinks do you intend to have today/tonight?

Blood Sample

After completion of the oral fluid sample, the drug questionnaire, and the DUD and AUD surveys (if applicable), the interviewer requested that the subject provide a blood sample in exchange for an additional $50 incentive. The incentives were given in the form of money orders so that the subjects would not be able to spend the money immediately.

Spanish-speaking participants were escorted to the phlebotomist by the Spanish-speaking interviewer, and the Spanish consent form was given to the participant. The interviewer read the consent form to the participant and also stayed with him/her to answer any questions and provide translation between the phlebotomist and participant.

Licensed phlebotomists conducted the blood draws. The phlebotomist set up the blood draw station in a middle seat of a rental van. The subject sat in the middle seat of the van and the phlebotomist stood just outside the van or in the adjoining seat with supplies.

The phlebotomist drew one gray-top tube (10 ml) of the subject's blood. There are several types of tubes available for the collection of blood specimens, with different color tops. The choice of tube is dependent upon the type of test to be performed on the blood. The Federal Aviation Administration (FAA) recommends the gray-topped tube for drug and alcohol testing of blood specimens (Toennes & Kauert, 2001). The gray top tube contains two preservatives, potassium oxalate and sodium fluoride. The oxalate and EDTA (ethylene diamine tetraacetic acid) are anti-coagulants, which prevent the blood from clotting, and the sodium fluoride is an anti-bacterial stabilizer. These preservatives reduce the need for refrigeration, but do not affect the ability to detect and quantify drugs. Both additives are inorganic; therefore, they oxidize very slowly and are extremely stable. The preservative helps inhibit the degradation of cocaine in storage to its metabolite, benzoylecgonine (Toennes & Kauert, 2001). The presence of sodium fluoride, with or without refrigeration, and potassium oxalate, effectively inhibits cocaine degradation, with 86 to 91% of the drug present after 48 hours. In contrast, more substantial degradation of cocaine occurs in the samples stored without sodium fluoride (Brogan et al., 1992). The presence of the parent drug is particularly useful in the determination of recent use, as more cocaine per se (prior to its transformation to benzoylecgonine) indicates more recent drug use. Additionally, gray-top tubes are helpful in conducting ethanol analysis because the sodium fluoride is an effective antibacterial agent, which helps inhibit endogenous alcohol production.

For this study, glass tubing was used, as opposed to plastic, to better maintain reliable drug results. For example, in a study on the stability of THC in whole blood during storage in both polystyrene and glass vials (Christophersen, 1986), THC concentration in blood stored in glass vials for four weeks at -20° C remained unchanged; however, blood stored in plastic vials lost 60 to 100% of its THC content during storage. Thus, glass vials are preferred for collection of blood samples where marijuana content is suspected.

The blood sample tubes were labeled with pre-printed Chain-of-Custody (CoC) labels that linked the blood sample to the oral fluid sample to the subject's blue card, so the specimen could be tracked throughout the project. The CoC labels contained a unique identifier that corresponded to that sample. The interviewer also entered this number into the PDA. CoC numbers were preprinted by the laboratory and were used to maintain a documented link between each sample collected and the respondent who provided it.

The phlebotomists were not able to draw a full tube for all subjects because some individuals had small and/or difficult-to-locate veins, even when using small gauge butterfly needles on the back of the hand. In those cases, the laboratory was able to conduct an initial screening test, but was not able to conduct a confirmatory analysis by gas chromatography-mass spectrometry (GC/MS), due to the insufficient volume.

At the conclusion of the blood draw procedure, the subject received the $50 incentive and sat for a moment in the blood draw station. The subject was offered a piece of candy before being directed safely out of the survey site and back onto the roadway.

Once collected, the blood samples were placed in a cooler with blue ice packs for the remainder of that night's survey(s). When survey teams arrived at their hotel after data collection, the blood samples were stored in refrigerators, or, if no refrigeration was available, in coolers with blue ice packs. The samples were subsequently shipped to the laboratory with blue ice as an additional precaution.

Team Development and Training

This section discusses team members' roles and the training they received. As is often the case, the success of the 2007 NRS relied ultimately on the ability of all team members to fulfill their roles in a proper and timely manner. To this end, PIRE and NHTSA devoted a substantial amount of time and effort to establish suitable working protocols and to train all team members to be able to satisfactorily carry out their assigned tasks. This section describes those efforts.

Team Development

The Data Collection Teams

The data collection system that PIRE employed to conduct the 2007 NRS was comprised of six specialized, trained teams that went into the field to collect data. Each team consisted of 1 survey manager, 1 phlebotomist, and 8 to 10 interviewers/traffic controllers (about 12 members per team). However, although a team consisted of 12 members, only 9 or 10 individuals (see Figure 10) actually went out on each survey weekend; this included the survey manager, the phlebotomist, and about 8 or 9 interviewers, one of whom was a traffic director. Building a team with at least 1 back-up interviewer for a total of 12 fully trained data collectors allowed for necessary back-up in the event of illness or scheduling difficulties. Interviewers and phlebotomists could also move from team to team, as needed, to meet logistical needs. Four teams were dispatched from our Calverton, Maryland, office and two from our San Diego, California, office.

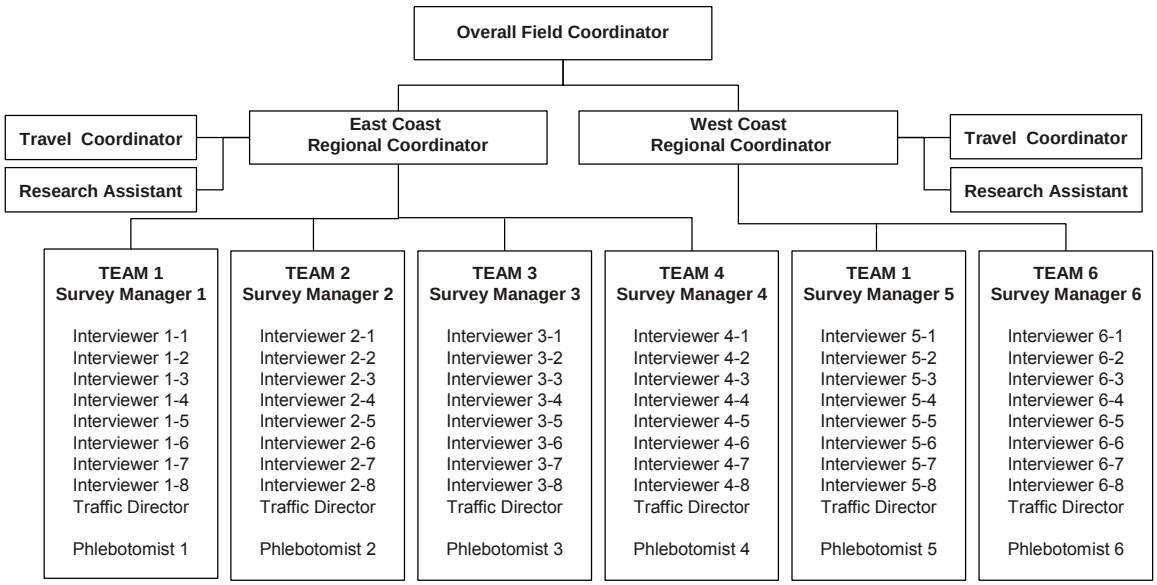

Figure 10. 2007 National Roadside Survey Teams

Overall Field Coordinator

The overall field coordinator oversaw and facilitated the data collection activities, which included supervising the hiring and training of all of team members, scheduling of all field data collection, and serving to conduct quality control during field implementation. The overall field coordinator also led all training sessions and attended all booster training sessions to ensure quality control of training delivery.

Regional Coordinators

The main role of the two regional coordinators (one on the East Coast and one on the West Coast) was to hire interviewers, schedule and conduct training sessions, and directly oversee the survey managers. Regional coordinators and survey managers attended Training of Trainer (TOT) and Quality Control (QC) sessions (see description for these activities below in this section of the report) to learn the entire scope of data collection activities, including how to operate and maintain equipment, elements of research integrity, personnel issues, safety issues, logistics, and how to conduct training seminars for interviewers. The regional coordinators and survey managers then conducted the training sessions for the interviewers.

Survey Managers

Survey managers were the team leaders. They oversaw all aspects of team supervision and ensured that data were collected according to established procedures of the research protocol. Survey managers attended all training sessions, assisted with the interviewer training sessions, and followed up with interviewers who needed additional training on equipment or protocol. Survey managers were responsible for their team's conduct, welfare, morale, and effectiveness while in the field. All survey managers were equipped with cell phones and laptop computers to ensure access to appropriate communication tools while in the field.

Survey managers traveled to PSU sites prior to scheduled data collection activities (Wednesday afternoon or Thursday morning) to coordinate with local law enforcement and select locations within the PSU areas that adhered to requirements described previously (e.g., randomly selected square grid areas and locations that were safe, well-lit, etc.). While reviewing the randomly selected square grid areas with the law enforcement to see which allowed for data collection, survey managers drew detailed maps of each possible data collection location, outlining entrances and exits, interview bay areas, position of officers on the roadway to conduct traffic in and out of the site, and where to locate the phlebotomy van. These detailed maps facilitated site setup when teams arrived later to conduct the surveys.

At the hotel, survey managers made sure that all boxes of equipment arrived and that all supplies and equipment were in good working order. When teams arrived (usually Thursday night), survey managers coordinated team transportation from the destination airport to the hotel in rental vans and then, on Friday and Saturday, to and from the selected locations at the proper times.

Survey managers facilitated all activities at data collection locations, including troubleshooting any difficulties and providing ongoing training/reinforcement to interviewers. They communicated with law enforcement to set up sites in a safe, timely, and orderly manner, and ensured that all procedures were followed. Resolving any challenges that arose with law enforcement, interviewers, equipment, surveys, data collection, or driver information cards (blue

cards) were the responsibility of the survey manager. Additionally, survey managers were responsible for handling any incidents (e.g., impaired drivers, drivers circling to return through the bays trying to be interviewed again, interviewers that become ill, etc.) in a proper manner and reporting such incidents to their supervisors.

After the data collection activity, survey managers downloaded data from that day/night from PDAs and PBTs to upload to a computer server at PIRE's Calverton, Maryland location, filled out and submitted Survey Manager Report Forms (Appendix J), and oversaw correct packing of biological specimens. Each Sunday morning, survey managers used overnight shipping services to get the specimens to the laboratory on Monday morning, checked the team out of the hotel, and survey managers also made sure they arrived at the airport for their flights.

Research Assistants

Several in-house research assistants were dedicated to this study, on both the east and west coasts.

Two research assistants (one east, one west) arranged all team travel logistics including scheduling flights, lodging, and van rentals, and researching for local restaurants, hospitals, and taxi services.

Other research assistants were in charge of all equipment and supplies. They worked with survey managers and phlebotomists to make sure that the teams had what they needed at all times. To this end, research assistants monitored supply stocks and reordered at appropriate times. Equipment responsibilities of the research assistants included tracking all equipment (PDAs, PBTs, PASs) and supplies, calibrating PBTs at proper intervals and changing batteries, ensuring that PASs were calibrated at proper intervals by PAS International, Inc., keeping all equipment in good working order, and ordering replacement supplies (e.g., breath tubes, batteries).

Research assistants also were responsible for packing and shipping all equipment and supplies to the destination hotels. To facilitate packing, a laminated list of all supplies was used to coordinate packing; this list was then used on the other end, by survey managers at the hotel, to check that all supplies had arrived.

Research assistants were also responsible for packing individual carry-on bags for interviewers that contained all necessary equipment for each interviewer's bay. A laminated list of supplies was included in each interviewer's bay bag to facilitate packing by the research assistant and double-checking by the interviewer.

Interviewers

The main role of the interviewer was to interact face-to-face with drivers at the survey sites to collect data, including: recording initial observations, conducting face-to-face interviews, obtaining oral fluid and breath samples, obtaining passive alcohol sensor readings, requesting blood samples required, and giving the subjects the appropriate incentives. For their safety, interviewers and traffic directors were clothed in a "uniform" that included a hat with retro-reflective lettering, a white lab coat, a retro-reflective vest, khaki pants, and comfortable closed-toe shoes.

Interviewers attended training sessions to learn every aspect of the equipment and the data collection procedures and protocol. All interviewers (and all staff on the project) had Human

Subjects training. A major component of that training focused on how to interact with the public and successfully recruit participants while also ensuring informed consent was given before conducting the interview. Another important training component was detection of impaired drivers. If interviewers suspected that a driver had been drinking (e.g., through the odor of alcohol, number of bars lit up on the PAS unit, the driver's actions, etc.), they called over the survey manager who assessed the situation and made arrangements so that impaired drivers would make it home safely (see Appendix E, Impaired Driver Protocol).

Generally, each interviewer was assigned to a team and traveled with the team to scheduled data collection activities under the supervision of the survey manager. During travel, each interviewer was responsible for one carry-on bag that was pre-packed by in-house research assistants and contained everything one interviewer needed for data collection activities in a bay at the data collection site.

On location in the field, interviewers were responsible for setting up their bays in an orderly manner, collecting data accurately, entering data correctly into the PDA, and carefully filling out the Driver Information Card (blue card). After each data collection activity at a site was completed, interviewers were responsible for breaking down their bays and repacking supplies quickly and neatly so that they were ready to get back into the van and travel to the next site with the team.

Traffic Directors

The role of the traffic director was to oversee vehicles entering and exiting the data collection site in a safe and efficient manner. Once the police officer directed a vehicle off the main roadway and into the site, the traffic director took over movement of the vehicle by directing the driver into a bay. Traffic directors used lit traffic wands or flashlights equipped with long orange cones to indicate in what direction the vehicle should proceed.

In some instances, police were reluctant to direct traffic into the site; at those times, traffic directors stood out near the roadway and directed traffic into the site, while officers were nearby. However, local law enforcement officers were always on-site for the safety of the public and the researchers.

Phlebotomists

The 2007 NRS employed a lead phlebotomist and a corps of specially trained, licensed phlebotomists who were assigned to the teams.

The main role of the lead phlebotomist was to oversee all aspects of blood sample collection, including procedures and protocol for phlebotomists in the field. Her role included hiring, training, and careful monitoring and reporting on proficiency of the phlebotomy staff in performing field blood draws. All Office of Safety and Health Administration (OSHA) rules were followed and all phlebotomists were certified and up-to-date on vaccinations and had Human Subjects training. The lead phlebotomist also ordered supplies and kept stocks up to date, and coordinated shipping of phlebotomy supplies to the team phlebotomists in the field, ensuring that all phlebotomists had what they needed for each data collection activity. Arrival of all supplies at hotels was verified; backup shipments of supplies were ready to go in the event that a package went astray.

The lead phlebotomist also worked directly with the laboratory to ensure a smooth set of procedures from blood drawing to shipping to processing of the samples in the laboratory. She oversaw proper packing and shipping of samples and paperwork to the lab via overnight shipping.

The lead phlebotomist also performed quality assurance checks on blood-related services conducted in the field to ensure that the blood collection protocol was followed at all times, especially assurance that the OSHA Exposure Control Plan (ECP) on blood-borne pathogens was followed. PIRE followed Federal requirements for handling blood and other biological specimens (see Appendix K), and appropriate staff had OSHA training. PIRE is OSHA-compliant.

The NRS phlebotomists were assigned to teams and usually met up with the teams on Friday afternoon or early evening at the hotels. Phlebotomists then traveled with the team to data collection sites, assuring that blood supplies were present and in good working order, overseeing the set up of the phlebotomy van at each site, conducting the blood draws, and packing the biological samples for shipment to the lab.

Training Sessions

Given the importance of this research study and the complexities and pioneering nature of the data collection activities, it was critical that PIRE's research team be proficient when the first subject was interviewed. To that end, the objective of this task was for PIRE to thoroughly train research staff in the approved protocol and develop a quality control protocol to evaluate and ensure integrity of data collection throughout the entire data collection period. In addition to in-office training, we held several mock simulation sessions to ensure that the regional coordinators, survey managers, interviewers, and phlebotomists were comfortable with all aspects of data collection and were efficient at using all the data collection devices, such as the personal digital assistant (PDA), preliminary breath tester (PBT), and passive alcohol sensor (PAS) in a simulated roadside survey setting.

PIRE first conducted a training of the trainers (TOT), which included the Principal Investigator, Co-Principal Investigators, program managers, overall field coordinator, regional coordinators, survey managers, and the lead phlebotomist. See Appendix L for the TOT Agenda.

The regional coordinators then conducted trainings within their respective regions for interviewers, including mock surveys in parking lots. See Appendix M for the Interviewer Training Agenda. Phlebotomists attended a specialized phlebotomy training (see Appendix N for Phlebotomy Training Agenda) and also the mock surveys to understand their role in the surveys and practice setting up the phlebotomy van under different circumstances.

During the month of August 2007, three weekends were not scheduled for roadside surveys because of NHTSA's special Labor Day anti-DWI enforcement operations. During these non-scheduled weekends, we conducted regional booster trainings, reviewing results of the first three weekends of data collection to address any areas needing improvement. A survey simulation was set up as part of the booster training.

Quality Control for Training Sessions

All regional coordinators who led interviewer training sessions used the same manuals and support materials. Regional coordinators and survey managers were instructed to adhere exactly to the documented roadside protocol and train the local staff in the same manner. The overall field coordinator attended all regional training sessions. All training materials were provided from the PIRE office in Calverton to ensure uniformity in information, materials, and procedures throughout the project.

Quality Control for Data Collection Activities

Performance standards were established for interviewers, survey managers, and regional coordinators, including establishment of a minimum response rate for individual interviewers (as well as teams as a whole), and also data quality, attendance requirements, and subject satisfaction.

Quality Control (QC) staff were trained in a one-day training session by the overall field coordinator and were also required to attend mock training surveys to practice QC skills. Feedback from QC staff was crucial to honing teams' and individuals' survey skills (see Appendix O for the QC form for data collectors and Appendix P for the QC form for survey managers).

Additionally, the lead phlebotomist developed QC standards for phlebotomists, and all phlebotomists were evaluated in QC assessments, both in training and in the actual roadside surveys.

Initially, the Principal Investigator (PI), one of the Co-Principal Investigators (Co-PIs), or the overall field coordinator attended the first survey for each survey team. Supervisory PIRE research staff not involved in data collection attended a total of 30 field surveys to monitor and assess the interviewers and the survey managers. While on-site in the field, QC staff stood near the interviewer, but not so close as to interfere with the survey. They not only assessed interviewers and gave feedback and support in real-time, but also filled out QC forms. After each QC assignment, QC staff reported back to headquarters and briefed the core PIRE team on skill levels and efficiency in the field. Survey managers received copies of the QC forms so they could directly address suggestions with their team members. Additional training and support were then arranged for teams as a whole, or for individual interviewers, as necessary.

Additionally, the core project team (PI, Co-PIs, project managers, regional coordinators, survey managers, research assistants, and statisticians) met every Wednesday at PIRE headquarters (West Coast staff were connected by video conference to the meeting, and survey managers on the road called in via conference call). The data coordinator and analysts provided site-specific statistics for the team to review. These data provided a basis for ongoing and rapid assessment and evaluation, so that any problems or inconsistencies (e.g., a particular interviewer entered multiple CoC numbers incorrectly or forgot to enter PAS readings) could be addressed as needed and additional training provided prior to the next survey site.

Project Operations and Procedures

Travel Logistics

We established two teams on the west coast and four on the east coast. Teams were assigned to sites according to PIRE's survey resources and the location of the candidate PSUs. If substitute sites were required (e.g., due to lack of cooperation at the State- or PSU-level), the team assignments changed accordingly. We assigned and reassigned teams to optimize survey efficiency (i.e., using a survey team that was well-rested and available) and resources (e.g., taking into account travel logistics and expenses). The actual assignment of teams to PSUs was determined as sites were recruited and confirmed.

A research assistant on each coast was responsible for travel logistics, including flight reservations, hotels, and van rentals. These logistics were extremely challenging because up to 6, but usually 4 or 5 teams (each with 8 to 10 members) were engaged in the survey during 16 weekends over a 6-month period. Two vans were necessary to transport the survey team and equipment, and during survey time these served as the phlebotomy station.

At sites where air travel was not necessary (sites located within a 5-hour drive from a PIRE office) or where airport locations made driving more timely or less expensive than flying, we generally made arrangements for the survey team to drive in rental vans rather than fly.

Each team received a packet with a Travel Logistics Sheet (see Appendix Q) that included travel information plus names, dates, confirmation numbers, addresses, and phone numbers of all team members; all airlines, hotels, and rental agencies involved in plans for that weekend; as well as a list of local hospitals, taxi companies, overnight shipping offices, large department stores, and restaurants.

Packing and Transportation of Equipment and Supplies

Research assistants ordered, assembled, and packed all supplies and equipment necessary for the data collection activities. A list of the supplies and equipment required to conduct the activity is shown in Table 12.

Table 12. List of Supplies and Equipment

Uniforms	Lab coats Reflective safety vests "Research Team" hats T-shirts Fingerless Gloves Headbands Half-aprons with pockets for survey materials
Equipment	PDAs with survey already downloaded PBTs (no display of BAC) 1 PBT with display of BAC PAS Vr's Breath tubes Extra supply of batteries (AA for PBT; 9V for PAS) Carry-on luggage Plastic storage containers Fold-up cubical container for on-site use PDA chargers
Incentives	Cash/Money orders
Paper Documents	Paper surveys (as backup, in case PDAs fail) Participant consent forms (English and Spanish) Refusal consent forms (English and Spanish) Blood consent forms (English and Spanish) Drug questionnaires (English and Spanish) Passenger surveys (English and Spanish) Driver Information Cards (includes driver and passenger information) Supervisor Report Form Consultant Agreement forms Consultant Invoices Chain of Custody (COC) forms that include labels for saliva samples COC forms that include labels for blood samples
Blood Sample and Oral Fluid Sample Supplies	Quantisal™ oral fluid tests Needles Butterfly needles Gray-top tubes (blood collection tubes) Gloves (powder-free latex) Pre-wrapped alcohol pads Pre-wrapped sterile 2x2 gauze pads Band-aids Sharps container (for safe disposal) First aid kit Biohazard spill kit Tourniquets Absorbent shipping pads (for blood specimens) Cooler and blue ice Specified cardboard container for shipping

Additional	Scissors	Stapler
	Traffic signs: "VOLUNTARY SURVEY"	Pre-filled overnight shipping airbills & pouches
	Banner Signs (hung from side of blood draw van) "NATIONAL ROADSIDE SURVEY"	Velcro tape
	Traffic stands	Duct tape
	Orange traffic cones (if not provided by police)	First aid kit
	Garbage bags	Hand warmers
	Pens with styli	Paper towels
	Clipboards (3 per data collector)	Rain ponchos
		Traffic wands
	Binder clips	Traffic batons
	Coloring books w/crayons	Plastic file folders
	Glow sticks	Ziploc bags
	Clip light	Hand sanitizer and Kleenex
	Lantern/Flashlights (extra source of light)	Power strips (to charge multiple PDAs)
	Hand tally counters	
	Two-Way Radios	Dog treats
	Rubber bands	Clorox wipes
	Sealers/Fasteners (for mailing bins)	Mosquito wipes
	Freezer/Thermos Bags	Wet Ones
	Waterproof PDA Cover	Sunscreen
	Ballpoint pens	Freshening spray

To ensure that all supplies necessary for the survey activity arrived and were in good condition at each survey setting, carry-on luggage (identical brightly colored carry-on suitcases on wheels, and labeled with PIRE identification tags) were used for survey items. This ensured that not only were the team's luggage easy to identify en route (bright color), but the wide array of equipment, forms, and materials necessary for the data collection process at each interview bay were all packed and ready to go for quick on-site setup in one bag (one bag = one bay) (see Table 13).

Table 13. Pre-Packed Contents of Interviewer Carry-on Bags for Traveling

#	Supplies
2	Survey paper backups
50	Consent forms (both participant and refusals)
50	Driver information cards (Blue Cards)
30	AUD/DUD booklets
30	Passenger surveys
3	Clipboards
7	Coloring sheets (e.g., buckle-up cartoon)
	Crayons
1	Fold-up cubical container for on-site use
1	Plastic file folder (filled with all questionnaires/surveys and forms)
1	Plastic file folder for blank blue cards and COC oral fluid labels (sent empty)
1	COC booklet (oral fluid samples)

#	Supplies
1	COC booklet (blood samples)
1	Lantern/Flashlight
1	Clip light
2	Glow sticks
2	Uniforms (hats, safety vests, lab coats, t-shirts, fingerless gloves, aprons, and headbands)
5	Ziploc bags (1 for each site) for completed oral fluid samples
5	Garbage bags
1	Pens with styli
1	Waterproof PDA cover
	Bag of Supplies
1	Bag 50-count each breath tubes
1	Bag of candy
12	Ballpoint pens
4	Hand warmers (2 sets)
2	Gloves (1 pair of non-latex)
2	Ponchos
1	Kleenex pack
1	Flashlight /Lantern
	Extra batteries: AA (9), 9V (2)
12	Binder clips
	Equipment
1	PBT
1	PAS
1	PDA

Each bag was assigned to an interviewer for the duration of the weekend's data-collection activity. Each interviewer was responsible for that specific bag and its contents for the entire weekend. The interviewer may have had to check his/her personal luggage, but the data collection bag was always brought onto the plane and stored in an overhead bin. This precautionary procedure distributed the necessary materials and responsibility among interviewers prior to departure so that, in the unlikely event that one bag disappeared en route, the data collection activity could continue.

Teams assembled at the airport prior to departure and again after arrival at the destination to ensure that all team members were present and all bags were accounted for.

Using the individual bay bags, on-site setup in the field was a quick procedure for the interviewers, who unzipped the bags at the assigned bay, put on their uniforms (from their bags), and removed the necessary data collection devices and materials (also from their bags). The compact size of the carry-on bag allowed each interviewer to find all equipment and materials quickly and to organize materials on-site with all supplies accessible at all times during the data collection activity.

Similarly, after each data collection activity, site breakdown was a quick procedure (taking only a matter of minutes). This was especially important and useful when moving from one site to another at night. The interviewer repacked materials into the bag. The interviewer, familiar with

the bag's contents, could readily recognize if the bag was running low on supplies and would alert the survey manager when needed.

During the pilot study for this project, we obtained a letter of permission from the favored project airline to allow transport of diagnostic specimens onto the plane rather than having to check items in the unpressurized freight space below the plane. Thus, in the preliminary study we carried specimens home and shipped them to the lab on the following Monday morning. Because of revised air traffic safety restrictions and the prohibition of carrying some necessary data collection items onto the plane in the interim, the protocol for transporting and shipping biological specimens was revised for the full study. All bags were shipped out from 24-hour copy businesses that provided overnight shipping services. Survey managers were responsible for shipping the packed, cooled samples to the laboratory before proceeding to the airport with the team on Sunday afternoon and returning home.

Human Subjects / Institutional Review Board

PIRE operates under a Federalwide Assurance (FWA) issued by the Office of Human Research Protection (OHRP), an agency of the Office of the Secretary of the Department of Health and Human Services (DHHS). OHRP requires that all personnel involved in human subjects research receive education and training on the requirements for protecting human subjects. All Principal Investigators are required to assure that key personnel proposed on research applications have received this training. To satisfy these requirements, PIRE compiled a Human Subjects Protection Training Module for project staff. Among the precautions taken were steps to intervene with impaired drivers (persons with BACs higher than .05) and others at special risk (e.g., underage drinkers and possibly pregnant drinkers). These steps are described in detail in Appendix E. All research staff completed these modules, which included reading "The Belmont Report" and the "Human Subjects Protection Training Certification." These were presented at the training sessions and were completed by all staff.

Additionally, all law enforcement officers received training on the requirements for protecting human subjects while on-site, prior to the beginning of the data collection session.

Survey Administration

Overview

With the exception of the first 2 weeks of the roadside survey schedule and 3 weekends around Labor Day when the NHTSA-sponsored National Crackdown on Impaired Driving was underway, our goal was to have a minimum of four teams in the field on each survey weekend. This was, of course, dependent on securing jurisdiction approval and local law enforcement agency support.

As previously mentioned, the survey managers arrived on-site earlier than other team members (usually on Wednesday) to meet with police officers on Thursday and secure survey locations. At that time, the survey manager and an officer reviewed the selected survey sites (see section of the report entitled "Survey Sampling Procedures" where survey locations are discussed) for the five survey periods (one Friday daytime, and two each on Friday and Saturday nights). Multiple sites were identified in order to have alternatives in case unexpected events were discovered when the survey team arrived on location (e.g., cars parked in the lot, lack of lighting, lack of traffic, etc.). The sites were chosen for safety of the public, the police, and the interviewers. Although the possible square grid area had been randomly selected, the final selections required an adequate off-road area to conduct the interviews, easy access from the roadway, good lighting, and appropriate traffic volume.

Prior to the team's arrival, survey managers also checked on the status of the rental vans for transporting the survey team and serving as the blood draw and equipment van, and confirmed hotel reservations for incoming staff. At the hotel, survey managers sorted through the incoming equipment and supply boxes to determine if anything was missing and/or needed to be purchased or reshipped from PIRE headquarters. The survey managers also purchased any additional supplies (refreshments for interviewers, ice, etc.) in preparation for the data collection activities.

Interviewers arrived Thursday evening or Friday morning in time to meet with officers before conducting the scheduled daytime surveys. Because blood collection was not conducted during the daytime survey, the phlebotomist usually arrived on Friday afternoon, in time for the Friday night data collection.

The daytime survey took place on Friday between 9:30 a.m. and 11:30 a.m. or between 1:30 p.m. and 3:30 p.m. The morning or afternoon data collection period was randomly selected for each site. The team, along with the police officers, arrived at the daytime survey site 1 hour prior to the start of the survey in order to set up the site and have time to handle any issues or concerns that may have arisen. After the daytime survey, interviewers returned to the hotel to rest, and survey managers uploaded data (if there was enough time) and prepared equipment for the nighttime surveys. Survey managers organized dinner meetings on Friday evenings for the entire team as a time to debrief from the daytime survey session and go over the evening's upcoming activities. This time was also used to motivate the teams and discuss any site-specific challenges or changes to the protocol. Survey managers answered any questions or concerns interviewers may have had.

After dinner, the survey teams traveled together in the two rental vans to arrive at the first nighttime site at least 1 hour before the survey began. Friday and Saturday night surveys were

conducted between 10 p.m. and midnight, after which the team packed all supplies and relocated to the next site for the 1 a.m. to 3 a.m. survey.

General Survey Procedures

Data Collection Site Set-Up

When the team arrived at a survey site, set-up was facilitated by the sketches previously prepared by the survey manager (see Survey Sampling Procedures section above). Upon arrival at the selected off-road parking lot, the survey manager met with officers from the local participating agency for final logistical positioning for traffic flow and research bays. In locations where lighting was insufficient, lantern lights were used. In some cases, police officers brought a command vehicle to light the exterior survey area, but they were located sufficiently away from the roadside survey site so as not to draw attention until drivers were immediately at the site.

Interviewers set up the area with bays marked off by the orange traffic cones. They then unpacked their bay bags of supplies. Most interviewers arrived at sites already in uniform (khakis, t-shirt, white lab coat, safety vest, reflective "Research Team" hat); if not, they donned their uniforms when they set up their bays. At this time, for the nighttime data collection, the phlebotomist set up the blood draw station in the phlebotomy van, ensuring that he/she had a well-lit work area that was out of the way of traffic, and that all materials necessary for safe and sanitary blood draws were within reach. Each site was different, which necessitated individual assessment and flexibility on the part of the phlebotomist.

During the set-up phase, the survey manager handed out any necessary back-up equipment and supplies to the interviewers (i.e., PDAs, PBTs, PASs, breath tubes, money for incentives, etc.) and addressed any last-minute concerns. The survey manager also huddled with the data collectors to ensure a correct PDA setting by all team members (e.g., to verify all data collectors entered the correct PSU number, time of day, interviewer's ID, etc.). The survey manager also briefed the police officers about everyone's role, the logistics of the survey, reviewed protocols and answered questions. A large banner sign was set up across one of the rental vans saying NATIONAL ROADSIDE SURVEY and a uniformed police officer positioned a sign that said VOLUNTARY SURVEY at the side of the road, approximately 200 feet ahead of the survey location.

Another officer positioned a police vehicle at the side of the road with its overhead lights flashing so that approaching traffic could see it, and with the vehicle's headlights illuminating the officer. Although local law enforcement was always present during data collection activities, some jurisdictions did not turn on flashing lights or direct traffic into the site. In those cases, interviewers with traffic wands were assigned to motion traffic off the roadway and into the site.

Driver Selection

Once a survey was completed and the driver left the site, a researcher indicated the availability of a surveying spot to the officer stationed at the roadway. When necessary, a portable two-way radio was used to communicate between the survey manager (and/or traffic director) and the officer. When given the go-ahead, the officer waited for the first vehicle to arrive at the site and signaled the driver to enter the survey area. The officer's duty was to direct drivers from the traffic flow and safely into the site. To ensure unbiased selection of the first vehicle at each site

after the survey manager confirmed that the team was ready, the third vehicle after initiation of the survey that could be safely waved in was waved in by the officer for the first interview. This procedure is typically used in roadside surveys and results in a random selection of eligible vehicles that is not biased toward any particular class of driver or vehicle. Police officers were provided with handheld counters to record all vehicles passing the site during an interview period so that driver selection probabilities could be estimated.

To ensure that a random sample of motorists was selected for the survey, we brought the next available vehicle into the survey site when an interviewer was ready for a subject. In practice, a few of the selected motorists were missed because they turned away from the site, the officer was unable to signal them in time, or the officer allowed the individual, after speaking with him/her, to proceed without entering the site, which sometimes happened if the driver indicated that he/she was in a hurry (e.g., some drivers were en route to a hospital or to a job and needed to proceed immediately, a situation that occurred more frequently during the daytime surveys than at nighttime). Once the officer directed the driver into the survey site, the officer had no further contact with the driver. Interviewers took over from there, directing vehicles into interview bays.

Field Data Recording and Basic Survey Sequence

Each interviewer recorded initial observational data, responses to the questions (replicating the previous national roadside survey), AUD screener questions, documentation of other survey components (oral fluid COC number, PBT test number, etc.), and results from the PAS on a Personal Digital Assistant (PDA). Results of the breath test on the Portable Breath Test (PBT) device were not displayed but rather were stored within the device and downloaded to a computer and merged with other data about the subject at a later date. Thus, no one at the survey site knew the BAC reading of a driver at the time, unless the impaired driver protocol was implemented, because the samples were anonymous and confidential.[9] For drivers who spoke only Spanish, the survey was administered in that language.

The following sections introduce the basic roadside survey elements. A detailed description of each component is then provided. The overall field data collection process consisted of the following major components:

- Observational demographic measures
- Initial PAS reading
- Verbal informed consent
- Survey interview
- Second PAS reading (during the interview)
- Breath sample collection
- Oral fluid sample collection ($10 incentive)
- AUD screener
- Drug questionnaire – self-reported on paper by subject

[9] If the Impaired Driver Protocol was implemented, the survey manager would then elicit a breath sample on a PBT device to determine an immediate BAC reading to monitor the level of impairment and ensure the driver's safety.

- Criminal Justice Questions – self-reported on paper by subject
- DUD – self-reported on paper by subject
- AUD – self-reported on paper by subject ($5 incentive)
- Blood sample collection ($50 incentive)
- Driver information card (blue card)

Besides these major sources of individual drivers' information, we also collected data about "refusers" and our attempts to convert them by offering a larger incentive, and about drivers who triggered the impaired driver safety protocol. In addition, we administered a brief questionnaire to right front seat passengers. We also recorded overall information about the data collection site (e.g., weather and traffic reports as well as unexpected incidents). These items are discussed in more detail below.

Observational Demographic Measures

As the motorist came to a safe stop in the bay, the interviewer recorded basic demographics based on observation. Measures recorded during the initial observational assessment included:

- Driver's age (within specified ranges)
- Driver's ethnicity
- Driver's race
- Signs of driver impairment
- Vehicle type
- Driver's gender
- Seat belt use of driver
- Number of passengers
- Seat belt use of front passenger
- Passengers younger than age 15 present

All observations were captured as soon as possible for every participant who entered the bay. If the driver refused (at anytime before providing the oral fluid sample) to participate, these observations were recorded in the PDA as the driver left the bay. However, for most drivers, if the information was not captured immediately, these observations could be recorded in the PDA while the participant provided the oral fluid sample and filled out the drug questionnaire. Providing the oral fluid sample and filling out the drug questionnaire usually took participants several minutes to complete, thus allowing the interviewer time to record the observations into the PDA.

Initial Passive Alcohol Sensor (PAS) Reading

While the interviewer conducted the verbal informed consent process (see below) for the interview, a PAS reading was taken on all subjects, prior to their consent or refusal of the survey. Because this measure was taken passively prior to informed consent, it was deemed to be

acceptable under human subjects guidelines (analogous to observing or smelling). This provided the researchers with an indication of alcohol level for all drivers and helped identify the potential need for intervention even among those drivers who did not participate in the data collection.

If an interviewer believed a driver to be impaired, or the driver received a high PAS reading at this time, the interviewer signaled the survey manager who then administered a breath test with a PBT that displayed the result. If the driver had a BAC of .05 or higher, the survey manager arranged an alternate ride home for the driver, so that the driver was not released onto the roadway (see Impaired Driver Protocol, Appendix E). Alternate transportation included:

- Having another licensed occupant of that vehicle drive (if he/she passed a BAC test);
- Calling a friend or relative of the driver to the site to pick up the driver;
- Calling for a ride such as a taxi (at no cost to the subject);
- Arranging for a hotel room for out-of-town drivers (at no cost to the subject); and
- Having a member of the PIRE research team drive the subject's vehicle to his/her home, while another research team member followed in another vehicle to drive the first team member back to the site afterwards.

If the driver refused all of these options, the police officer was called over to suggest the subject accept the offer. Of the thousands of subjects we have surveyed over the years, no one has yet driven away following these intervention steps. During this study, we found that the need for the research team to provide transportation was fairly infrequent (about 2% of all drivers interviewed). Most of these protocols were implemented at nighttime (2.4% of all nighttime-interviewed drivers, .3% of all daytime-interviewed drivers). Each incident concluded with another licensed occupant of the vehicle driving the vehicle home, a friend of the driver coming to the site to pick up the subject, a taxi ride home, the subject leaving the parked vehicle and walking home,[10] or a ride home from a research team member. Throughout the time a subject was engaged with a research team, interviewers continually assessed the driver's impairment level and called over a survey manager if a driver showed signs of risk.

Verbal Informed Consent

After recording observational data, the interviewer approached the vehicle and initiated contact with the driver using a basic protocol. In accordance with human subjects protection procedures, all subjects were informed of the nature of the research, that participation was voluntary and anonymous, and that they could end the interview at any time. If subjects declined the interview, they were asked to provide only a breath test. The verbal consent script for the survey is shown in Table 14.

[10] This rarely occurred and only if the Impaired Driver Protocol was implemented.

Table 14. Driver Survey and Alcohol Breath Test Consent Statement

You have not committed any violation. You have been randomly selected to participate in a voluntary and anonymous driver survey. The survey takes just a few minutes. We'd like to ask you some questions and take a sample of your breath. You may skip any question or leave at any time. If eligible, you can earn up to $65 ($15 for daytime surveys) for completing some ADDITIONAL parts of the study. (May I begin?)

If a subject appeared to be younger than 25 years old, the interviewer asked: *Are you at least 16 years of age?* If the answer was *yes*, the survey continued. If the answer was *no*, the interviewer said, *Thanks, but you must be 16 to participate* and the interview was terminated. The traffic controller then directed the vehicle out of the research bay and back into the stream of traffic.

The interviewer asked all drivers, *Did you hear about this survey before you were waved in?* Any subjects who had heard about the survey (e.g., through friends or relatives who had previously participated and called on cell phones) and thus came to the survey location to volunteer, were told they were ineligible to participate in this study.

Refusal Conversion Protocol

In the pilot study, we experienced a somewhat lower response rate than that obtained in the 1986 and 1996 NRS studies. Thus it was important to attempt to convert some persons who initially refused so that we could compare their data with the data of those who initially complied and with the demographics of others who refused altogether to see if we could identify any systematic bias in the refusal group. To that end, we attempted to convert two initial refusers at each of the five data collection sessions per location by offering an additional incentive of $100.

At the beginning of each session, the interviewers notified the survey manager when a driver refused to participate in the survey. Our protocol was that we did not try to convert the first driver to refuse in each session. On the second refusal of the session, the interviewer called out *Refusal.* While the interviewer handed the yellow consent form to the driver that explains the survey or attempted to obtain a breath sample, the survey manager came over to the bay. The survey manager attempted to convert the driver, saying: *It's really important for us to interview as many drivers as we can, so I'd like to offer you an additional $100 money order if you would be willing to participate in our survey*.

If the participant accepted, the survey manager stated *Thank you. We will be asking you the survey questions and are asking you to provide a breath and saliva sample. In addition to the $100 I just mentioned, you will be given $10 cash for the saliva sample. There will also be opportunities for you to earn an additional $55 after that.* The interviewer then proceeded with the regular protocol, including all consent statements, the oral fluid sample, the drug questionnaire, the AUD screen, and the blood sample consent. Once the survey was completed, the survey manager returned and provided the participant with two $50 money orders and thanked the driver for his/her time.

If the subject refused the offer, the survey manager thanked him/her and the interview was terminated. The traffic controller then directed the vehicle out of the research bay and safely back into the stream of traffic.

The interviewers continued to notify the survey manager of refusals until two participants were successfully converted at each data collection, at which time interviewers were told that they no longer need to notify the survey manager when they had a refusal, and normal protocol for refusals was implemented. The goal of two conversions per session was not always reached.

Non-English-Speaking Participants

Each survey team included at least one Spanish-speaking interviewer. In some heavily Spanish-speaking sites, such as Miami, Florida; Tucson, Arizona; and Albuquerque, New Mexico, the team composition consisted of more Spanish-speaking interviewers to accommodate the potential for conducting multiple surveys in Spanish. Additionally, all of the survey components, drug questionnaires, protocols, consent forms, and the passenger survey were translated into Spanish and were available for subjects at all locations.

If, during the initial consent process or at any time during the start of the survey, an interviewer noticed that the participant did not understand English, the interviewer asked the participant if he/she spoke Spanish. If the participant did not comprehend English or Spanish very well, the interview was terminated and the interviewer noted on the PDA that the participant was ineligible due to a language barrier.

However, if the participant spoke Spanish and the interviewer also spoke Spanish, the survey continued in Spanish. The interviewer proceeded to conduct the survey with a paper-and-pen format and all consents were conducted in Spanish. When the interviewer did not speak Spanish, he/she either called over a survey manager (who spoke Spanish), in which case the survey manager continued the survey using the paper-and-pen format and the interviewer became the "eyes and ears" of the survey site, or, when both the interviewer and survey manager did not speak Spanish, a Spanish-speaking interviewer switched interview bays and continued the interview. However, all equipment stayed in the same interview bay. When the survey was completed, the interviewers returned to their original bays.

Survey Interview and Second PAS Reading

Once the subject gave verbal consent for the survey interview and breath test, the interviewer asked the subject the interview questions covering topics such as annual mileage, the origin and destination of the current trip, drinking, drinking and driving, demographics, and whether he/she was acting as a designated driver. Again, if a subject objected to answering survey items and wished to end the survey, the subject was asked to provide a breath sample before the vehicle was directed out of the survey bay.

Note that at item number 4 in the survey, interviewers were prompted on the PDA to obtain a second PAS reading, and after item number 13, interviewers were prompted to record the number of colored bars indicated into the handheld PDA.

Breath Sample Collection Procedure

After the brief interview was complete, the interviewer requested a breath sample from the subject. The interviewer obtained breath samples using a portable breath alcohol test device (Intoxilyzer SD-400; for more detail, see Appendix D).

To request a breath test, the interviewer said: *Now I'd like to get an anonymous sample of your breath. Our device does not display any readings and there is no risk to you.* (Show respondent PBT.) *This will take just a few seconds.* The interviewer then held the PBT while reaching into the vehicle window towards the subject, and instructed the subject to pull the sanitary plastic wrapping off of the white plastic tube so that the interviewer's hands did not touch the breath tube where the subject placed his/her lips. The interviewer then instructed the subject to *take a deep breath and blow long and steady into the tube.* As the subject blew into the breath tube, the interviewer encouraged the subject to continue blowing a steady stream of air by saying: *Keep blowing, keep blowing, keep blowing.*

The PBT emitted a double beep to signal that it had taken in a sufficient amount and quality of air for BAC determination; at this time, the interviewer concluded the breath test and disposed of the breath tube.

If the driver did not (i.e., some subjects held their breath or sucked in air to avoid a breath sample) or could not (e.g., some elderly subjects or asthmatics) blow sufficient air into the PBT, a manual override was used which required less air from the subject to obtain a breath sample.

All PBT results were stored electronically in the devices themselves (rather than displaying the result) to be downloaded the following day so that subjects and interviewers did not know the reading. However, if a driver appeared impaired, the data collector signaled the survey manager who administered a breath test with a PBT that displayed the result. If the driver had a BAC of .05 or above, PIRE staff arranged a ride home for the driver from another occupant of the vehicle if that person passed a BAC test, from a friend or relative of the driver, by taxi, or by PIRE staff (see Impaired Driver Protocol, Appendix E).

As mentioned above, breath samples were requested from all drivers who agreed to the survey after they completed the brief interview. Even if a participant refused to participate in the interview itself, a breath sample was still requested. Data collectors were trained to ask for the sample if they could not convert the driver: *Thank you for your time. Before you leave, would you mind giving us at least a breath sample?*

Oral Fluid Sample Collection Procedure and AUD Screener

Upon completion of the verbal survey and breath sample collection, the PDA prompted the interviewer to obtain consent for an oral fluid specimen collection and offer a $10 incentive for the oral fluid sample. The oral fluid sample consent is shown in Table 15.

Table 15. Oral Fluid Consent Statement

For $10 cash, we are now asking you to VOLUNTARILY PARTICIPATE in two anonymous research activities about prescription and non-prescription drug use. This will take a few minutes. It involves collecting a sample of your saliva for later analysis in a lab AND filling out a questionnaire about your use of substances. As before, you may stop participating at any time.

Prior to giving the subject the oral fluid collection device; however, the interviewer asked the subject a screener question to determine if he/she were eligible for the AUD survey. The screener item was: *In the past year, how often did you have a drink containing alcohol?* If a driver's response was a frequency of greater than zero (i.e., he/she had consumed alcohol in the past year), the interviewer then asked if he/she was willing to answer a questionnaire about alcohol use and offered him/her an additional $5 incentive. If the subject responded "*never*" or refused to answer the question, then he/she was not eligible for the AUD assessment and proceeded directly to completing the oral fluid sample collection and self-report drug questionnaires. Because alcohol disorder diagnoses are sensitive to drinking behavior in the past year, only drivers who had consumed alcohol in the past year were eligible for this portion of the study.

For subjects who were eligible for the AUD assessment, the interviewer then read the AUD consent statement to the subject (shown in Table 16).

Table 16. AUD Screener Consent Statement

OK, for $5 more, we are now asking you to VOLUNTARILY answer a few questions about your use of alcohol in the past year. Your answers to these questions CAN IN NO WAY BE ASSOCIATED WITH YOU and there is no risk to you by participating in this anonymous study. As before, you may stop participating at any time.

The interviewer then held out the Quantisal™ oral fluid collection device (see Appendix G) and instructed the subject to place it under the tongue so that it could collect saliva. The Quantisal™ device's color change pad turned blue to indicate when a sufficient fluid volume had been collected. At that time, the subject placed the swab in a vial provided by the interviewer, which the interviewer then capped tightly so that no fluid would be lost in storage or transit.

The oral fluid samples were labeled with pre-printed Chain of Custody (CoC) labels that contained a unique identifier that corresponded to that sample. This number was also entered into the PDA. CoC numbers were preprinted by the laboratory and were used to maintain a documented link between each sample collected and the respondent who provided it. To minimize possible data-matching problems if a CoC number was entered incorrectly, we arranged for Immunalysis Corporation to provide additional labels on the CoC forms that contained the CoC number we affixed to the oral fluid samples. In addition to entering the CoC number into the PDA, we affixed one label to the oral fluid sample and another label to a driver information card that contained unique information for each participant.

The interviewers stored the vials of oral fluid samples in zip lock bags in their bay bags. The survey manager or the phlebotomist (if not busy drawing blood samples) frequently walked

through the interviews bay and collected the vials, put them in a different zip lock bag, and stored them in a central cooler with blue ice.

The Booklet: Drug Questionnaire, Criminal Justice Questions, Drug Use Disorder (DUD) Questionnaire, and Alcohol Use Disorder (AUD) Questionnaire

The drug questionnaire, criminal justice questions, the DUD questionnaire, and the AUD questionnaire (see Appendix H) were printed in a four-page booklet, which could be handed to the subject with a pencil and completed while the oral fluid swab was in his/her mouth. This streamlined the interview and minimized any additional time burden to subjects.

The initial AUD question served as a screener to determine if the AUD questions would be asked. Persons who had not had a drink in the past year were not eligible for the AUD assessment. In this case, the interviewer crossed out the AUD side of the booklet before handing the subject the booklet and pencil.

The drug questionnaire was a brief paper-and-pencil drug instrument regarding over-the-counter, prescription, and illegal drug use. Subjects who reported using marijuana, cocaine, or pain killers in the past year also completed the DUD questionnaire. Subjects were assured that their answers were completely anonymous and confidential.

Once the subject had completed the oral sample, the drug questionnaire, and the DUD and AUD questionnaires (if applicable), the interviewer dispersed the $10 incentive for the oral fluid sample and the $5 incentive for AUD survey participation to the subject.

Passenger Survey

Because it was our experience in the pilot study that drivers with passengers in the vehicle were less likely to complete the entire protocol, for the full-scale 2007 study we engaged passengers as a means to retain eligible drivers in the NRS data collection activities. We provided small incentives (e.g., candy, lollipops, etc.), coloring pages and crayons for children, and dog biscuits to drivers with a dog in the vehicle. We also offered a passenger survey (see Appendix I) for passengers in the front seat who were older than 16, with an incentive of $5. The interviewer read the passenger survey consent statement to the passenger (shown in Table 17).

Table 17. Passenger Survey Consent Statement

We'd also like to gather some information from you as well. Please read the first paragraph and indicate whether you would like to complete the survey. If you choose to do so, I can offer you $5 cash.

This procedure was successful in retaining those drivers throughout the brief interview portion of the study. Questions on the passenger survey included date of birth, sex, race, driving habits, relationship to the driver, and drinking habits.

Blood Sample Procedure

After completion of the oral fluid sample, the drug questionnaire, and the DUD and AUD surveys (if applicable), the interviewer requested that the subject provide a blood sample in exchange for an additional $50 incentive. The incentives were given in the form of money orders

so that the subjects would not be able to spend the money immediately. At this time, interviewers were prompted by the PDA to read the consent statement for blood sample collection (Table 18).

Table 18. Blood Consent Statement

We would like to offer you a $50 money order to provide a quick blood sample. The purpose is to measure some blood components that may reflect alcohol or drug use. This is completely voluntary and anonymous. We have a licensed phlebotomist available who is very skilled and it should take about 5 or 10 minutes. Would you be willing to participate in this part of the study?

In most States, subjects had to be at least 18 years of age to give a blood sample. The exceptions were in Alabama and Nebraska, where subjects had to be at least 19 years of age, and in Indiana and Pennsylvania, where they had to be at least 21 years of age.

If the subject agreed to give a blood sample, he/she was instructed to move his/her vehicle forward into a designated parking area, which cleared the interview bay and permitted the next vehicle to be randomly selected from the roadway. Once the vehicle was safely parked, the subject exited the vehicle and walked to the phlebotomy van.

Licensed phlebotomists conducted the blood draws. The phlebotomist set up the blood draw station in the middle seat of a rental van. The subject sat in the middle seat of the van and the phlebotomist sat in the adjoining seat or stood just outside the van with supplies. During blood draws, one gray-top tube of the subject's blood was drawn (10 ml, about 2 teaspoons). The gray-top tube is a glass test-tube type container that contains a preservative of potassium oxalate/sodium fluoride that reduces the need for refrigeration, but does not affect the ability to detect and quantify drugs.

Phlebotomists were well trained and used standard medical practices to draw the blood safely. Phlebotomists screened subjects for age, use of blood thinners (i.e., Coumadin), and blood disorders, such as hemophilia.

The phlebotomists were not able to draw a full tube for all subjects because some individuals had small and/or difficult-to-locate veins, even when using small gauge butterfly needles on the back of the hand. In those cases, the laboratory was able to conduct an initial screening test, but was not able to conduct a confirmatory analysis by gas chromatography-mass spectrometry, due to the insufficient volume.

At the conclusion of the blood draw procedure, the subject received the $50 incentive and sat for a moment in the blood draw station. The subject was offered a piece of candy before being directed safely out of the survey site and back onto the roadway. Venipuncture is not entirely without risk and occasionally subjects felt dizzy or faint. In these instances, the subject sat in the phlebotomy van until dizziness or faintness passed.

The blood sample tubes were labeled with pre-printed CoC labels that linked the blood sample to the oral fluid sample to the blue card. The CoC labels contained a unique identifier that corresponded to that sample. This number was also entered into the PDA. CoC numbers were preprinted by the laboratory and were used to maintain a documented link between each sample collected and the respondent who provided it.

Once collected, the blood samples were placed in a cooler with blue ice packs for the remainder of that night's survey(s). Upon return to the hotel, blood samples were stored in refrigerators, or, if no refrigeration was available, in coolers with blue ice packs. The samples were subsequently shipped to the laboratory with blue ice as an additional precaution.

Spanish-speaking participants were escorted to the phlebotomist by the Spanish-speaking interviewer, and the Spanish consent form was given to the participant. The interviewer read the consent form to the participant and also stayed with him/her to answer any questions and provide translation between the phlebotomist and participant.

Driver Information Card (Blue Card)

The interviewer completed a driver information card for each subject who drove into a bay. Driver information cards were made of heavy 8.5" x 11" blue cardstock. One driver information card (also called the blue card) was assigned to each subject. The card tracked which components of the NRS the subject participated in and detailed key information necessary to link all the different data provided by a subject.

Each driver information card contained the driver's unique ID number which consisted of the assigned Interviewer ID, Primary Sampling Unit number (each of the 60 PSU locations were given a number), survey site number (each of the survey times were given a number between 1 and 5), and the case number for each driver entering the individual bay.

The driver information card also contained a checklist that specified what data components of the survey were collected and an area to affix the oral fluid sample CoC label and blood sample CoC label. Additionally, the PDA, PAS, and PBT device numbers were recorded on the card, and whether a Spanish paper form was used. Thus, the driver information card ensured that all data components of one subject were properly assigned and stored together. A sample of a driver information card is included in Appendix J.

Post-Survey Activities

When the last driver passed through the data collection bay and exited the site, the survey manager notified interviewers that it was time to break down the site. Each interviewer was responsible for packing up his/her bay, including all materials used in the data collection process, and disposing of all trash. The interviewer packed all supplies back into the carry-on bag, which was then put into the back of the van, along with other supplies.

Survey managers collected all driver information cards from every interviewer after each survey session and put them in individual folders. After the last Friday and Saturday night sessions, the survey manager collected all PDAs and PBTs from the interviewers and stored them in a separate container for later uploading.

Survey Manager Report Form

Survey managers were responsible for filling out a Report Form (Appendix J) for each site at the conclusion of the event. The form detailed information about the site, including date, time, address, survey manager and interviewer names/IDs, phlebotomist, officers, and weather. It also included a sketch of the site layout. The survey manager also wrote details of all attempts to convert refusers, and all instances when the impaired driver protocol was implemented.

Summary of Survey Events

In summary, the roadside survey process included:

- A law enforcement officer directed the randomly selected driver into the research site. Generally, one or two uniformed police officers were on hand to assist with traffic.
- A traffic director directed the vehicle into a specific research bay (usually five bays operated at each site), marked out by orange traffic cones.
- ***Observational data:*** The interviewer noted easily observable information about the driver and vehicle and recorded those data (e.g., type of vehicle, number of passengers, seat belt usage, gender of driver, and likely age of driver) into an electronic PDA.
- ***First PAS reading:*** The interviewer obtained an initial PAS reading for the driver and recorded the result into the PDA.
- ***Consent for interview:*** The interviewer briefly explained the purpose of the interview and that it was both voluntary and anonymous. The interviewer obtained verbal consent for continuing, or the driver refused. If the driver refused, he/she was counted as a refusal and the interviewer asked for a breath sample. Additionally, at each site, for a sample of those who refused, the survey manager was called over to offer an additional incentive of $100 to participate in the study.
- ***Interview questions:*** The interviewer asked the driver a few questions regarding the subject's general drinking behavior, driving patterns, and driving on that particular night (or day), and entered the information into the PDA.
- ***Second PAS reading:*** The interviewer obtained a second PAS reading for the driver and recorded the result into the PDA.
- ***Breath test:*** The interviewer requested a breath test from the driver.
- ***Oral fluid test:*** The interviewer requested an oral fluid sample from the driver. The subject kept the oral fluid testing swab in his/her mouth for 3 to 5 minutes, until the indicator changed colors signaling a sufficient quantity of saliva.
- ***Drug questions:*** The subject completed a self-administered paper-and-pencil questionnaire about drugs they may have used.
- ***Criminal justice questions:*** The subject completed a self-administered paper-and-pencil questionnaire about interaction with the criminal justice system.
- ***AUD questions:*** The subject completed a self-administered paper-and-pencil alcohol use questionnaire while the oral fluid swab was in the mouth.
- ***DUD questions:*** The subject completed a self-administered paper-and-pencil drug questionnaire while the oral fluid swab was in the mouth.
- ***Passenger survey:*** If a front-row passenger was present, he/she was offered a passenger survey for a $5 incentive.

- The subject was then paid for completing the field survey ($5 AUD, $10 oral fluid sample).
- ***Blood sample:*** The interviewer requested a blood sample. If the driver consented, he/she walked to a nearby blood draw station in the phlebotomy van, where the blood sample was drawn by a certified phlebotomist and according to OSHA standards. The subject then received a $50 money order and was escorted back to his/her vehicle and directed back into the flow of traffic.
- ***Driver information card:*** The interviewer completed this card to facilitate tracking data.

Length of Individual Surveys

A major difference between previous roadside surveys and the 2007 survey was the time it took to complete a full interview. Prior roadside surveys took approximately 5 minutes to complete a breath test and a brief interview with each participant; the 2007 survey, however, included additional data collection procedures (oral fluid and blood samples, two drug questionnaires, and an AUD screen) which resulted in the lengthening of the interview by 5 to 20 minutes or longer if there was a waiting line at the phlebotomy van.

The entire procedure (survey, BAC, oral fluid sample, drug questionnaires, AUD, and blood sample) took approximately 30 minutes (see Table 19). The survey and BAC test alone averaged approximately 5-7 minutes. The survey with BAC and oral fluid test averaged approximately 10-12 minutes; adding the blood test increased the data collection time to up to 30 minutes. The fact that the additional components of the survey required additional time is one reason that incentives were offered for providing an oral fluid sample ($10), responding to the AUD questions ($5) and providing a blood sample ($50).

Table 19. Time Required per Subject for Roadside Data Collection

Test	Combined Time
Survey and BAC	5-7 minutes
Survey, BAC, and Oral Fluid Sample	10-12 minutes
Survey, BAC, Oral Fluid Sample, and Blood Sample	30 minutes

Optimizing Response Rates

Several strategies were used to optimize participant response rates. The first strategy included thorough training and practice for all field personnel on survey protocols prior to the initiation of the survey. Although some subjects will always refuse to answer certain questions, evidence suggests that able and experienced interviewers can minimize refusal rates (Groves, Cialdini, & Couper, 1992) As Hox, de Leeuw, & Snijkers (1998) pointed out, "during the initial moments of contact, the data collector is the initiator and dominant actor in this interaction, and much depends on the data collector's ability to persuade the potential respondent" (page 173). The evidence suggests that there is noticeable variation in response rates attributable to interviewers (e.g., Lyberg & Lyberg, 1991; Lyberg & Dean, 1992; Singer, Frankel, & Glassman, 1983), and that better trained, more experienced interviewers tend to obtain better response rates (Couper &

Groves, 1992). As specified in the training section of this report, all interviewers were extensively trained in recruiting and retaining subjects. During training, we emphasized collecting a breath sample from all subjects, even if they did not participate in other portions of the survey program. Booster or refresher trainings were conducted early in the process, as necessary.

In addition to extensive training, we also conduct weekly evaluations of survey teams and individual interviewers and examined response rates, by site, night, and interviewer. This procedure allowed us to examine the performance of individual interviewers and identify any need for further training. We quickly identified which interviewers to replace or remove from the survey team based on their ability to recruit and retain subjects. Doing this on a weekly basis provided essential feedback in real-time needed to ensure the overall response rate throughout the data collection was adequate.

Interviewer-related strategies to optimize response rates included:

- Thorough screening for and selection of outgoing and confident interviewers.
- Clear communication regarding the job's requirement and the interviewer's responsibility. Individuals who showed little enthusiasm for the work were replaced.
- Increasing the interviewer pool and hiring replacement interviewers over time to minimize turnover impact. Having more interviewers allowed us to rotate them more often (reducing the likelihood of interviewers becoming tired or burned out), and/or to be ready for replacements, if needed.
- Devoting appropriate time and efforts to training interviewers with emphasis on recruitment and retention.
- Using mock training sessions in the field and simulation trainings at a designated site (e.g., in a parking lot), in addition to the initial "in-class" training. The simulations mirrored the actual roadside survey experience.
- Providing booster training after the first few weeks of survey activity to collectively review protocols and procedures and to address interviewer concerns, etc.
- Increasing the number of interviewers on each team. Having a larger team of interviewers allowed interviewers to take breaks. This reduced the exhaustion interviewers showed near the end of the second survey night. Reducing this exhaustion improved the chances that interviewers kept their refusal rates low through the end of the survey.
- Offering incentives or bonuses for interviewers with the greatest response rates and attendance.
- Weekly monitoring of interviewers' performance, including analysis of response rates after each weekend's data collection activities to assess each team as a whole and each member of each team's performance.
- Review of procedures by survey managers prior to going into the field every week.

- Debriefing after each survey weekend – both at the data collection location and headquarters.
- Enhancing peer communication among interviewers by asking our most successful interviewers to participate actively in the training sessions.

In addition to interviewer characteristics, several driver characteristics were examined after the pilot study, which formed the basis for further strategies to optimize response rates. For example, participation in the pilot study declined from one component of the survey to another for vehicles with passengers, suggesting that drivers who drive alone are more likely to complete the survey. To overcome this obstacle in the full-scale 2007 study, we engaged passengers as a means to retain the participation of eligible drivers. We provided small incentives (e.g., candy, lollipops, etc.), coloring pages and crayons for children, and a Passenger Survey for passengers in the front seat (see Appendix I). We also provided dog biscuits to drivers with a dog in the vehicle. These procedures were successful in retaining many drivers throughout the survey.

Impaired Driver Protocol

As indicated above, while the interviewer conducted the informed consent process for the interview, a PAS reading was taken on all subjects prior to their consent or refusal to participate in the survey. This reading, along with initial observations of the driver's intoxication level, provided the researchers with an indication of alcohol level for all drivers and helped to identify the potential need for intervention measures. Additionally, throughout the time the subject was engaged with the research team, the interviewer continually assessed the driver's impairment level and called over the survey manager if a driver showed signs of risk.

If a driver appeared impaired or received a high PAS reading, the interviewer signaled the survey manager who then administered a breath test with a PBT that displayed the result. As noted earlier, if the driver's BAC was .05 or higher, we attempted to arrange a ride home for the driver, so that the driver would not be released onto the roadway. When the survey manager was called over, he/she explained his/her concern to the driver. The survey manager also explained that the second PBT device did provide results, so that if the subject blew .05 or higher, alternative arrangements would be made to get the driver home safely.

The Impaired Driver Protocol procedures for handling such incidents are described in detail in a well-developed and tested protocol for dealing with such situations in Appendix E. Alternate transportation included:

- Having another licensed occupant of that vehicle drive (if he/she passed a BAC test);
- Calling a friend or relative of the driver to the site to pick up the driver;
- Calling a local taxicab company for a ride (at no cost to the subject);
- Arranging for a hotel room for out-of-town drivers (at no cost to the subject); and
- Having a member of the PIRE research team drive the subject's vehicle to his/her home, while another research team member followed in the rental van to drive the first team member back to the site afterwards.

If the driver refused all of these options, the police officer was called over to suggest that the subject accept the offer.

Additionally, interviewers handed out prevention information brochures (Appendix R) to all subjects who were younger than 21 years old and to all pregnant women. This was an attempt to intervene with impaired drivers (persons with BACs higher than .05) and others at special risk (e.g., underage drinkers and possibly pregnant drinkers).

Biological Sample Analysis

Selection of Drugs for Screening and Analysis

Oral fluid and blood samples were screened and confirmed for the following drug categories and at the noted concentration (Table 20). We screened using enzyme-linked immunosorbent assay (ELISA) micro-plate technology. Of all tests, 14.08% required confirmation for drugs and 4.6% for alcohol. Confirmation was performed using gas chromatography-mass spectrometry (GC/MS) or liquid chromatography-mass spectrometry (LC/MS/MS) technology. Our toxicological laboratory, Immunalysis Corp. of Pomona, California provided all necessary confirmations.

Table 20. Proposed Drugs and Minimum Detection Concentrations

Drug Class	Minimum Concentration Oral Fluid (ng/ml)		Minimum Concentration Blood (ng/ml)		Self-Report Item
	Screen	Confirm	Screen	Confirm	
Cocaine *(Cocaine, benzoylecgonine)*	20	8	25	10	Cocaine (e.g., crack or coke)
Opiates *(6-AM, codeine, morphine, hydrocodone, hydromorphone)*	40	10	25	10	Heroin Morphine or Codeine (e.g., Tylenol® with codeine)
Amphetamine/ Methamphetamine *(MDMA, MDA, MDEA, Ephedrine, Psuedoephedrine)*	50 50	50	20 20	10	Amphetamine or Methamphetamine (e.g., speed, crank, crystal meth)
Cannabinoids *(THC, THC-COOH[THCA])*	4	2	10	1	Marijuana (e.g., pot, hash, weed)
Phencyclidine	10	10	10	10	PCP (e.g., angeldust)
Benzodiazepines *(oxazepam, nordiazepam, bromazepam, flurazepam, flunitrazepam, lorazepam, chlordiazepoxide, temazepam, diazepam, clonazepam, alprazolam, triazolam, midazolam, nitrazepam)*	20	10	20	10	Benzodiazepines (e.g., Valium® or tranquilizers)
Barbiturates *(Phenobarbital, pentobarb, secobarbital, butalbital)*	50	50	500	500	Barbiturates (e.g., phenobarbital)
Methadone	50	25	50	10	Methadone
Ethyl alcohol	.02%	.02%	.02%	.02%	Alcohol
Oxycodone (Percocet®)	25	10	25	10	Prescription pain killers (e.g., Percocet®,
Propoxyphene (Darvon®)	10	10	10	10	
Tramadol (Ultram®)	50	25	50	10	

Drug Class	Minimum Concentration Oral Fluid (ng/ml)		Minimum Concentration Blood (ng/ml)		Self-Report Item
	Screen	Confirm	Screen	Confirm	
Carisoprodol (Soma®)	100	50	500	500	OxyContin®, oxycodone, Demerol®, Darvon®)
Meperidine (Demerol®)					
Sertraline (Zoloft®)	50	25	50	10	Anti-depressants (e.g., Prozac®, Zoloft®)
Fluoxetine (Prozac®)	50	25	50	10	
Tricyclic anti-depressants (amitryptiline, nortriptyline)	25	25	25	10	
Zolpidem (Ambien®)	10	10	10	10	Ambien® or other sleep aids
Methylphenidate (Ritalin®)	10	10	10	10	ADHD medications (e.g., Ritalin®, Adderall®, Concerta®)
Dextromethorphan	50	20	50	20	Cough medicines (e.g., Robitussin®, Vicks 44®, etc.)
Ketamine	10	10	10	10	Ketamine/ Special K

Screening utilizes ELISA micro-plate and confirmation utilized GC/MS or LC/MS/MS technology.

The drugs we tested by bioassay and self-report represented a list of over-the-counter, prescriptions, and illegal drugs that have the potential to impair driving performance and that we had some expectation could appear in the driver population.

The first five categories of drugs listed constitute the National Institute on Drug Abuse (NIDA)-5, which are prevalent drugs of abuse and are of universal interest in the study of drug involvement. The NIDA-5 are routine components of a drug-screening panel. The other drugs on the list (with the exception of barbiturates) appear in the NHTSA publication titled "Drugs and Human Performance Fact Sheets" (NHTSA, 2004) and are of interest because an expert panel identified those drugs as presenting potential traffic safety risks. We further refined that list by selecting drugs from it that were most likely to appear in the driving population, including both prescription and over-the-counter drugs.

Cocaine is a drug of abuse that, while also a local anesthetic, is abused because it is a central nervous system (CNS) stimulant. At low doses, cocaine might actually have performance-enhancing effects; however, little is known about its effects on human performance at higher levels and in conjunction with alcohol. It is clearly a drug of abuse in the United States and worthy of study in drivers.

Opiates are narcotic analgesics used both medicinally and as drugs of abuse. After an initial rush, they act as CNS depressants, which certainly could have performance-decreasing effects.

Amphetamines are CNS stimulants and are also used both medicinally and as drugs of abuse. Amphetamines are generally taken recreationally and to enhance performance (e.g., truck drivers to stay awake). Ecstasy falls within this category, and as a methylated amphetamine derivative also has hallucinogenic properties. Amphetamines have been associated with crash occurrence and could logically be associated with driving impairment both in the stimulation and withdrawal

stages, in the latter case especially as the drug interacts with fatigue. The analytical methodology is described in Moore, Coulter, & Crompton (2007).

Cannabinoids have a variety of effects on humans and can be associated with stimulant, sedative, and hallucinogenic effects. Both the experimental and epidemiologic evidence on cannabinoids' effects on driving are mixed. When marijuana is found in drivers, however, it is often in conjunction with alcohol, where an impairing effect is more likely (Couper & Logan, 2004). The most prevalent drug detected in the pilot study was marijuana.

In the 2006 roadside pilot study, there appeared to be a strong positive correlation between the oral fluid and blood tests. The only discrepancies (negative oral fluid and a positive blood) were from 10 cases where the inactive metabolites were detected in blood, but not the active tetrahydrocannabinol (THC). A positive metabolite result (THCA) with a negative parent compound (THC) is consistent with less recent use (e.g., in the days before assessment). Thus, a positive oral fluid for the parent compound is likely to be associated with very recent THC use, the timeframe consistent with potential impairing effects. Such oral fluid results can be very informative. The laboratory procedures have been previously published in Moore et al., 2006; Moore, Rana, & Coulter (2007b).

Phencyclidine (PCP) is related to veterinary tranquilizers such as ketamine, that impair motor ability, but PCP also has hallucinogenic effects and is used as a recreational drug. It has serious performance-diminishing effects and has been found in impaired-driving cases and its determination in oral fluid has recently been published (Coulter, Crompton, & Moore, 2008).

Benzodiazepines include many widely prescribed drugs (e.g., Valium®, Xanax®) to reduce anxiety. These drugs act as CNS depressants, show cross-tolerance to ethanol, and are potentially associated with driver impairment. Different types of benzodiazepines have very short to very long half-lives and many are known to cause impairment in traffic cases when present at high levels. The desired/therapeutic effect, for example, of lorazepam (Ativan®) is sedation, which would obviously have a detrimental effect on driving a motor vehicle. The most common benzodiazepine is diazepam (Valium®) and/or its metabolites: nordiazepam, oxazepam, and temazepam (Couper & Logan, 2004). The confirmation procedure for the 2007 study included LC/MS/MS confirmation using the method described (Moore, Coulter, Crompton, & Zumwalt, 2007).

Barbiturates are still widely prescribed CNS depressants, in some cases as anti-epileptic medications. Because of their depressive effects, barbiturates are associated with delayed reaction times and possible loss of concentration, thus potentially affecting driving performance.

Methadone, a narcotic analgesic, is used both medicinally for opiate detoxification and maintenance, and for pain. It has also been used as a drug of abuse. It may have differential performance effects in naïve or recreational users versus tolerant therapeutic users.

Ethyl alcohol is related to elevated crash risk (Borkenstein, Crowther, Shumante, Ziel & Zylman, 1964; Zador, Krawchulk & Voas, 2000; Peck, Gebers, Voas & Romano, 2008). Ethyl alcohol was also tested through breath tests. It will be informative to learn how test results obtained with oral fluid and blood samples correlate with breath tests as we establish the rate of alcohol-involved driving.

Painkillers are a class of drugs that may lead to driving impairment. Commonly used painkillers include oxycodone (an opioid). Oxycodone has similar effects to morphine and heroin. If used in

combination with other depressants of the CNS, such as alcohol or benzodiazepines, it can cause severe impairment or lead to death. Tramadol, an opiate analgesic, has similar effects to oxycodone. Propoxyphene was included, as well as meperidinr. The methods used for their analysis are described in Rana et al. (2006) and in Moore, Rana et al. (2007a). Other painkillers, such as carisoprodol, a CNS depressant and muscle relaxant (Soma® also called Miltown®), are used as prescription drugs, but can lead to abuse. Even at therapeutic concentrations, carisoprodol and its metabolite meprobamate may cause driving impairment as the desired effect is sedation.

Antidepressants, most commonly in the form of selective serotonin reuptake inhibitors (SSRIs), such as fluoxetine (Prozac®) and sertraline (Zoloft®), can cause impairment, especially in circumstances of high concentrations or if they are taken outside of medical need or therapeutic treatment. There is also an additional risk of impairment associated with combined use with alcohol.

Sleep aids (such as Ambien®) cause drowsiness and may cause dizziness. If consumed with alcohol, there is an increased likelihood of these symptoms. This could have a detrimental effect on driving ability.

Other stimulants, such as methylphenidate (brand name: Ritalin®), are amphetamine-like prescription drugs commonly used to treat Attention Deficit Hyperactivity Disorder (ADHD) in children and adults. They are CNS stimulants. Some people abuse these drugs by crushing the tablets and snorting them, the "high" resulting from the increased rate of dopamine transporter blockade due to quicker absorption into the bloodstream. The effect of this other stimulant abuse is similar to that of cocaine or amphetamine.

Dextromethorphan, a synthetic analog of codeine, is an antitussive widely used in cough medicines (e.g., Robitussin®, Sucrets®, Vicks Formula 44®), and in high doses in recreational use, is a CNS depressant and may have driving impairment effects at those levels. The analytical method has recently been published (Rodrigues et al., 2008).

Ketamine (Special K) is medicinally primarily a veterinary tranquilizer that is used recreationally as a psychedelic and would likely be associated with decrements in skills related to driving.

Laboratory Quality and Proficiency

At Immunalysis Corporation of Pomona, California, all the analytical procedures used to test for the above listed drugs are fully validated according to established protocols. Negative, low- and high-level controls are run in each batch, along with calibration standards.

In the pilot study, the lab was completely blinded as to the pairings of the blood and oral fluid samples. The correlation of the results was excellent, and it was possible to determine saliva:plasma (S:P) ratios for drugs that had never before been reported. For example, in the pilot study, the drug concentration in oral fluid for tramadol (a synthetic opioid) was approximately 10 to 12 times higher than the corresponding blood samples, indicating for the first time the utility of oral fluid as a specimen for the detection of tramadol. Other drug classes were extremely well correlated between specimen types.

Proficiency Testing

As an external monitor of oral fluid analysis quality, accuracy, precision, and timely reporting, Immunalysis Corporation is enrolled in the Proficiency Testing program for oral fluid, administered by Research Triangle Institute (RTI), North Carolina.

Oral Fluid Sample Analysis Procedures

The tubes from each data-collection weekend were packaged and sent together overnight to Immunalysis, Inc. for analysis. Upon receipt of the specimens at the testing facility, screening analysis was carried out using enzyme linked immunosorbent assays (ELISA) at the cut-off concentrations described in Table 20. Screen positive specimens were then reanalyzed, using a separate sample of the fluid, using GC/MS or liquid chromatography with tandem mass spectral detection (LC/MS/MS) according to standard operating procedures. All methods were fully validated according to good laboratory practices, and all standard operating procedures are on file at Immunalysis Corporation (Pomona, California).

Gas Chromatography-Mass Spectrometry (GC/MS)

Instrumentation:

Agilent 6890 gas chromatography - 5973 or 5975 mass selective detector (GC/MSD); electron impact (EI) mode.

Extraction:

Oral fluid (1 ml) of diluted specimen (1:3 buffer) was extracted using mixed mode solid phase methods with drug specific column phases.

Derivatization:

Drug specific derivatives used for maximum detectability and stability.

Drugs included in the confirmation profile are shown in Table 21.

Liquid Chromatography-Tandem Mass Spectrometry (LC/MS-MS)

Instrumentation:

Agilent LC/MS-MS System: 1200 Series LC pump 6410 Triple Quadropole.

Zorbax Eclipse XDB C18 (4.6 x 50mm x 1.8 μm) column.

Extraction:

Blood (1 ml); protein precipitate with cold acetonitrile; mixed mode solid phase extraction using drug specific column phases.

Blood Sample Analysis Procedures

As noted above, screening analysis was carried out using ELISA at the cut-off concentrations described in Table 20. This table also shows the specific drugs that were tested. Screen positive specimens were confirmed using either GC/MS or LC/MS. All methods were fully validated according to good laboratory practices. See above for instrumentation.

Ethanol (Oral Fluid and Blood)

Screen positive alcohol specimens were sent to BioTox Laboratories, Riverside, California, for confirmation which has the specialized equipment necessary for the ethanol confirmation.

Instrumentation:

Perkin-Elmer: Model F-45 Gas Chromatograph

Flame ionization detector (FID)

.2 percent Carbowax 1500 Graphpac-GC, 80/100 column (6 ft. x 1/8 in. ID)

Extraction:

Whole blood or 1:3 buffered oral fluid (.1 ml), add 1 ml double deionized water containing .1 percent propanol

Analyzed using headspace GC/FID

Data Handling and Processing

Handling of Data

As mentioned earlier, interviewers solicited six forms of data from each participant driver during a roadside data collection activity. These six forms of data (interview data, PAS sample, PBT breath sample, AUD/DUD/drug use assessment, and oral fluid and blood samples) were merged into a working file, to create a master file containing all the information collected over the entire duration of the 2007 survey for evaluation and analytical purposes. The complete 2007 survey master file contains information on several variables collected via each of the six data forms outlined above, as well as on the following additional data sources:

1. The "driver information card" or "blue card (BC)" (The BC contains detail on which portions of the survey were completed and, where applicable, details unique identification numbers for linking the different data sources.)
2. Surveys provided for Spanish-speakers
3. The passengers' survey (if available)
4. Identification of refusers' conversions
5. Identification of drivers to whom an impaired safety protocol was implemented
6. Information about the specific weather and traffic conditions of the survey as reported by the survey managers

The master database was constructed in sequential steps by adding individual files corresponding to each wave of data collection. Each individual file was created by merging the several sources of data mentioned above, plus the following characterizing variables: date, State, location, site, time, interviewer ID, as well as a variable to flag the occurrence of any unexpected event during the survey (for instance, noting in the file that a crash was blocking the roadway for 1 hour during the survey) along with an explanation (if needed). These were extracted from the Survey Manager Report Form (see Appendix J). Individual weights for population-based estimates were subsequently added. Once ready, each individual file was subsequently added to the master database.

We developed procedures to monitor, check, and correct potential errors that might occur at each of the steps in the data collection and handling process. This section reviews the procedures used to safeguard data. Procedures for handling the data collection in the field and at the survey sites are presented first, and then the procedures required for data merging and manipulation at the office are presented.

Data in the Field

At the conclusion of each roadside activity, survey managers and interviewers worked together to sort and merge the data. This process constituted a second opportunity for field staff to audit their work. Back in the hotel, the survey manager connected a special synchronizing cable between each PDA and the survey manager's laptop. The cable uploaded each subject's PDA-entered questionnaire data to the server in Calverton, Maryland. The data were uploaded using

PDA data collection software called Pendragon™ (Pendragon Software Corporation, Libertyville, IL) that stored the PDA data in its own database on the PIRE server. Once the original data were secure on the server, copies of the data were exported to an Excel file on the survey manager's laptop. This process was repeated for each PDA used during the data collection activities. Once the survey data were uploaded from the PDA, the device was automatically reset and ready to charge for use at the next event.

Following transfer of the PDA data, the survey manager connected a cable between each PBT device and his/her laptop. The PBT data were downloaded into an Excel file on the laptop using the Data 400 software program in the form of the PBT device number, the test number, the test result, and the date and time stamp for each test administered to subjects. This process was repeated for each PBT device used to collect samples during the data collection activities. After the PBT results were downloaded from the device, the PBT was immediately reset and ready for use in another data collection activity.

Meanwhile, interviewers reviewed each subject's driver information card to validate any corrections of the different identification numbers (unique ID, CoC labels) and then further correct any errors. The team compared the unique identifier for each subject listed in the PDA file to the unique identifier found on the driver information cards. They then confirmed the presence of the items on the checklist to the data found for each unique identifier in the PDA file. In this process, the presence of each unique identifier was confirmed and validated against the CoC numbers for any oral and/or blood sample provided by subjects. This process ensured that each participant had a corresponding driver information card and that all collected data were married to the subject who supplied the information. This procedure safeguarded the integrity of data by ensuring that each collected data component was correlated to the appropriate subject (this was especially important for matching when oral fluid and blood sample lab results were received at PIRE at a later date). To ensure the reliability of the information, the data collectors were prohibited from making data corrections other than ensuring the validity of the subjects' identifiers. If, in their review, data collectors discovered any data entry error, they were instructed and encouraged not to amend the data, but to report any anomaly as a commentary on the blue card (later at PIRE, data analysts would evaluate those comments and make the suggested data corrections, if appropriate). Upon completion of this process, any errors were corrected and the data were saved in a working file and uploaded to the servers in Calverton, Maryland.

The PDA and paper survey data were cleaned[11] and merged immediately after each data collection activity.

Finally, survey managers filled out a summary report of the overall field conditions (i.e., traffic conditions, weather conditions, or any comment of interest) (see Survey Manager Report Form, Appendix J).

At PIRE headquarters, the information from the driver information card was entered into Excel via an MS Access database. The first item entered was the unique identifier comprised of the interviewer ID, PSU number, session number, and subject number. Then data from a checklist,

[11] Broadly speaking, data cleaning involves the detection and correction of data entry errors. Although looking for errors and inconsistencies is a long-term process (i.e., analysts are always checking for previously overlooked errors), most of such errors were detected and fixed immediately after data collection, when the memory of the data collectors was still fresh.

which indicated exactly which data were collected from the subject during the roadside event, were entered, specifically: survey participation, provision of PAS 1, PAS 2, breath, oral fluid, and blood samples, AUD survey, DUD questionnaire, and drug questionnaire. It also indicated the PDA, PAS, and PBT device numbers as well as the PBT test number. If the subject provided an oral and/or blood sample, then a CoC label was affixed to the card and the number on each label was entered. Where inconsistencies were detected between the data from the driver information card and the records that were downloaded from the PDA and PBT, the records were individually examined and reconciled (a list of the variables are included in Appendix S).

Data Downloading and Merging

Downloading data and sending it to headquarters was accomplished with a Web-enabled laptop and a Tungsten™ GPS/PDA. The survey managers and one interviewer were responsible for forwarding data to headquarters from both the PDAs and PBTs to a server in Calverton, Maryland. This allowed analysts to quickly provide NHTSA with weekly roadside survey reports.

Once information from a data collection activity was received, the data processor at the main office received the following files: an electronic file containing all the interview data (i.e., observational data, survey, PAS readings, and AUD screener), and another with the PBT breath sample.

The data processor downloaded the PDA data from the working file and exported it into Excel. Next, the data processor downloaded the Excel file containing the PBT data. This file contained a PBT device number, test number, date and time stamp, and BAC reading for all tests taken on a PBT device number used during the data collection period. He or she visually checked to ensure that the PBT device number and test number provided in the PDA data had a corresponding PBT device and test number. If discrepancies were noted, the data processor used the PBT device number assigned to the interviewer and date/time stamp provided for each PBT test result to identify the correct PBT device and/or test number for its corresponding subject. If necessary, changes were made and the file was again saved to the servers.

The data processor subsequently merged each PBT test result for each subject into its corresponding PDA record. First, the data processor opened the PDA file; using the Unique Identifier, the data processor located the PBT device number and test number for the first participant. Then he or she opened the PBT file and searched for the corresponding device number, test number, and test results. This result was copied from the file and then pasted into the neighboring cell in the subject's PDA file. To assist in this process, the date and time stamp that was generated for each PBT test result was paired with the date and time stamp generated for each PDA survey. These time stamps were then associated to resolve potential discrepancies and safeguard data. This process was repeated for each participant. If any missing data or PBT errors arose during the process, the survey manager and the interviewer assigned to that device were contacted by the data processor to troubleshoot the problem together.

With this information cleaned and prepared, the data processor prepared site-specific statistics reports about each data collection activity conducted over the weekend. These reports focused on key findings because any major discrepancies found in the data could indicate a need for adjustments in preparation for the next weekend's data collection. This site-specific report provided information about response rates for each interviewer, response rates for the interview

team, potential equipment usage problems that were distorting output, and any obvious unforeseen problems that might skew the data. A summary of this survey evaluation provided immediate feedback to all personnel responsible for the performance of the survey team.

The data processor subsequently took each Excel data file and merged it into one working SAS database for the project. This database eventually came to contain all of the subject data from each data collection activity in the study. To begin the merging process, the data processor used "Stat Transfer" software to export the PDA data from Excel into an SAS file. The merged data file contained all of the observational data, responses to the survey, the AUD screener, PBT test results, and PAS results. According to the sample table (see Table 21), this weekly preliminary report showed the number of vehicles stopped and the survey completion rate. The report also specified the number of subjects who completed the self-reported drug use survey and how many provided breath, oral fluid, and blood samples. A summary distribution of PBT BACs was also provided. When relevant, the brief summary included information about weather conditions, any unusual events or circumstances about traffic patterns, interviewers who were replaced, or any arrangements made for impaired drivers.

The remaining data sources were the lab results. Once completed, the lab sent the test results for the oral fluid and blood samples obtained in the field to PIRE. The results were then matched to each subject who supplied the original specimen, and merged into the existing SAS working database. The CoC numbers that were assigned to each sample at the time of collection were the key matching variable between the Excel file, the lab results, and the Excel/SAS database, and were used to merge these data together. Once these data elements were matched, and the additional sources of information added, they constituted one common SAS file.

Response Results and Discussion

This section presents an overview of the response rates for the various data elements collected in the survey. Data and figures in this section are based on the actual number of sampled records and, thus, are not weighted. Crash volume-based estimates of all variables of interest and a complete analysis of these data will be presented in subsequent reports.

Basic Survey Components

The 2007 NRS data extends our knowledge of the prevalence of impaired driving on our Nation's roads. As with the 1973, 1986, and 1996 surveys, the 2007 NRS measures the BACs of weekend nighttime drivers. However, unique to the 2007 NRS data is the extension of the survey to daytime hours (Fridays mornings, 9:30 a.m. to 11:30 a.m., or afternoons, 1:30 p.m. to 3:30 p.m.). Table 21 shows the total number of drivers that participated in the four roadside surveys. As the first row in Table 21 indicates, the number of drivers who were selected to participate approximately doubled from 1986 to 1996 and again from 1996 to 2007. Note that the 2007 data is presented in total, as well as separated by daytime and nighttime survey hours. For 2007, the total number of drivers initially selected to participate includes the overall number of drivers who entered the survey bays and were eligible to participate (total n =10,909), plus those who entered a bay but were determined not to be eligible to participate (i.e., too young, language barrier, or commercial vehicle) (n=202), plus those who failed to follow the directions of the police and or refused to the police before entering the data collection site (n=1,949), for a total of 13,069 vehicles which were signaled to enter the site. In 2007, valid breath test samples were collected from 86% of those who were eligible to participate.

Table 21. Participating Drivers (Percentages in Parentheses)

	1973	1986	1996	2007		
				Daytime	Nighttime	Total
Signaled to enter site	Not reported	3,260	6,480	3,516	9,553	13,069
Did not enter site	Not reported	217	182	933	1,016	1,949
Stopped and entered site	–	–	–	2,583	8,537	11,120
Eligible	3,698	3,043	6,298	2,525	8,384	10,909
Entered site and interviewed	3,353 (90.7)	2,971 (97.6)	6,045 (96.0)	2,174 (86.1) *	6,920 (82.5) *	9,094 (83.4) *
Valid breath sample	3,192 (86.3)	2,850 (93.7)	6,028 (95.7)	2,254 (89.3) *	7,159 (85.4) *	9,413 (86.3) *
Oral Fluid sample	–	–	–	1,850(73.3)*	5,869 (70.0)*	7,719 (70.7)*
Blood sample	–	–	–	NA	3,276 (39.1)*	NA
AUD &/or drug Questionnaire	–	–	–	1,889 (75.2)*	5,983 (71.4) *	7,882 (72.2)*
Passenger questionnaire	–	–	–	220 (8.7)*	1,393 (16.6)*	1,613 (14.8)*

NA (not applicable): Blood samples were not collected in daytime.
* Percent of eligible.

Table 21 further shows that the participation rates for the 2007 NRS were fairly high (83.4% for the total sample of eligible drivers). A priority for our data collectors was to gather a BAC reading above any other survey element. Thus, if a driver did not participate in the interview, a breath sample was still requested. Though some of the participants who agreed to participate in the interview were unable to provide a valid breath sample, we were able to capture breath samples from a large enough portion of those who declined to participate in the survey to obtain a total of 86% of eligible drivers providing breath samples. We attribute this success to the careful preparation and the training of the data collectors. Still, even these high response rates were lower than those recorded in previous surveys. We suspect that the lower rates reflect national changes in the culture and attitudes towards survey participation (i.e., litigation concerns, participation rights, etc.). It is also possible that, with the increase in computer-assisted telephone surveys and computer-generated telephone marketing calls, the public is becoming increasingly resistant to survey-type activities. Additionally, the 2007 data collection activities included more research personnel at each data collection site and the individual survey was more time consuming, including providing oral fluid and blood samples. All of these factors may have led to participation being more of an inconvenience, leading to the lower response rate than achieved in the previous three NRS studies. Nonetheless, the response rates we achieved in the 2007 NRS are still well above those generally obtained with Random Digit Dialing telephone surveys, which are currently typically lower than 50% (Battaglia, Frankel & Link, 2008).

Unique to the current NRS, objective information on drug use by drivers was collected. Table 21 shows the number of oral fluid samples collected in the 2007 NRS by time of day and the number of blood samples, which were only collected during nighttime surveys. A total of 7,719 oral fluids (which have been matched to the interview items and breath tests) were collected. They represent about 71% of the 10,909 eligible drivers who were interviewed.

A total of 3,276 drivers provided a blood sample. This figure constitutes about 39% of those drivers who were eligible to participate in nighttime surveys.

A total of 7,882 drivers completed at least a portion of the AUD and/or the drug questionnaire. This is about 72% of all drivers who agreed to initiate the 2007 NRS.

Regarding passengers, a total of 1,613 front-seat passengers were surveyed. This represents almost 15% of all vehicles for which the driver was interviewed. Again, note that (1) not all drivers were carrying passengers, and (2) that the passenger survey was activated only if the AUD survey was also activated.

As previously noted, breath samples were provided by a large proportion of participants (86%). However, for those subjects who were unable to provide a valid PBT and for those who refused to provide a breath sample, a passive alcohol sensor was used in both 1996 and 2007. As in the 1996 survey, this passive data will be available to impute BAC values for subjects not willing to provide the breath sample. Passive sensor measures were *attempted on all* drivers reaching the bays, whether they agreed to the survey or not. Table 22 details the basic results of this strategy, by comparing the distribution of PAS readings among those who agreed to the survey against those who refused, for both 1996 and 2007 surveys. In the 2007 NRS, we were able to obtain a PAS reading from almost 96% of drivers who provided a PBT sample and 85% from those who did not provide a PBT sample. These results compare favorably with those obtained in 1996.

Table 22. Percentage of Drivers With PAS and PBT Readings for 1996 and 2007

1996	N	% with PAS Reading
Agreed to PBT	6,028	89.6%
Unable/Refused to provide PBT sample	270	53.7%
2007	**N**	**% with PAS 1 Reading**
Agreed to PBT	9,413	95.8%
Unable/Refused to provide PBT sample	1,496	84.9%

Comparison to the 1996 Survey Protocol

As part of our efforts to better understand our response rates, we also conducted a small-scale study to determine whether our 2007 survey techniques needed to be reconsidered or whether cultural attitudes and behaviors were influencing the slightly lower participation rates that we were obtaining. The severe weather conditions in Knox County, Tennessee, forced us to cancel some sessions of the survey. The need to return to that location to complete the non-surveyed sessions gave us the opportunity to implement in the same location not only our regular 2007 NRS procedures, but also to conduct a survey in the simpler fashion employed in the 1996 survey. In the 1996 survey, many of the interviews were conducted right at the roadside, and the survey team at any one location usually involved only one or two interviewers and a police officer. A brief survey was followed by a request for a breath test. Thus, the whole interview setting and process was potentially less intimidating and, certainly, less time consuming than in the 2007 NRS. Tables 23 and 24 show the basic outcomes of this comparison. About 16% of all drivers for the replication survey failed to stop at the officer's signal to enter the site. This is higher than the 11% who failed to stop in the 2007 nighttime survey using the current protocol. Among those drivers who entered the bay, the proportion of refusals in the replication survey and the current nighttime NRS were similar (13% and 15%). Only the proportion of ineligible drivers among the two surveys was different (4% of all who entered the bay in the replication survey versus 2% using the 2007 protocol nighttime NRS).

Table 23. Comparison of Participation Rates From the 1996 Survey, Replication of the 1996-Protocol, and Current 2007 Protocol

	1996 NRS	Replication of 1996 NRS in 2007 in Knox County	Standard 2007 NRS Protocol
		Nighttime	Nighttime Only
Signaled to Enter Site	6,480	223	9,553
Failed to Stop at Police Officer	182 2.8%	36 16.1%	1,016 10.6%
Entered Bay	6,298 97.2%	187 83.9%	8,537 89.4%
Not Eligible	__	*9* 4.0%	*153* 1.6%
Eligible	6,298 97.2%	178 79.8%	8,384 89.2%
Refused	253 3.9%	29 13.0%	1,464 15.6%
Participated	6,045 93.3%	149 66.8%	6,920 73.6%

Note: All percentages are computed with respect to "signaled to enter site."

Table 24 displays the same information provided in Table 23 but with percentages computed with respect to the number of eligible drivers. Table 24 shows that the refusal rates (estimated as a percent of eligible drivers) in the replication survey and using the 2007 protocol were also very similar.

Table 24. Participation Rates: Replication of 1996 Survey and 2007 NRS Eligible and Refusals Comparing the Replication With All Other 2007 NRS Sites

	1996 NRS	Replication of 1996 NRS in 2007 in Knox County	Standard 2007 NRS Protocol
		Nighttime	Nighttime Only
Participated	6,045 95.9%	149 83.7%	6,920 82.5%
Refused	253 4.1%	29 16.3%	1,464 17.5%
Eligible drivers	6,298	178	8,384

Note: All percentages are computed with respect to "eligible drivers."

The most significant difference between the replication survey and the 2007 nighttime NRS involved the collection of breath samples. Table 25 shows that approximately 80% of all eligible drivers in the replication survey provided a breath sample compared to the 85% when the 2007 nighttime protocol was used. Although this study included only a small sample and was only conducted in one jurisdiction, it provides support for our hypothesis that our lower participation rate in 2007 was due to reasons other than the changes made to the survey protocol. We

speculate that public's changing perceptions towards survey participation may help explain the observed outcome.

Table 25. Rates for PBTs Provided: 1996 NRS, Replication of 1996-Procotol, and 2007 NRS

	1996 NRS	Replication of 1996 NRS in 2007 in Knox County Nighttime	Standard 2007 NRS Protocol Nighttime Only
Provided PBT	6,028	142	7,159
% of Eligible Drivers	95.7%	79.78%	85.4%

Refusal Conversions

To better understand the drinking patterns of those who refused participation, a subset of the drivers who refused to participate in the survey were offered an additional $100 incentive to reverse their refusal. Table 26 shows the number of "refusal conversions" that were attempted and the number that were successful.

Table 26. Refusal Conversions

	Daytime	Nighttime	Overall
Number of Attempts	93	351	444
Successful Conversions	52	170	222
% Successful	55.91%	48.43%	50.00%
Unsuccessful Conversions	41	181	222
% Unsuccessful	44.09%	51.57%	50.00%

Note: a successful conversion was defined as "agreeing to provide a breath test."

A total of 444 drivers that initially refused were approached and offered $100 to change their minds. Fifty percent of those 444 drivers were converted, accepted the incentive, and provided at least a breath test. There was no statistically significant difference between the conversion rates of daytime and nighttime subjects. The data from those refusal conversions will provide information for detecting biases in the drug and alcohol use data from those drivers who did initially participate in the 2007 survey.

Summary

This report documents the procedures followed and response rates obtained in the conduct of the 2007 National Roadside Survey. Over 10,000 eligible drivers were approached to participate in the survey; 9,094 completed the basic interview, and 9,413 provided a breath sample for analysis for alcohol. Additionally, 70.8% of eligible drivers (7,721) provided an oral fluid sample for analysis for both alcohol and other drugs. Among nighttime drivers, 3,552 provided a blood sample. The results of these analyses and prevalence estimates for alcohol and drug use in the U.S. driver population will be the subject of forthcoming reports.

References

American Psychiatric Association. (1994). *The Diagnostic and Statistical Manual of Mental Disorders* (4th ed.). Washington, DC: American Psychiatric Association.

Babor, T. F., de la Fuente, J. R., Saunders, J., & Grant, M. (1992). *The Alcohol Use Disorders Identification Test: Guidelines for use in primary health care*. Geneva: World Health Organization.

Battaglia, M. P., Frankel, M. R., & Link, M. W. (2008). Improving standard poststratisfication techniques for random-digit-dialing telephone surveys. *Survey Research Methods, 2*(1), 11-19.

Borkenstein, R. F., Crowther, R. F., Shumante, R. P., Ziel, W. B., & Zylman, R. (1964). *The role of the drinking driver in traffic accidents*. Bloomington, IN: Department of Police Administration, Indiana University.

Brogan, W. C., Kemp, P. M., Bost, R. O., Glamann, D. B., Lange, R. A., & Hillis, L. D. (1992). Collection and handling of clinical blood samples to assure the accurate measurement of cocaine concentration. *Journal of Analytic Toxicology, 16*, 152-154.

Cammisa, M., Ferguson, S., & Wells, J. (1996). *Laboratory evaluation of PAS III sensor with new pump design*. Arlington, VA: Insurance Institute for Highway Safety (IIHS).

Christophersen, A. S. (1986). Tetrahydrocannabinol stability in whole blood: plastic versus glass containers. *Journal of Analytic Toxicology, 10*, 129-131.

Chung, T., Colby, S. M., Barnett, N. P., & Monti, P. M. (2002). Alcohol use disorders identification test: Factor structure in an adolescent emergency department sample. *Alcoholism: Clinical and Experimental Research, 26*(2), 223-231.

Conley, T. B. (2001). Construct validity of the MAST and AUDIT with multiple offender drunk drivers. *Journal of Substance Abuse Treatment, 20*(4), 287-295.

Cottler, L. B., Grant, B. F., Blaine, J., Mavreas, V., Pull, C., Hasin, D., et al. (1997). Concordance of DSM-IV alcohol and drug use disorder criteria and diagnoses as measured by AUDADIS-ADR, CIDI and SCAN. *Drug and Alcohol Dependence, 47*(3), 195-205.

Coulter, C., Crompton, K., & Moore, C. (2008). Detection of phencyclidine in human oral fluid using solid phase extraction and liquid chromatography with tandem mass spectrometric detection. *Journal of Chromatography B: Biomedical Sciences and Applications, 873*, 123 -128.

Couper, F. J., & Logan, B. K. (2004). *Drugs and human performance fact sheet* (DOT HS 809 725). Washington, DC: National Highway Traffic Safety Administration.

Couper, M., & Groves, R. (1992). The role of the interviewer in survey participation. *Survey Methodology, 18*, 263-277.

Federal Highway Administration. (2006, April 10, 2008). *Highway statistics 2006*. Retrieved June 25, 2008, from http://www.fhwa.dot.gov/policy/ohim/hs06/driver_licensing.htm

Fiorentino, D. (1997). A laboratory study of passive alcohol sensors. In C. Mercier-Guyon (Ed.), *Alcohol, drugs and traffic safety: Proceedings of the 14th International Conference on Alcohol, Drugs, and Traffic Safety* (pp. 539-545). Annency, France: CERMT Centre d'Etudes et de Recherches en Médecine du Trafic.

Grant, B. F., & Dawson, D. A. (1997). Prevalence and correlates of alcohol use and DSM-IV alcohol dependence in the United States: Results of the National Longitudinal Alcohol Epidemiologic Survey. *Journal of Studies on Alcohol, 58*(5), 464-473.

Groves, R. M., Cialdini, R. B., & Couper, M. P. (1992). Understanding the decision to participate in a survey. *Public Opinion Quarterly, 56*, 475-495.

Hasin, D., Carpenter, K., McCloud, S., Smith, M., & Grant, B. (1997). Alcohol use disorder and associated disabilities interview schedule (AUDADIS): Reliability of alcohol and drug modules in a clinical sample. *Drug and Alcohol Dependence 44*(2,3): 133-141.

Hox, J., De Leeuw, E. & Snijkers, G. (1998). Fighting Nonresponse in telephone interviews: Successful interviewer tactics. Nonresponse in survey research. A. Koch and R. Porst, Eds. Germany, ZUMA**:** 173-185.

Kiger, S., Lestina, D., & Lund, A. (1993). Passive alcohol sensors in law enforcement screening for alcohol-impaired drivers. *Alcohol, Drugs and Driving, 9*, 7-18.

Lacey, J. H., Kelley-Baker, T., Furr-Holden, C. D. M., Brainard, K., & Moore, C. (2007). *Pilot Test of New Roadside Survey Methodology for Impaired Driving* (DOT HS 810 704). Washington, DC: National Highway Traffic Safety Administration.

Lestina, D. C., Greene, M., Voas, R. B., & Wells, J. (1999). Sampling procedures and survey methodologies for the 1996 survey with comparisons to earlier National Roadside Surveys. *Evaluation Review, 23*(1), 28-46.

Lund, A. K., & Wolfe, A. C. (1991). Changes in the incidence of alcohol-impaired driving in the United States, 1973-1986. *Journal of Studies on Alcohol, 52*(4), 293-301.

Lunn, E., Hedlund, J., Brick, M., Fell, J., Meyer, E., & Parsons, G. (1979). *The National Accident Sampling System (NASS). Vol. III: Implementation* (DOT HS 804 029). Washington, DC: National Highway Traffic Safety Administration.

Lyberg, I., & Dean, P. (1992). *Methods for reducing nonresponse rates: A review.* Paper presented at the Annual Meeting of the American Association for Public Opinion Research, St. Petersburg, FL.

Lyberg, I., & Lyberg, L. (1991). *Nonresponse research at Statistics Sweden.* Paper presented at the Annual Meeting of the American Statistical Association, Atlanta, Georgia, USA.

Moore, C., Coulter, C., & Crompton, K. (2007). Achieving proposed Federal concentrations using reduced specimen volume for the extraction of amphetamines from oral fluid. *Journal of Analytic Toxicology, 31*(8), 442-446.

Moore, C., Coulter, C., Crompton, K., & Zumwalt, M. (2007). Determination of benzodiazepines in oral fluid using LC/MS/MS. *Journal of Analytic Toxicology, 31*(9), 596-600.

Moore, C. and Lacey, J. (2007). Correlation of drug profiles in paired blood and saliva samples from randomly selected drivers: Implications for US National Roadside Survey 2007. Proceedings of the T2007 Joint International Meeting of TIAFT/ICADTS/IIS, August 26-30 Seattle, WA. ICADTS.

Moore, C., Rana, S., & Coulter, C. (2007a). Determination of meperidine, tramadol and oxycodone in human oral fluid using solid phase extraction and gas chromatography-mass spectrometry. *Journal of Chromatography B: Biomedical Sciences and Applications, 850*, 370-375.

Moore, C., Rana, S., & Coulter, C. (2007b). Simultaneous identification of 2-carboxy-tetrahydrocannabinol, tetrahydrocannabinol, cannabinol and cannabidiol in oral fluid. *Journal of Chromatography B: Biomedical Sciences and Applications, 852*, 459-464.

Moore, C., Vincent, M., Rana, S., Coulter, C., Agrawal, A., & Soares, J. (2006). Stability of Delta(9)-tetrahydrocannabinol (THC) in oral fluid using the Quantisal™ collection device. *Forensic Science International, 164*(2-3), 126-130.

National Highway Traffic Safety Administration. (1991). *Alcohol limits for drivers: A report on the effects of alcohol and expected institutional responses to new limits* (DOT HS 807 692). Washington, DC: Department of Transportation.

National Highway Traffic Safety Administration. (1995a). NASS/CDS. *National accident sampling system/crashworthiness data system: Analytical users manual.* Washington, DC: National Highway Traffic Safety Administration.

National Highway Traffic Safety Administration. (1995b). *National automotive sampling system: Crashworthiness data system 1991-1993*. Washington, DC: National Highway Traffic Safety Administration.

National Highway Traffic Safety Administration. (2004). *Drugs and human performance fact sheet* (DOT HS 809 725). Washington, DC: U.S. Department of Transportation.

National Highway Traffic Safety Administration. (2007). Conforming products list of evidential breath alcohol measurement devices. *Federal Register 72*(241), 71480-3. Washington, DC: National Highway Traffic Safety Administration.

National Highway Traffic Safety Administration. (2000). *National Automotive Sampling System (NASS) General Estimates System (GES) analytical user's manual 1988 – 1999*. Washington, DC: National Highway Traffic Safety Administration.

National Highway Traffic Safety Administration. (2006). *National Automotive Sampling System (NASS) General Estimates System (GES) analytical user's manual 1988 – 2005*. Washington, DC: National Highway Traffic Safety Administration.

O'Neal, C. L., Crouch, D. J., Rollins, D. E., & Fatah, A. A. (2000). The effects of collection methods on oral fluid codeine concentrations. *Journal of Analytic Toxicology, 24*(7), 536-542.

Peck, R., Gebers, M., Voas, R., & Romano, E. (2008). The Relationship Between Blood Alcohol Concentration (BAC), Age, and Crash Risk. *Journal of Safety Research, 39*(3), 311-319.

Pull, C. B., Saunders, J. B., Mavreas, V., Cottler, L. B., Grant, B. F., Hasin, D. S., et al. (1997). Concordance between ICD-10 alcohol and drug use disorder criteria and diagnoses as measured by the AUDADIS-ADR, CIDI and SCAN: Results of a cross-national study. *Drug and Alcohol Dependence, 47*(3), 207-216.

Quintela, O., Crouch, D. J., & Andrenyak, D. M. (2006). Recovery of drugs of abuse from the Immunalysis Quantisal™ oral fluid collection device. *Journal of Analytic Toxicology, 30*(8), 614-616.

Rana, S., Moore, C., Agrawal, A., Coulter, C., Vincent, M., & Soares, J. (2006). Determination of propoxyphene in oral fluid. *Journal of Analytic Toxicology, 30*(8), 516-518.

Rodrigues, W., Wang, G., Moore, C., Agrawal, A., Vincent, M., & Soares, J. (2008). Development and validation of ELISA and GC-MS procedures for the quantification of dextromethorphan and its main metabolite dextrorphan in urine and oral fluid. *Journal of Analytic Toxicology, 32*, 1-7.

Singer, E., Frankel, M. R., & Glassman, M. B. (1983). The effect of interviewer characteristics and expectations on response. *Public Opinion Quarterly, 47*, 68-83.

Soderstrom, C. A., Ballesteros, M. F., Dischinger, P. C., Kerns, T. J., Flint, R. D., & Smith, G. S. (2001). Alcohol/drug abuse, driving convictions, and risk-taking dispositions among trauma center patients. *Accident Analysis and Prevention, 33*, 771-782.

Terhune, K. W., Ippolito, C. A., Hendricks, D. L., Michalovic, J. G., Bogema, S. C., Santinga, P., Blomberg, R, & Preusser, D.F. (1992). *The incidence and role of drugs in fatally injured drivers* (DOT HS 808 065). Washington, DC: National Highway Traffic Safety Administration.

Toennes, S. W., & Kauert, G. F. (2001). Importance of vacutainer selection in forensic toxicological analysis of drugs of abuse. *Journal of Analytic Toxicology, 25*(5), 339-343.

Townsend, T. N., Lane, J., Dewa, C. S., & Brittingham, A. M. (1998). *Driving after drug or alcohol use: Findings from the 1996 National Household Survey on Drug Abuse*. (SMA) 99-3273. Washington D.C.: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Office of Applied Studies.

Ustun, B., Compton, W., Mager, D., Babor, T., Baiyewu, O., Chatterji, S., Cottler, L., Gogus, A., Mavreas, V., Peters, L., Pull, C., Saunders, J., Smeets, R., Stipec, M.R., Vrasti, R., Hasin, D., Room, R., Van den Brink, W., Regier, D., Blaine, J., Grant, B.F., & Sartorius, N. (1997). WHO study on the reliability and validity of the alcohol and drug use disorder instruments: Overview of methods and results. *Drug and Alcohol Dependence, 47*(3), 161-169.

Verstraete, A., & Raes, E. (2006). *Rosita-2 project*. Belgium: Ghent University, Department of Clinical Biology.

Voas, R. B., Wells, J., Lestina, D., Williams, A., & Greene, M. (1998). Drinking and driving in the United States: The 1996 National Roadside Survey. *Accident Analysis and Prevention, 30*(2), 267-275.

Wolfe, A. C. (1974). *1973 U.S. national roadside breath testing survey: procedures and results* (DOT HS 801 241). Washington, DC: National Highway Traffic Safety Administration.

Zador, P. L., Krawchuk, S. A., & Voas, R. B. (2000). Alcohol-related relative risk of driver fatalities and driver involvement in fatal crashes in relation to driver age and gender: An update using 1996 data. *Journal of Studies on Alcohol. 61*(3), 387-395.

Appendices

Appendix A: Driver Information Card (Blue Card)

Appendix B: Portable Digital Assistant (PDA) Specifications (Tungsten E2™)

Appendix C: Passive Alcohol Sensor (PAS) Specifications (PAS Vr.™)

Appendix D: Preliminary Breath Alcohol Tester (PBT) Specifications (Intoxylizer SD-400™)

Appendix E: Impaired Driver Protocol

Appendix F: National Roadside Survey Instrument

Appendix G: Oral Fluid Specifications (Quantisal™)

Appendix H: 2007 National Roadside Survey Booklet: Drug Use, Experience With Criminal Justice System, Drug Use Disorder (DUD), and Alcohol Use Disorder (AUD)

Appendix I: Passenger Survey

Appendix J: Survey Manager Report Form

Appendix K: OSHA Requirements

Appendix L: Training of the Trainers (TOT) Agenda

Appendix M: Interviewer Training Agenda

Appendix N: Phlebotomy Training Agenda

Appendix O: Interviewer Quality Control (QC) Site Report

Appendix P: Survey Manager Quality Control (QC) Site Report

Appendix Q: Travel Logistics Sheet

Appendix R: Prevention Information Brochures

Appendix S: NRS List of Variables

DOT HS 811 237
December 2009

U.S. Department of Transportation
National Highway Traffic Safety Administration

NHTSA
www.nhtsa.gov