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A Colorado Validation Study of the Standardized Field Sobriety Test (SFST) Battery

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Technical Summary

In the State of Colorado, motor vehicle operators are subject to arrest if they are found to be driving with a blood alcohol concentration (BAC) over 0.05%. At BACs above 0.05% but less than 0.10%, they are charged with Driving While Ability Impaired (DWAI). At BACs of 0.10% and higher, the charge is Driving Under the Influence (DUI). These statutes reflect the evidence from both epidemiological and laboratory studies of alcohol impairment of driving skills.

It is the responsibility of law enforcement officers to detect and arrest alcohol-influenced drivers in accordance with these statutory limits. In an effort to meet that objective, police officers, not only in Colorado but in all fifty of the United States, rely on a battery of standardized field sobriety tests (SFSTs). Observations of drivers' performance of the tests, together with driving pattern, appearance and manner, odor of alcohol, and other signs, underlie officers' arrest and release decisions.

To be genuinely useful, roadside tests must be valid and reliable; i.e., they must measure changes in performance associated with alcohol and they must do it consistently. To the extent that they meet the validity and reliability criteria, they can be expected to contribute to traffic safety by increasing the likelihood that alcohol-impaired drivers will be removed from the roadway by arrest. Importantly, they also will further serve the driving public's interests by decreasing the likelihood that a driver who is not alcohol-impaired will be mistakenly detained or arrested. Thus, the validity and reliability of the tests are important issues.

This study was undertaken specifically to extend study of the SFSTs from the laboratory setting to field use. The primary study question was, "How accurate are officers' arrest and release decisions when the SFSTs are used by trained and experienced officers?" Over a five-month period, officers from seven Colorado law enforcement agencies who volunteered for the study provided the records (N=305) from every administration of the SFSTs.

Using only the standardized 3-test battery (Walk-and-Turn, One-Leg Stand, Horizontal Gaze Nystagmus), officers seldom erred when they decided to arrest a driver.

Breath or blood specimens confirmed that 93% of the arrested drivers were above 0.05% BAC.

Officers were more likely to err on the side of releasing drivers than on the side of incorrectly arresting drivers. Given the difficulty of the task which confronts officers at roadside, in particular with alcohol-tolerant individuals, the finding that approximately one-third of the released drivers should have been arrested is not unexpected. However, it is important to note that officers' decisions to release *were correct* two-thirds of the time.

Overall, 86% of the officers' decisions to arrest or release drivers who provided blood or breath specimens were correct.

It is concluded that the SFSTs are valid tests; i.e., they serve as indices of the presence of alcohol at impairing levels. The study design did not support an examination of test-retest reliability. It should be noted, however, that the test battery appears to have served equally well across agencies and officers, strongly suggesting that it achieves acceptable reliability as well.

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I. Introduction

A battery of standardized field sobriety tests (SFSTs), which was developed under National Highway Traffic Safety (NHTSA) funding during the 1970's, is now used by police officers nationwide. Traffic officers in fifty states, who have been trained in standardized administration of the tests, routinely use them and incorporate their observations of drivers' test performance into their arrest or release decisions. Defense attorneys, however, often challenge the admissibility of court testimony about the test battery.

Roadside decisions are a critical component of alcohol-and-driving enforcement and, therefore, of traffic safety. Because the SFSTs aid officers in the often-difficult task of identifying alcohol-impaired drivers, it is likely that the tests have contributed in some unknown measure to the significant decline in alcohol-related fatalities over the last decade. Given that they have exerted a positive impact on traffic safety, it is important to resolve questions about their validity and reliability, to maintain their credibility, and to preserve them as a roadside tool.

Because court arguments about SFSTs focus largely on the research conducted at the Southern California Research Institute (SCRI) and because that research is sometimes misrepresented or misunderstood, it is necessary first to clarify its purpose. Two large-scale laboratory experiments were conducted for the purpose of identifying and standardizing a "best" set of tests (Burns and Moskowitz, 1977; Tharp, Burns and Moskowitz, 1981). Although it clearly is relevant at this point in time to inquire whether the methods of those experiments were scientifically sound, it should be recognized that the laboratory data are now only indirectly enlightening about current roadside use of the tests. In particular, note that controlled laboratory conditions are less variable and, therefore, may be less challenging than the highly varied conditions which officers routinely encounter in the field.

Also, officer experience with the SFSTs is key to the skill and confidence with which they use them as a basis for their decisions. Thus, it is important to understand that the officers who participated in the SCRI studies had not been trained with the SFSTs until just prior to the experiments. They had not had opportunity and time to gain skill or to develop confidence in the tests. In contrast, many of the officers who now use and testify about the tests have been using them regularly for ten or more years, and it is reasonable to assume they have gained skill and to expect that their decisions based on the tests may be more accurate than those of the officers during the initial research.

The question to be addressed in 1995 by agencies, officers and the courts is, "How accurate are the arrest decisions which are made by experienced, skilled officers under roadside conditions when they rely on SFSTs?". A broadly applicable answer cannot be found in laboratory research. It requires field data; i.e., information about real-world arrest decisions by officers trained by NHTSA guidelines to administer the SFSTs.

The Colorado Department of Transportation funded a 1995 study to obtain such data. Through a grant to the Pitkin County Sheriff's Office and with the cooperative effort of seven Colorado law enforcement agencies, records were collected from drivers tested with the SFSTs at roadside. The seven agencies were:

- Aspen Police Department (APD)
- Basalt Police Department (BPD)
- Boulder County Sheriff's Office (BCSO)
- Colorado State Patrol (CSP)
- Lakewood Police Department (LPD)
- Pitkin County Sheriff's Office (PCSO)
- Snowmass Village Police Department (SVPD)

With information drawn from impaired-driving records, a data base was created and analyzed at the Southern California Research Institute.

II. Study Background and Rationale

Whenever a police officer observes a driving error or equipment violation and takes action by stopping the vehicle, he/she must subsequently make a decision to arrest or release the driver. Those forced-choice decisions include driving-under-the-influence (DUI) decisions about drivers who may or may not have been drinking alcohol and who may or may not be legally under-the-influence. DUI arrest decisions fall into one cell of the [Figure 1](#) matrix.

**FIGURE 1
DECISION MATRIX**

Measured BAC	OFFICERS' DECISIONS	
	Arrest	Release
≥0.05%	1 Correct Arrest	2 Incorrect Release
<0.05%	3 Incorrect Arrest	4 Correct Release

As illustrated by the figure, the decisions may be correct under two different conditions. A “Correct Arrest” (Cell 1) occurs when an officer correctly decides, as confirmed by a chemical test, that the driver’s blood alcohol concentration (BAC) is at or above legally-defined limits for driving. In Colorado’s two-tiered system, drivers are charged with driving-under-the-influence if their BACs are 0.10% or higher. They are charged with a lesser offense of driving-while-ability-impaired (DWAI) if their BACs are in the range >0.050 to <0.100%. A copy of the Colorado statute appears in [Appendix I](#).

A second kind of correct decision occurs whenever a driver has *not* been drinking, or has been drinking only a very small amount. When the officer correctly concludes that the driver is not DUI or DWAI, *as defined by the BAC limits*, he has made a Correct Release decision (Cell 4). Whether that driver actually is or is not impaired at a low BAC is a separate issue, which was not specifically addressed in this study.

Decisions may also be incorrect in two different ways, each with different consequences. An “Incorrect Arrest” occurs when an officer decides that the driver is DUI or DWAI, but a breath test shows the driver to be below the criterion level (Cell 3). For this analysis an Incorrect Arrest is defined strictly in terms of the BAC statute and does not speak to the more difficult question of the individual driver’s impairment. The officer’s incorrect arrest error, defined by a strict BAC criterion, may in fact not be an error in the sense that the driver may actually be impaired at a low BAC, may be impaired by a low level of alcohol combined with some other substance, or may be alcohol free but impaired by some other substance or combination of substances. Fortunately, true Incorrect Arrests for alcohol are relatively rare. When they occur, however, citizens are likely to be angered by having been detained. Certainly, officers wish to avoid the appearance of undue harassment, as well as to minimize nonproductive contacts with citizens.

A second type of error, an “Incorrect Release,” occurs when a driver is at or above the BAC criteria and is stopped but then released. The officer concludes either that the driver has not been drinking or that he/she is not impaired (Cell 2). Typically, this kind of error occurs more frequently than Incorrect Arrest errors, and it has potentially more serious consequences for traffic safety. There is a risk that the impaired driver, who is allowed to proceed, will be involved in a crash before reaching a destination. A second and less frequently recognized and unfortunate consequence of the error is that it may reinforce drinking-driving behavior. Some number of persons, who drive after drinking and who are released after being stopped, will conclude that they can continue to drink-and-drive without risk of penalty.

Two of these four decision categories, Correct Arrests and Incorrect Arrests, can be confirmed with reasonable speed by breath or blood tests. Unless the arrested drivers refuse to provide specimens for testing, their BACs can be determined either immediately with breath specimens or within a day or two with analysis of blood specimens.

Data to determine whether and under what conditions the releas-

es of drivers are errors are more difficult to obtain, i.e., data to confirm Correct and Incorrect Releases. In most cases, when an officer releases a driver after a roadside examination, no specimen for measuring BAC is obtained. Without breath or blood specimens, questions about the accuracy of officers' decisions will remain unanswered. Because data pertaining to released drivers are difficult to obtain, they do not often appear in assessments of officer performance.

III. Study Design

This study was designed to:

- (1) gather data to assign officers' decisions to the four cells of the decision matrix illustrated in [Figure 1](#), and to
- (2) examine the accuracy of the SFST battery when used in the widely varying weather conditions of Colorado winter, spring, and summer months.

Both the design and the execution of the study focused on the *integrity, completeness, and standardization* of the data.

It is important to note how the study population was defined and how the sample of subjects was drawn. Subjects were a subset of the population of drivers who were detained by police officers during the study period. They were drivers, both those arrested and those released, who were stopped by police officers during the study period *and who were requested to perform the SFSTs*. The officers' decisions about those drivers have been analyzed in terms of correct decisions (Correct Arrests and Correct Releases) and errors (Incorrect Arrests and Incorrect Releases).

In a broader context, the terms Correct Releases and Incorrect Releases could be extended to motorists who were stopped but who were not asked to perform the SFSTs. In many of those cases, the release decisions were correct, but it is likely that some of them were impaired drivers who were released without ever being asked to perform the SFSTs. Those individuals and those decisions are of interest and would be included in an assessment of overall proficiency in DUI detection and arrest. In fact, the entire population of impaired drivers, only some of whom are detected and stopped, is of interest in terms of traffic safety. In a validation study of SFSTs, however, the subjects were only those drivers who were asked to perform the tests.

IV. Method

A. Data Integrity

It was necessary to develop study procedures which insured that decisions to arrest were based solely on roadside observations and SFSTs. Officers used only the 3-test battery, Walk-and-Turn, One-Leg Stand, and Horizontal Gaze Nystagmus. If it was the policy of the agency or the individual officer to use additional tests, that practice was set aside for the duration of the study. Also, officers were not equipped with preliminary breath testers (PBTs) during the study.

Data integrity was emphasized during pre-study orientation sessions. To minimize competitiveness between officers or agencies, no feedback was given to anyone during data collection. Officers were told that their agencies would receive details of their performance, but that the final report would not identify arrests by officer name.

Trained observers, who were present during the contact with 125 (41%) of the subjects, obtained data which were critical to study objectives. They monitored the administration of the SFSTs, confirmed that no other roadside tests were given and that the officer did not have a PBT, and obtained BACs from released drivers.

The importance of the observers' role in the study is underscored by the experience with an earlier field study of SFSTs (T. Anderson, R. Schweitz, and M. Snyder, 1983). When that study is cited in court, it often is noted that because some of the officers had access to PBTs, it is not possible to state with certainty that they did not know drivers' BACs prior to making their arrest decisions. BACs obtained with PBTs could have inflated their accuracy rate, and the contribution of the SFSTs to their decisions cannot be unequivocally determined.

In this study, the observer completed a checklist ([Appendix II](#)) each time the SFSTs were administered and reported the following for each of the three roadside sobriety tests:

- Were instructions given correctly?
- Was the test administered correctly?
- If the test was not given, what was the reason?
- If the test was not observed, what was the reason?

Whenever an officer decided to release a driver, the observer then asked that driver to provide a voluntary breath specimen for PBT measurement of BAC. Since no arrest was being made and no evidential breath specimen would be available, the BACs obtained by the observers were essential in order to calculate estimates of officers' accuracy in releasing drivers.

When drivers were asked to provide voluntary breath specimens, they were told that if found to be at an impairing alcohol level, transportation would be provided. They were told further that an arrest would be made only if they attempted to drive away from the scene. Whenever drivers agreed to provide the specimen, the Informed Consent document ([Appendix II](#)) was offered for signature.

B. Completeness

Because it is possible for incomplete data sets to be systematically and significantly biased in known and unknown ways, the data for this study included the entire work product of the officers who participated in the study. Work product was defined as the reports for every occasion of administering the SFSTs.

Data collection methods, which were designed to meet study requirements without unacceptable disruption of an agency's established procedures, insured that all records were available. Reports were tracked by the Computer Aided Dispatch (CAD) numbering system that attaches a unique number to each report. The CAD numbers were used to resolve questions about missing data.

The participating agencies copied all study documents and forwarded them to the Project Manager, who verified that they were com-

plete. At the end of the data collection period, all participating officers and observers signed certifications attesting that the records of all their contacts with drivers, which had involved the SFSTs, had been submitted ([Appendix II](#)).

In addition to the documents routinely generated by contact with a citizen, officers completed a checklist ([Appendix II](#)) which provided the following additional information for the study about the stops and drivers:

- weather conditions
- temperature
- type of roadway
- roadway conditions
- condition of the surface where SFSTs were given
- reason for the stop
- related circumstances (major recreational events; holidays, taverns, bars, and restaurants nearby)
- open containers in the vehicle
- driver's clothing (whether adequate for weather conditions)
- driver's footwear
- observer (present/absent)
- BAC by PBT (Yes/No)
- If yes, measured BAC

C. Standardization

The validity of the SFSTs hinges on standardized administration and scoring. To the extent that officers' instructions and demonstrations, or their interpretations of observations, differ from those established by research, it diminishes the meaning which can be attached to drivers' test performance.

Officers from the cooperating law enforcement agencies, who were routinely assigned to traffic patrol and/or special DUI units and who were SFST-trained by NHTSA guidelines, were eligible to participate. Participation was voluntary, and the officers were paid for their extra duty time. Refresher training in standardized testing methods was given by an SFST instructor during pre-study orientation sessions.

In order to examine the relationship of experience and arrest decisions, participating officers completed an Officer Information form ([Appendix II](#)). They were queried about their years of law enforcement experience, date and place of SFST training, and the approximate number of DUI arrests since training.

In [Table 1](#), participating officers are ranked by their years of law enforcement experience. In [Table 2](#) they are ranked by the number of DUI arrests each officer estimated he/she had made.

D. Training

The study's successful completion hinged directly on the officers. It was essential for them to understand and concur with study objectives and commit to its rigorous execution. As a group, they met those criteria and were cooperative with the stringent, sometimes burdensome requirements. They attended a two-hour orientation session, conducted either by Deputy Anderson and Dr. Burns or by Deputy Anderson alone. Five such training sessions were held at three different locations. The training session protocol can be seen in [Appendix III](#).

E. Data Instruments

The study data records include the following:

- Officer Information Forms
 - Law enforcement experience
 - SFST training
 - DUI arrest experience
- Arrest Documents including SFST Report
- Breath Test (evidential) Report
- Officer's Checklist
- Observer's Checklist
- Consent Form for Breath Testing

F. Data Security

As study documents were received, they were kept in a secure file under the care of Deputy Anderson at the Pitkin County Sheriff's

TABLE 1
COLORADO VALIDATION STUDY OF THE STANDARDIZED
FIELD SOBRIETY TEST (SFST) BATTERY
Participating Officers Ranked by Years of Law Enforcement Experience

RANK	AGENCY	BADGE	NAME	1	2	3
1	CSP	39	Bruce L. Berry	23 yrs 5 mos	1985	1612
2	LPD	1447	John E. Griffith	18 yrs	1985	200
3	LPD	1511	Jeff Cohn	17 yrs	1985*	1000+
4	APD	120	Steven R. Smith	15 yrs	1987	350
5	BCS	548	Dan Johnson	14 yrs	1986*	400
6	LPD	1632	Michael Greenwell	12 yrs	1987*	400
7	BCS	593	Mark George	12 yrs	1985	1000
8	LPD	1557	Ernest E. Applegate	11 yrs 9 mos	1989	75
9	LPD	1467	Steve C. Hipwell	11 yrs 8 mos	1985	600
10	BCS	576	Kevin E. Parker	10 yrs	1993	50
11	BCS	581	Terry Bierwiler	9 yrs	1987*	50
12	LPD	1592	Dutch A. Smith, Jr.	7 yrs 6 mos	1991	100+
13.5	LPD	1584	Mark G. Dewhurst	7 yrs	1988*	535
13.5	LPD	1603	Brent E. Sawyer	7 yrs	1993	23
15	LPD	1583	Beck E. Leider	6 yrs 7 mos	1992	90
16.5	BPD	304	Lee Tos	6 yrs	1991	100
16.5	BCS	575	Kyle S. Miller	6 yrs	1992	35
18	APD	127	Jeff Harmon	5 yrs 6 mos	1990	120
19	APD	121	Dan Glidden	5 yrs 5 mos	1990	105
20	BCS	579	Michael P. Linden	5 yrs	1993	50
21	LPD	1619	Eric P. Ebeling	5 yrs	1993	29
22	PCS	65	Scott Thompson	5 yrs	1990	100
23	LPD	1602	Patrick S. Wilson	4 yrs 4 mos	1990*	200+
24	LPD	1609	William K. Csikos	2 yrs 8 mos	1992	40
25	APD	115	Sandy Brownlee	2 yrs 6 mos	1993	25
26.5	BPD	305	Christopher Maniscalchi	1 yr 9 mos	1993	25
26.5	LPD	1622	Tracie L. Kinderknecht	1 yr 9 mos	1993	15
28	APD	126	James A. Cannan	1 yr 8 mos	1995	5
29.5	CSP	1301	Dan C. Gibbons	1 yr 6 mos	1993	50
29.5	BCS	556	John Repjar	1 yr 6 mos	1994	30
31	BPD	306	Don Calvano	1 yr	1994	5

(1) Number of years/months employed in law enforcement as a sworn officer.

(2) Year trained with SFSTs

(3) Number (approximate) of DUI arrests since SFST training

* Officers have had additional training since the initial training in SFSTs.

APD Aspen Police Department

CSP Colorado State Patrol

BPD Basalt Police Department

LPD Lakewood Police Dept.

BCSO Boulder County Sheriff's Office

PCSO Pitkin County Sheriff's Office

TABLE 2
COLORADO VALIDATION STUDY OF THE STANDARDIZED
FIELD SOBRIETY TEST (SFST) BATTERY
Participating Officers Ranked by Number (Estimated) of DUI Arrests

RANK	AGENCY	BADGE	NAME	1	2	3
1	CSP	39	Bruce L. Berry	23 yrs 5 mos	1985	1612
2	LPD	1511	Jeff Cohn	17 yrs	1985*	1000+
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4	LPD	1467	Steve C. Hipwell	11 yrs 8 mos	1985	600
5	LPD	1584	Mark G. Dewhurst	7 yrs	1988*	535
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11	APD	127	Jeff Harmon	5 yrs 6 mos	1990	120
12	APD	121	Dan Glidden	5 yrs 5 mos	1990	105
13	LPD	1592	Dutch A. Smith, Jr.	7 yrs 6 mos	1991	100+
14.5	PCS	65	Scott Thompson	5 yrs	1990	100
14.5	BPD	304	Lee Tos	6 yrs	1991	100
16	LPD	1583	Beck E. Leider	6 yrs 7 mos	1992	90
17	LPD	1557	Ernest E. Applegate	11 yrs 9 mos	1989	75
18.5	CSP	3101	Dan C. Gibbons	1 yr 6 mos	1993	50
18.5	BCS	576	Kevin E. Parker	10 yrs	1993	50
20.5	BCS	581	Terry Bierwiler	9 yrs	1987*	50
20.5	BCS	579	Michael P. Linden	5 yrs	1993	50
22	LPD	1609	William K. Csikos	2 yrs 8 mos	1992	40
23	BCS	575	Kyle S. Miller	6 yrs	1992	35
24	BCS	556	John Repjar	1 yr 6 mos	1994	30
25	LPD	1619	Eric P. Ebeling	5 yrs	1993	29
26.5	BPD	305	Christopher Maniscalchi	1 yr 9 mos	1993	25
26.5	APD	115	Sandy Brownlee	2 yrs 6 mos	1993	25
28	LPD	1603	Brent E. Sawyer	7 yrs	1993	23
29	LPD	1622	Tracie L. Kinderknecht	1 yr 9 mos	1993	15
30.5	APD	126	James A. Cannan	1 yr 8 mos	1995	5
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(1) Number of years/months employed in law enforcement as a sworn officer.

(2) Year trained with SFSTs

(3) Number (approximate) of DUI arrests since SFST training

* Officers have had additional training since the initial training in SFSTs.

APD	Aspen Police Department	CSP	Colorado State Patrol
BPD	Basalt Police Department	LPD	Lakewood Police Dept.
BCSO	Boulder County Sheriff's Office	PCSO	Pitkin County Sheriff's Office

Office. The materials forwarded to SCRI were:

- *Copies* of arrest reports, breath test records, and questionnaires
- *Original* checklists (officers and observers)

Under strict confidentiality procedures at SCRI, the documents were accessible only to the project staff.

G. Data Analysis

Data processing and analysis were carried out with NIDABASE software, which had been developed by SCRI under funding from the National Institute on Drug Abuse (Burns, 1990). NIDABASE was developed to record and analyze Drug Recognition Expert (DRE) evaluations of suspected drug-impaired drivers. The SFSTs are a core component of DRE evaluations, and information about them is recorded in detail; thus, it was possible to use NIDABASE for this project without modification. Date and time of arrest, demographic data, BAC, and other data from arrest records were also entered in standard format. An ADDON data base component was created to record additional variables of interest, including weather conditions, roadway type and condition, SFST surface conditions, subject clothing, subject residence, and BAC as obtained at roadside by PBT. NIDABASE and ADDON were linked for analysis.

NIDABASE is written in FOXBASE and provides powerful analytic capabilities. Three-level counts (e.g., BAC x AGENCY x GENDER) are made with simple keystroke commands and served in this study as an initial screening tool. Additional analysis was accomplished with data base interrogation via queries in logical-statement format.

Data analysis focused initially on questions of primary interest:

“What proportion of officers’ decisions were correct, as confirmed by breath tests?”

“How did correct and incorrect decisions relate to SFSTs and to BAC?”

“How did correct and incorrect decisions relate to weather conditions?”

As can be seen in the Results section, additional questions were also of interest.

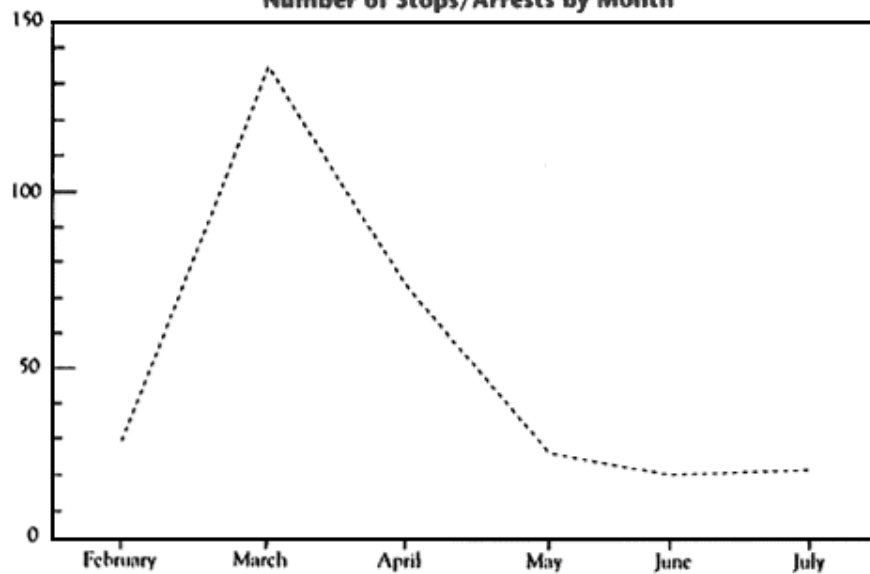
V. Results

Field data collection, which began on February 22, 1995, and concluded on July 30, 1995, yielded a total of 305 records. Three cases with incomplete documents could not be used. All complete records submitted by the officers and observers were legible and usable.

Because the data of primary interest to most readers of this report will be the accuracy of officers' decisions to arrest and release, a report of that analysis will follow a summary of the characteristics of the officers, observers, and the sample. Subsequent sections of the report will describe the drivers, circumstances and conditions at roadside, and additional analyses.

Records were obtained on 109 days. As can be seen in [Figure 2](#), the highest level of study activity occurred in March and April. The lower numbers during May, June, and July are believed to reflect a number of variables. The project was demanding, and the initial overall level of enthusiasm could not be expected to continue indefinitely. Also, the needs of the agencies for officer time for other duties changed over time. For example, problems associated with excessive rain and late-season snow created unusual demands on the participating agencies.

FIGURE 2
COLORADO VALIDATION STUDY OF THE SFSTs
Number of Stops/Arrests by Month



The numbers of records submitted by six agencies are listed below. To some extent, the differences in number of records parallel agency size.

Aspen Police Department (APD)	88
Basalt Police Department (BPD)	18
Boulder County Sheriff's Office (BCSO)	119
Colorado State Patrol (CSP)	17
Lakewood Police Department (LPD)	59
Pitkin County Sheriff's Office (PCSO)	4

Snowmass Village Police Department, one of the initial seven agencies, participated by sending personnel to a training session and providing an observer, but were unable to assign officers to the project and provided no records for the data base.

Correct and incorrect decisions by agency are tabled below. The numbers differ from those which appear above, because the table includes only cases for which BAC was determined by a breath or blood specimen. The BAC is unknown if a subject was released when no observer was present, or if an arrested driver refused to provide a specimen.

A. Officers

Thirty-one officers from six law enforcement agencies provided the study data. Seventeen of those individuals had dual roles in the project, serving on different occasions as law enforcement officers and as observers. Officer experience, which is graphed in [Figure 3](#), varied from one year to more than 23 years with an average of 7 years, 8 months ([Table 1](#)).

	APD		BPD		BCSO	
	No.	%	No.	%	No.	%
Correct Decisions:						
Arrested > 0.05%	42		8		65	
Released < 0.05%	11		1		13	
	53	78	9	82	78	88
Errors:						
Released > 0.05%	12		2		4	
Arrested < 0.05%	3		0		7	
	15	22	2	18	11	12
Total Number =	68		11		89	
	CSP		LPD		PCSO	
	No.	%	No.	%	No.	%
Correct Decisions:						
Arrested > 0.05%	5		42		1	
Released < 0.05%	3		7		3	
	8	89	49	92	4	100
Errors:						
Released > 0.05%	0		3		0	
Arrested < 0.05%	1		1		0	
	1	11	4	8	0	0
Total Number =	9		53		4	

Similarly, there were large differences in the total number of DUI arrests, as estimated by each officer (Table 2, Figure 4). The estimates ranged from five DUI arrests to more than 1600 with a mean of 239. It can be assumed that a number of variables, including duty assignments, agency size, and locale characteristics, contributed to the reported numbers to some degree. The length of time in law enforcement, however, largely accounts for differences between the officers. The correlation coefficient for length of service and number of arrests is statistically significant (Spearman $r = .75$, $p < .01$).

B. Observers

Table 3 lists 31 individuals who served the study as observers.

The asterisks identify 14 observers whose role was “observer only.” Some of these individuals were sworn peace officers, all were associated with law enforcement in some capacity, and all had received SFST training. The remaining 17 observers were officers who performed dual study roles, sometimes participating as an officer and sometimes as an observer. In total, 45 persons were involved in the data-gathering activities of the study.

The observers were diligent in completing the checklist of their observations. The errors by officers that they reported were relatively minor in nature.

TABLE 3
COLORADO VALIDATION STUDY OF THE STANDARDIZED
FIELD SOBRIETY TEST (SFST) BATTERY
Study Participants: Observers

Aspen Police Department

Fabrocini, Robert *
Kalkman, Gary W. *
Minard, Shawna *
Murray, Leon R. *
Pryor, Richard *
Ryerson, Loren H. *
Shinderman, Alan *
Bill Linn *

Basalt Police Department

Nye, Betty *
Calvano, Melinda *

Boulder County Sheriff's Office

Bierwiler, Terry
Linden, Michael P.
Miller, Kyle S.
Parker, Kevin E.
Repjar, John

Lakewood Police Department

Applegate, Ernest E.
Csikos, William
Cohn, Jeff
Dewhurst, Mark G.
Greenwell, Michael
Griffith, John E.
Hipwell, Steven C.
Kinderknecht, Tracie
Leider, Beck E.
Sawyer, Brent E.
Slater, Gregg
Smith, Dutch A., Jr.
Tenney, Phillip
Wilson, Patrick

Pitkin County Sheriff's Office

Benton, Brian *
Johnson, Elizabeth *

Snowmass Village Police Department

Vandemark, Sherry *

* Denotes "observer only"

C. Officers' Decisions

If breath or blood specimens had been obtained on all occasions and if measured BACs were now available for all subjects, the analysis of the officers' correct decisions and errors would be straightforward. With BACs unknown for more than 20% of the drivers, however, an analytic approach must be selected from several that are possible. A conservative analysis will be reported first; i.e., an analysis limited to cases with known BACs. Furthermore, the initial analysis allows no margin for instrument error in BAC measurements.

An additional analysis, in which clearly-stated assumptions have been made about unknown BAC values, will also be reported. Also, the data are provided in [Appendix IV](#). The list of all cases by BAC and case disposition will permit further analysis with different assumptions to be undertaken.

1. Correct Decisions and Errors for Subjects with Known BACs

The correctness of officers' decisions can be determined by measured BACs for 234 subjects ([Figure 5](#)). Breath or blood specimens were obtained from these subjects. Breath specimens were obtained either with instruments approved for evidential tests or with PBTs at roadside.

Under Colorado law ([Appendix I](#)), a driver commits an offense if he drives with a BAC > 0.05%. Therefore, the BAC arrest/release criterion for the [Figure 5](#) distribution of officer decisions is 0.05%. When the measured BACs are > 0.05% but < 0.10%, the drivers are charged with DWAI. When the BACs are ≥ 0.10%, they are charged with DUI.

**FIGURE 5
DECISION MATRIX**

Measured BAC	OFFICERS' DECISIONS	
	Arrest	Release
≥0.05%	1 Correct Arrest n=163	2 Incorrect Release n=21
<0.05%	3 Incorrect Arrest n=12	4 Correct Release n=38
	N=175	N=59

In reviewing the officers' decisions, notice that the drivers who were stopped were 3.7 times more likely to be above than to be below the 0.05% BAC limit, and they were 1.5 times more likely to be above than to be below the 0.10% limit. [Figure 6](#) and [Figure 7](#) graph the data given in the matrix of [Figure 5](#). [Table 4](#) summarizes the officers' correct decisions and errors.

FIGURE 6
COLORADO VALIDATION STUDY OF THE SFSTs
Arrest/Release Decisions for 234 Drivers with Measured BACs

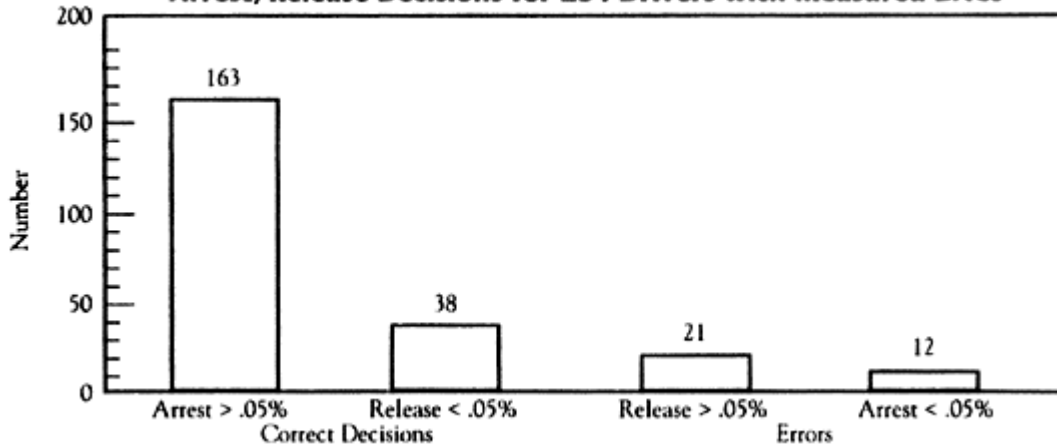


FIGURE 7
COLORADO VALIDATION STUDY OF THE SFSTs
Cases Without Measured BACs

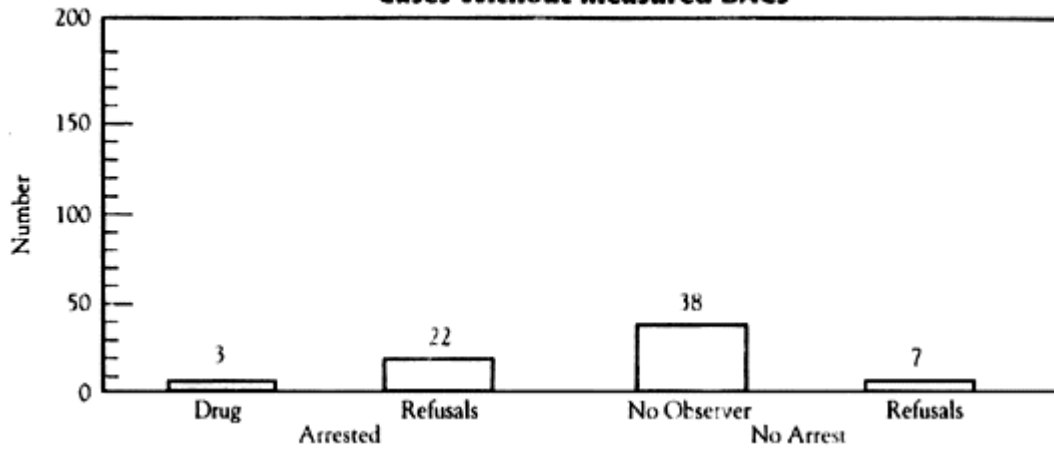


TABLE 4
COLORADO VALIDATION STUDY OF THE SFSTs
Officers' Correct Decisions and Errors, by a Measured BAC Criterion
234 Subjects

	SUBJECTS		ARRESTS		RELEASES	
	No.	%	No.	%	No.	%
Correct Decisions	201	86	163	93	38	64
Incorrect Decisions	33	14	12	7	21	36
Total	234		175		59	

In this analysis of 234 cases (77% of the total sample of 305):

93% of the decisions to arrest were correct.
64% of the decisions to release were correct.
86% of overall decisions to arrest or
release were correct.

For this analysis, BAC was the sole criterion by which officers' decisions were assessed, including borderline cases. For example, the measured BAC for Subject 17 was 0.05% ([Appendix IV](#)), and the officer's decision to release that driver was scored as an Incorrect Release. Subject 298's BAC was 0.048%, and the officer's decision to arrest was scored as an Incorrect Arrest. In these and in all cases, adherence to the 0.05% criterion was intentionally rigid in order to present the most stringent interpretation of officers' decisions.

The 0.10% criterion for a DUI charge dictated the entry of 133 arrests into the decision matrix as correct decisions. In addition, the criterion of >0.05 to <0.10% for a DWAI charge dictated the entry of 30 additional arrests for a total of 163 correct decisions.

With a BAC criterion of 0.05%, 38 decisions to release were correct. Cell 2, [Figure 5](#) shows that 21 released drivers should have been arrested under the Colorado statute. Fifteen were drivers with BACs of 0.05% to 0.099%. In those cases the officers failed to note sufficient

impairment to arrest the drivers, but the observers obtained breath specimens which indicated that the drivers should have been arrested on a DWAI charge. Under the same circumstances, six drivers were released and then found to have BACs of 0.10% or higher, thereby meeting the criterion for DUI arrest. It is of interest to observe that five of the latter group were borderline DUI cases (two BACs were 0.10%, three were 0.11%), and only one was relatively high at 0.16%.

The officers arrested 12 subjects whose BACs were lower than 0.050% (Cell 3). For these errors, as well as for the Incorrect Release errors reported above, measured BAC was the only criterion. The characteristics and circumstances of the twelve Incorrect Arrests are summarized in [Appendix V](#). It is of interest to also note that although women were only 18% of the sample of 305 subjects, they were 38% of the Incorrect Release, and 25% of the Incorrect Arrests.

2. Changes in the Distribution of Correct Decisions and Errors, Assuming a 0.08% DUI Statute

In a number of states the criterion BAC for DUI arrest is 0.08%. If the DUI statute in Colorado specified 0.08% instead of 0.05% and 0.10%, 12 subjects who were charged with DWAI would have been charged instead with DUI, and two Incorrect Release DWAI decisions would have been Incorrect Release DUI decisions. The relatively minor differences, which can be verified by referral to [Appendix IV](#), reflect in part the effect of having the DWAI statute in place in Colorado for lower BAC offenses. Also, the data can be interpreted as an indication that the SFSTs, which were standardized for 0.10% BAC, continue to serve officers well at BACs below 0.10%.

3. Correct Decisions and Errors for Total Sample

BACs are not available, or do not serve, as the criterion of officer accuracy for 71 cases. Breath specimens were obtained, but do not address the question at hand, for three subjects who were charged with being under the influence of a drug other than alcohol. Breath specimens were not obtained from 68 subjects for the following reasons:

		NUMBER OF SUBJECTS
Arrested:	Subject refused evidential breath test	22
Released:	Observer present at roadside but subjects refused to provide breath specimens	7
Released:	An observer was not present and a breath specimen was not obtained	<u>39</u>
		68

Although no precise assessment of officer accuracy can be made for cases without breath or blood specimens, further analysis can be based on arbitrary assumptions about the cases for which the BAC is unknown. Specifically, it has been assumed that 22 subjects (20 men, 2 women) refused evidential breath tests, because they had been drinking and expected the measured BAC to show them in violation of the Colorado statute. The average age of the men was just under 30 years. One woman was age 22 and the other was age 50. Both women were stopped after midnight, but the men were just as likely to be stopped before as after midnight, with the earliest arrest occurring at 2045 hours.

It was also necessary to make assumptions about subjects who refused a test by PBT after release at roadside. The reasons offered by six men and one woman do not clearly indicate whether or not they might have been drinking. The statement by one, who said he didn't trust the police and was fearful of being arrested, might be interpreted as an indication he had been drinking. Another subject "preferred not to," and another "didn't want to work with an outside agency." One driver didn't want to be further delayed in getting passengers home, and one man just said he wanted to exercise his right to refuse.

Assumptions about the BACs of both the roadside refusees (n=7) and the subjects who were released by officers when no observer was present to obtain a BAC (n=39) are based on the distribution of correct and incorrect decisions when BACs were known. When breath specimens were obtained from released drivers (n=59), 64% of the releases were correct decisions and 36% were incorrect decisions as confirmed by

measured BACs. If the BACs of the balance of the released subjects were distributed similarly, 29 would have been correct decisions and 17 would have been errors.

It has also been assumed that the three arrests on drug charges were correct. These assumptions add 25 additional arrests to the number of correct decisions.

In summary, for the analysis displayed in [Figure 8](#) the following assumptions have been made:

- Officers were correct in deciding to arrest subjects on drug charges (n=3).
- Subjects who refused an evidential breath test were at or above the criterion BAC for arrest, and their arrests were correct decisions (n=22).
- The BACs of released subjects for whom breath tests were not obtained were distributed in the same manner as the BACs for subjects who provided breath specimens. Specifically, 29 releases were correct decisions and 17 were errors.

Under the stated assumption, findings for the total sample do not change dramatically ([Figure 8, Table 5](#)).

94% of the decisions to arrest were correct.

64% of the decisions to release were correct.

84% of overall decisions to arrest or release were correct.

**FIGURE 8
DECISION MATRIX**

Measured BAC	OFFICERS' DECISIONS			
	Arrest		Release	
≥0.05%	1	Correct Arrest n=188	2	Incorrect Release n=38
<0.05%	3	Incorrect Arrest n=12	4	Correct Release n=67
	N=200		N=105	

**TABLE 5
COLORADO VALIDATION STUDY OF THE SFSTs
Officers' Correct Decisions and Errors, Total Sample
305 Subjects**

	SUBJECTS		ARRESTS		RELEASES	
	No.	%	No.	%	No.	%
Correct Decisions	255	84	188	94	67	64
Incorrect Decisions	50	16	12	6	38	36
Total	305		200		105	

The distribution of additional cases under these assumptions results in a lower incorrect arrest rate and a higher incorrect release rate than obtained for decisions with available BACs.

D. Drivers' BACs

The BACs of 234 drivers who provided breath and blood specimens ranged from 0.000% to 0.343%. The mean BAC, including both DUI and DWAI drivers, was 0.152%.

The 34 subjects, who elected to provide blood specimens, included many with high BACs. In fact, 42% of the BACs above 0.20% were measured with blood specimens. The range of BACs for subjects in this group was 0.076% to 0.324% with a mean of 0.187%. Only two drivers were below 0.10% and 22 were above 0.15%.

The distribution of BACs for drivers charged with DUI (X=0.170%, std.dev.=0.055%) can be seen in [Figure 9](#). That level, which is identical to the BAC reported for DUI drivers two decades ago (Burns and Moskowitz, 1977), raises important questions about citizens' drinking-driving practices, statutory limits, and enforcement:

- Do the high BACs of this study reflect the distribution of BACs among the driving population during the primary hours of DUI enforcement?
and/or
- Do the high BACs demonstrate that officers are able, by observation of driving behavior, to regularly detect high BACs and to less frequently detect low-to-moderate BACs?

and/or

- Do the high BACs demonstrate that the SFSTs and other roadside observations are sensitive and reliable indices only of high BACs?

FIGURE 9
COLORADO VALIDATION STUDY OF THE SFSTs

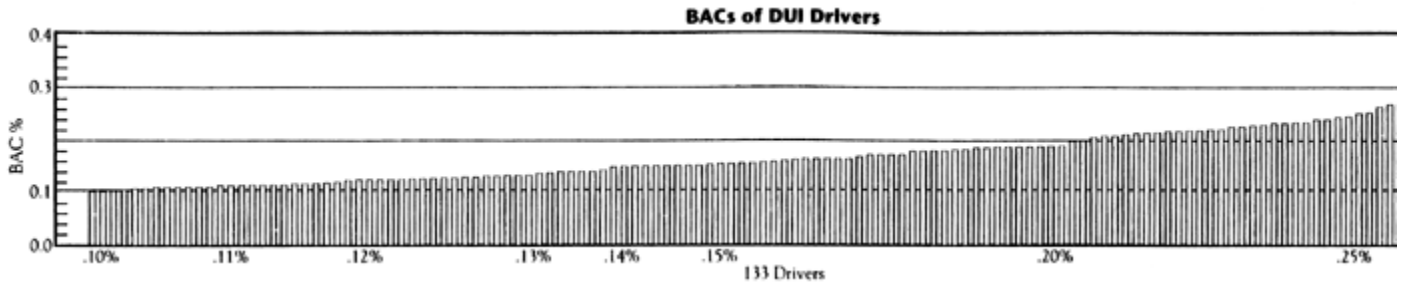
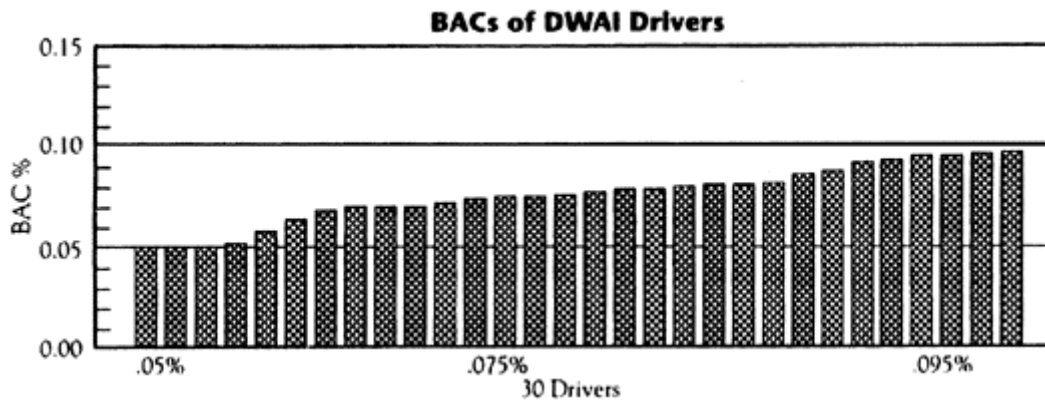


FIGURE 10
COLORADO VALIDATION STUDY OF THE SFSTs



The data from this validation study of the SFSTs do not fully address the questions, but further examination of the BAC distribution of the study subjects is of interest.

More than 60% of the driver contacts, for which breath or blood specimens subsequently were obtained, were with drivers whose BACs were 0.10% or higher. Although 10% (n=13) of DUI drivers were just at the statutory limit ($>0.10\% <0.11\%$), many others were driving with very high alcohol levels. Over half were 0.15% or higher. More than 25% were above 0.20%, and five drivers had BACs of 0.30% and higher.

There is no question that the task of detecting and arresting impaired drivers becomes more difficult at lower alcohol levels. Nonetheless, the officers in this study correctly arrested 30 DWAI drivers with a mean BAC of 0.076% (Figure 10), and correctly released 38 drivers whose BACs were below 0.05%.

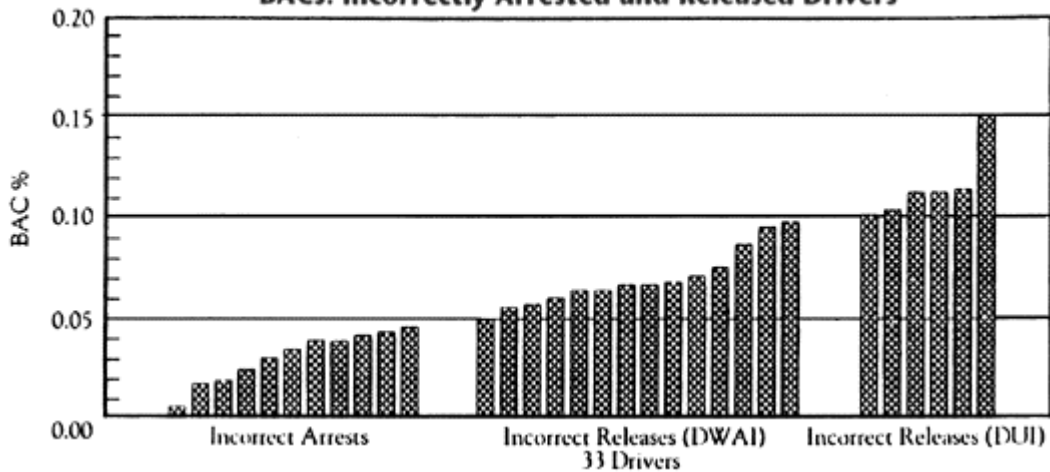
The discrimination task obviously is very difficult when the driver's BAC is near the limit, in this case 0.05%. It is instructive to notice, therefore, the Correct Arrests of five subjects with BACs $>0.05\% <0.06\%$ and the Correct Releases of seven subjects with BACs $>0.04\% <0.05\%$. Officers were able to make correct decisions in the range of $0.05\% +0.01\%$. Also, as can be seen in Appendix IV, only seven decisions in this BAC range were incorrect, and four decisions in the range $0.10\% +0.01\%$ were incorrect. The BACs associated with incorrect decisions are graphed in Figure 11.

E. Field Sobriety Tests

For the duration of this study, officers were restricted to using the three standardized tests, WAT, OLS, and HGN. Hence, decisions to arrest or release were based on performance of those tests together with observations of the driving pattern and the driver's behavior and appearance. Some of the information underlying an officer's decision is not documented and cannot be examined, but it was important to the objectives of this project to evaluate factors which were known. The analysis

was most straightforward for the SFSTs, for which standardized observations were recorded.

FIGURE 11
COLORADO VALIDATION STUDY OF THE SFSTs
BACs: Incorrectly Arrested and Released Drivers



1. Walk and Turn Test (WAT)

An officer may decide not to administer the WAT, a decision likely to be taken in cases of gross intoxication when the drivers appear to be incapable of doing the test or when they might fall and be injured. In this set of records, WAT was not administered to eight subjects. In an additional 24 cases, the subjects were instructed to perform the test but unable to complete it. With only a few exceptions, those subjects were at very high BACs. All were arrested.

Performance of the WAT is observed for the following possible errors:

- Improper turn
- Impaired balance
- Starts too soon
- Stops walking during first nine steps
- Stops walking during second nine steps
- Misses heel-to-toe during first nine steps
- Misses heel-to-toe during second nine steps
- Steps off line first nine steps
- Steps off line second nine steps
- Uses arms for balance during first nine steps
- Uses arms for balance during second nine steps
- Takes wrong number of steps first nine steps
- Takes wrong number of steps second nine steps

In these records, impaired balance was reported most often. Missing heel-to-toe during the first nine steps was observed with the second highest frequency and improper turns with the third highest frequency. Since the correct turn is an easily-performed maneuver, those errors are believed to reflect subjects' inability to sustain attention during the instruction phase. That is, the subjects might have been physically capable of doing the simple walk-around turn had they listened to the instructions. Because of alcohol impairment, however, they were unable to maintain a heel-to-toe position on the line and simultaneously attend to the instructions.

Subjects are instructed that once they begin the test they should not stop until they have completed it. If they do stop, it is scored as an error, but that error occurred relatively infrequently. For all of the observations scored separately for the first and second nine steps, errors occurred most frequently during the first set.

Although examination of individual records revealed that some subjects at low BACs performed the WAT without error, others at low

Sum of Scored Errors
No. Subjects x No. Possible Errors
PERCENT
ERROR

RANK ORDER

Arrests

DUI	42	2
DWAI	34	4
Incorrect Arrests	39	3
Refusals	46	1
Drug Charges	31	5

Releases

With known BACs:

Correct	17	6
Incorrect Release	16	7
Refusals	12	8
BAC unknown	9	9

and moderate BACs made many errors. It is not unexpected that balance and coordination can be affected by variables unrelated to alcohol (e.g., physical disabilities, age effects, nervousness in the circumstance of potential arrest). Nor is it unexpected that alcohol-tolerant individuals may complete the test with few errors even at moderate to high BACs. Given these sources of variability, further analysis was undertaken to clarify the contribution of the test to officers' decisions.

In the following summary, subjects are grouped by arrest or release status, and ranked in terms of WAT errors. The "percent error" score is the sum of errors scored by the officers for all subjects in the group, as a percent of the total possible errors for the group, i.e., see the following table.

The analysis indicates that, despite the variability in WAT performance, the test does aid officers in the field in making a correct decision. Ranks 2 and 4 for correct arrests (DUI and DWAI) indicate at minimum that officers' observations of WAT errors were consistent with BAC and impairment. It also can be concluded that Incorrect Arrest and Incorrect Release errors at Ranks 3 and 7 are attributable, at least in part, to observations of WAT performance. Notice that the highest percentage of errors, Rank 1, was scored for WAT performance by arrested subjects who refused to provide a breath specimen. This finding lends support to the previously-stated assumption; namely, that subjects refuse to provide specimens when they know that the test will reveal high BACs.

2. One Leg Stand (OLS)

As with the WAT, the OLS is not administered to a driver who appears to be incapable of doing it and might be harmed if the test were attempted. In this study, the officers did not administer the test to 14 subjects, all of whom were arrested.

Performance of the OLS is observed for the following possible errors:

- Sways
- Raises arms
- Foot down
- Hops
- Number of times foot down

Swaying and raising the arms for balance were the most frequently reported errors. Roughly 100 subjects swayed and raised their arms during the OLS. Although a larger proportion of arrested subjects exhibited these symptoms, they were observed to some extent in all groups, both arrested and released.

Could Not Complete OLS (% of Group)

Arrests

DUI	30
DWAI	11
Incorrect Arrests	0
Refusals	32
Drug Charges	67

Releases

With known BACs:

Correct Releases	3
Incorrect Releases	0
Refusals	0

BAC unknown

0

Interestingly, the measure which in these data best discriminates between the drivers (grouped as arrests and releases) is "Cannot do test." Of 53 subjects, who made one or more attempts to perform the test and were unable to complete it, all except one were arrested. Also, as can be seen below, two of the three subjects arrested on drug charges could not complete the OLS. Almost one-third of those charged with DUI and those who refused to provide a specimen were unable to complete the OLS.

3. Horizontal Gaze Nystagmus (HGN)

HGN occurs in the presence of substances, which are referred to among Drug Recognition Experts as the D-I-P drugs: depressants (including alcohol), inhalants, and phencyclidine. Because HGN occurs in alcohol-tolerant drinkers, as well as in infrequent or light-to-moderate drinkers, it more reliably detects the presence of alcohol than do the WAT and OLS. Although its use as a SFST was established for a BAC of 0.10%, police officers from states with a 0.08% BAC statute report that it reliably discriminates at the lower level (personal communica-

tions). Wilkinson et al. (1974) reported that smooth pursuit movement breaks down at BACs as low as 0.04%, but controlled laboratory research at low BACs is needed to examine the three HGN signs (see items 1-3 below), which officers rely on as indices of alcohol.

In a recent report, Kennedy et al. (1994) reported that HGN was the best predictor of BAC in three large laboratory experiments. The subjects were tested with the SFST battery and with a battery of cognitive tests. A code substitution was consistently the best cognitive test, and HGN was the best of the field sobriety tests.

The basic requirements for examination of the eyes for HGN are only that the officer must be able to see the subject's eyes and the subject must be able to see the stimulus object. No special apparatus or conditions are necessary. The officer instructs the subject to hold his/her head still and to follow the movement of a stimulus (e.g., a pen, pen-light, or finger) with the eyes. The officer observes each of the subject's eyes for three signs:

- (1) the ability of the eye to smoothly track or pursue the stimulus as it moves left and right in the subject's visual field.

A lack of smooth pursuit movement is consistent with the presence of a D-I-P drug.

- (2) the presence and the amplitude of a jerking movement, which may occur when the eyes have deviated as far as possible to the extreme side of the visual field.

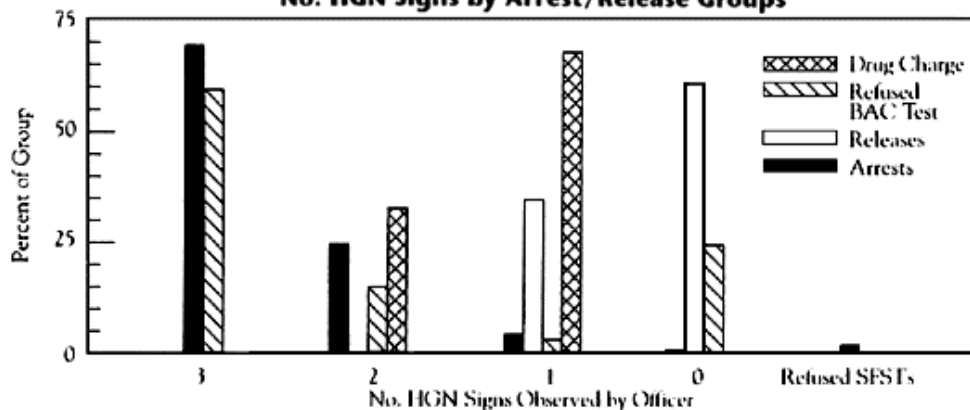
A distinct jerking is consistent with the presence of a D-I-P drug.

- (3) the angle of the eye's gaze when the first nystagmus jerking occurs; i.e., the angle of onset.

Jerking which occurs prior to a 45 degree angle of gaze and persists when the stimulus is held in one position indicates the presence of a D-I-P drug.

In the records obtained during this study, arrest/release decisions were strongly linked to the presence or absence of HGN signs (Figure 12). The officers made 98 DUI arrests of subjects for whom they reported all three signs; the mean BAC was 0.172%. For 24 DUI subjects with distinct jerking at maximum deviation and lack of smooth pursuit, the mean BAC was 0.154%. The officers did not report onset prior to 45 degrees for these cases.

FIGURE 12
COLORADO VALIDATION STUDY OF THE SFSTs
No. HGN Signs by Arrest/Release Groups



Three DUI subjects who could not or would not follow instructions for the HGN examination had a mean BAC of 0.223%. Twenty-eight of the 30 DWAI subjects displayed either two or three signs and had a mean BAC of 0.076%. In contrast, no signs were seen for 23 of the 38 subjects who were correctly released, and no released subject had shown all three signs. Officers did observe all three signs of HGN in 17 of the subjects who refused to provide breath or blood specimens, again suggesting that at least some of the subjects who refused to provide a specimen feared that a test would reveal a high BAC.

4. SFSTs and Incorrect Arrests

Since the measured BACs for twelve arrested subjects were found not to support the arrests, those arrests are classified as Incorrect Arrests. Whether the subjects were impaired by other substances or causes or whether the officers' observations were in error cannot be determined retrospectively, but further examination of the records is of interest.

Because the record for a 72-year-old female is incomplete, only eleven subjects entered a case-by-case analysis. In general, the reported SFST performance supports the arrest decision. Ten drivers admitted having drunk some alcohol. Taking into account the elapsed time

between the decision to arrest and the obtaining of specimens, it is possible that three of the subjects' BACs were 0.05% or higher at roadside (control numbers 112, 294, and 298).

All eleven subjects performed poorly on WAT and OLS. Also, in reporting HGN signs, the officers noted a lack of smooth pursuit for ten subjects and distinct nystagmus at extreme deviation for six. An onset angle prior to 45 degrees was observed for one. It is difficult to interpret these HGN observations since the research, which established the test battery for arrests at >0.10% BAC, did not address questions of lower alcohol levels.

It is possible that lack of smooth pursuit and distinct nystagmus at maximum deviation occur at low BACs with some subjects but not with others, or on some occasions but not others. It is possible that these subjects had combined low levels of alcohol with some other nystagmus-producing substances. Also, of course, it is possible that the officers erred in their observations. Research has not yet clearly defined HGN signs for low BACs.

5. SFSTs and Incorrect Releases

Twenty-one subjects were released incorrectly, as determined by BAC measurement by observers. As would be expected, in comparison to the observations reported for incorrect arrests, officers reported fewer symptoms associated with alcohol for released drivers. For nystagmus, an onset angle of less than 45 degrees was noted in only one subject (BAC 0.099%). Officers reported a lack of smooth pursuit in 14 of the 21 cases and distinct nystagmus at maximum deviation in five cases. Although these subjects did make errors on the WAT and OLS, at least half performed them reasonably well. Overall, the records reflect much better balance and walking than reported for Incorrect Arrests.

The alcohol-tolerant individual, of course, may be able to perform WAT and OLS without showing serious impairment. It is not clear, however, why a subject with onset angle less than 45 degrees was not arrested, or why HGN signs were not noted in subjects with BACs of 0.10% and higher.

F. Observer Records

The observers most frequently reported that officers' instructions, demonstrations, and administrations of the SFSTs at roadside were without error. Errors were noted on 13 occasions. They noted some deficiency in *instructions* six times. The *demonstrations of WAT and OLS* were incorrect one time each, and *administration of HGN* was reported to be flawed on five occasions. There is no evidence that the errors, which were relatively minor (e.g., "started on subject's right side" "not told to point toe down"), were associated with incorrect decisions.

G. Driver Characteristics

Study subjects were 249 male and 56 female drivers whose vehicles were stopped during the study period and who were asked to perform the SFSTs at roadside. Males were 82% and females were 18% of the total sample. In comparison, 75% of drivers involved in fatal alcohol crashes nationwide in 1994 were male and 25% were females (NHTSA, 1995).

More than 80% (n=250) of the stops occurred because the officers observed driving behavior which led them to believe the driver might be impaired. There also were equipment violations (n=43) and other reasonable suspicion (n=30), which sometimes occurred in combination with the observations of driving error and sometimes as a single indicator. Open containers were found in 21 vehicles, and 27 stops were made on a holiday or holiday weekend (St. Patrick's Day, Memorial Day, Independence Day).

As can be seen in the tables of subject characteristics ([Table 6](#) and [Table 7](#)), the data are incomplete for certain variables. For the most part, this clearly was not a matter of carelessness by the officers. Rather, it reflects the fact that agency policies and arrest forms differ in terms of the information about subjects which is routinely recorded.

Although ethnicity is known for many of the drivers, it was not reported on approximately one-third of the records. Similarly, occupation was not reported for almost one-half of the subjects. The incomplete ethnicity and occupation data are reported here as a matter of interest but with the caution that they do not support any conclusions

about study subjects on these characteristics. It remains unknown whether the subjects are representative of the total population from which the sample was drawn or whether members of particular ethnic groups and occupations are under- or over-represented.

TABLE 6
COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY
Ethnicity of Drivers

	Total Sample	AGENCIES					
		APD	BPD	BCSO	CSP	LPD	PCSO
Asian	4	2	1	1	–	–	–
Black	2	–	–	1	–	1	–
White							
Caucasian	159	47	3	66	7	35	1
Hispanic	42	4	3	18	2	15	–
Unknown	<u>98</u>	<u>35</u>	<u>11</u>	<u>33</u>	<u>8</u>	<u>8</u>	<u>3</u>
	305	88	18	179	17	59	4

TABLE 7
COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY
Drivers' Occupations

	Total Sample	AGENCIES					
		APD	BPD	BCSO	CSP	LPD	PCSO
Unemployed	8	1	–	3	–	4	–
Unskilled	10	1	–	4	–	5	–
Semiskilled	30	7	1	17	–	5	–
Skilled	88	26	–	33	3	26	–
Professional	18	1	–	12	–	5	–
Student	9	4	–	3	1	1	–
Unknown	<u>142</u>	<u>48</u>	<u>17</u>	<u>47</u>	<u>13</u>	<u>13</u>	<u>4</u>
	305	88	18	119	17	59	4

The drivers' ages are summarized in [Table 8](#) and graphed in [Figure 13](#) and [Figure 14](#). Although ages are not known for 19 drivers, the sample can be characterized as a predominantly young group. Twelve men and one woman were under age 21, and more than two-thirds of the total group were ages 21 to 40 years. Only 14 people were older than 50 years. Also, as can be seen in [Figure 14](#), the women were slightly younger than the men.

TABLE 8
COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY
Drivers' Ages

AGES (YRS.)	TOTAL SAMPLE		MEN		WOMEN	
	No.	%	No.	%	No.	%
<21	13	4.3	12	4.8	1	1.8
21-30	114	37.4	91	36.6	23	41.1
31-40	91	29.8	73	28.9	19	33.9
41-50	54	17.7	43	17.3	11	19.6
51-60	9	3.0	9	3.6	0	
61-70	4	1.3	4	1.6	0	
>70	1	0.3	0		1	1.8
Not reported	<u>19</u>	<u>6.2</u>	<u>18</u>	<u>7.2</u>	<u>1</u>	<u>1.8</u>
	305	100.0	249	100.0	56	100.0

Given that the study was conducted during the ski season of late winter and spring, some of the detained drivers in the mountain communities were expected to be tourists. Since alcohol effects might be especially acute among recent arrivals who had not adapted to the altitude, the officers inquired about residence status. Most of the detained drivers were found to be local residents; only 41 were tourists. Overall, the proportion of correct decisions was similar for locals and tourists (67% vs. 61%), but 65% of residents were arrested in comparison to 40% of the tourists. The data do not support an examination which

FIGURE 13
COLORADO VALIDATION STUDY OF THE SFSTs

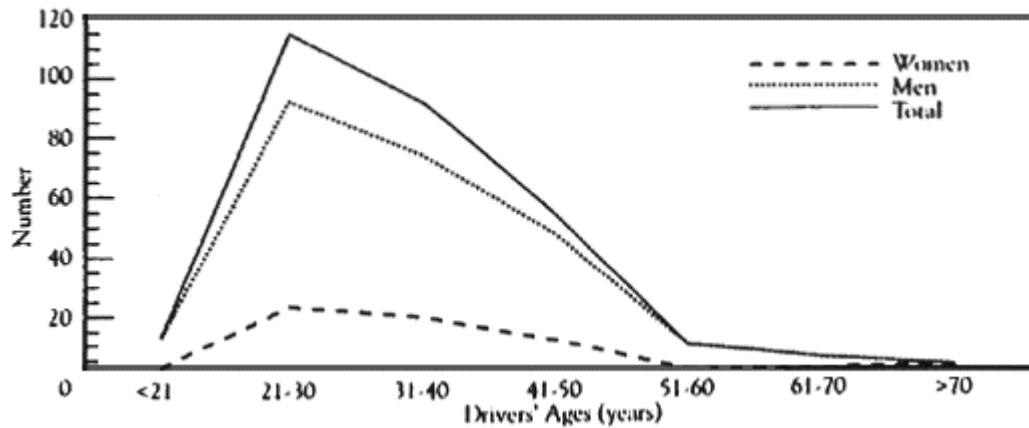
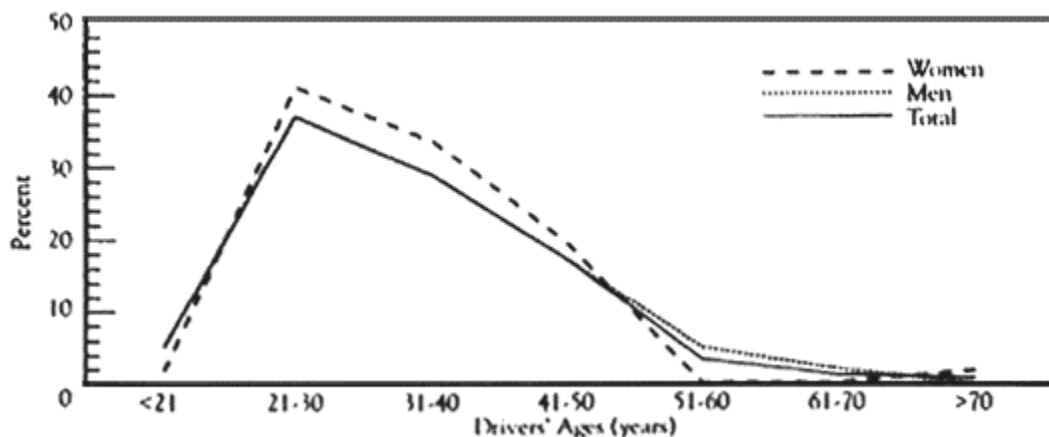


FIGURE 14
COLORADO VALIDATION STUDY OF THE SFSTs



might explain the observed differences.

Since it was likely that on some occasions the SFSTs would be given during severe weather, it was relevant to note whether the driver's clothing was adequate for the conditions. In most cases, officers considered it adequate, but they did note that 18 drivers were not dressed appropriately.

The question of interest is whether drivers' discomfort might affect roadside testing. Although the numbers are small, the direction of an observed change is of some interest. Specifically, the rate of Incorrect Release decisions was higher for drivers who were not adequately clothed; i.e., subjects were released who should have been arrested.

It is important to recognize, however, that the data suggest increased error by the officers rather than poor performance by subjects due to the cold. Poor performance of the SFSTs by the subjects would be expected to inflate Incorrect Arrest decisions. The finding of more Incorrect Release decisions suggests instead that officers may have acted quickly out of a concern for the subjects' discomfort.

Also in regard to subjects' clothing, it is widely assumed that shoes will affect the ability to walk and balance, as required by the SFSTs. For that reason, drivers often were given the option of removing high heels or other footwear that might impede performance on WAT or OLS. Since that would not have been an attractive option during weather that was expected to be often cold and wet, the officers were asked to record the type of shoes worn by drivers. Interestingly, it appears that the SFST performance was not affected by type of footwear. The distribution of correct and incorrect decisions was almost identical for drivers wearing cowboy boots or "heels" as for drivers wearing shoes with low heels.

H. Environment and Weather Conditions

An objective of the study was the examination of officers' accuracy as a function of different conditions at roadside. Toward that end, it was necessary to obtain information about environment and weather variables, which may bear some relationship to the probability of observing and stopping vehicles being operated by impaired drivers, as well as to the correct assessment of impairment based on the driver's performance of SFSTs.

The proximity of bars and taverns was the circumstance most often associated with stopping a vehicle. Not surprisingly, two-thirds of the stops were made on city streets (Table 9). Only 41 stops were made on rural roads. As would be expected, the more urban agencies made most of their stops on city streets whereas officers of Basalt Police Department made most of their stops on rural roads.

More stops and arrests occurred on weekend nights (Figure 15). In that respect, the data very closely parallel national data for alcohol-involved fatal crashes (NHTSA, 1995). Essentially all (97%) of the DUI stop/arrest activity occurred during hours of darkness (Figure 16). The locale of 128 stops was described as entirely dark and the locale of 168 stops was described as dark with lighting. The data provide no evidence that lighting conditions affected roadside activities and decisions in any way. Presumably, vehicle lights and flashlights suffice for roadside testing.

Contrary to expectations, conditions at roadside during this study were largely favorable. Data collection originally was scheduled to begin during December or January, but during those months officer time was required for law enforcement duties, including extra duties associated with very severe winter weather. Unfortunately for study objectives, data collection could not begin until February. It then continued into spring months, a period of wet but mild weather.

FIGURE 15
COLORADO VALIDATION STUDY OF THE SFSTs
Stops and Arrests by Day of Week

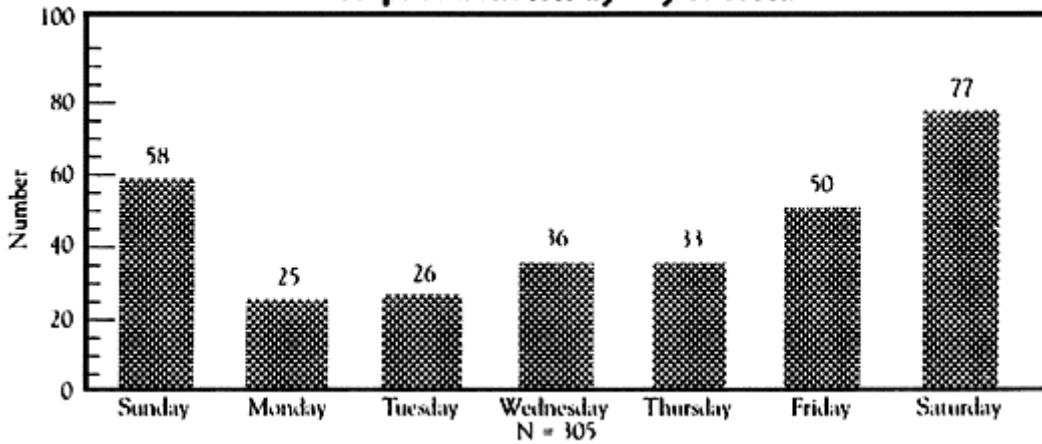
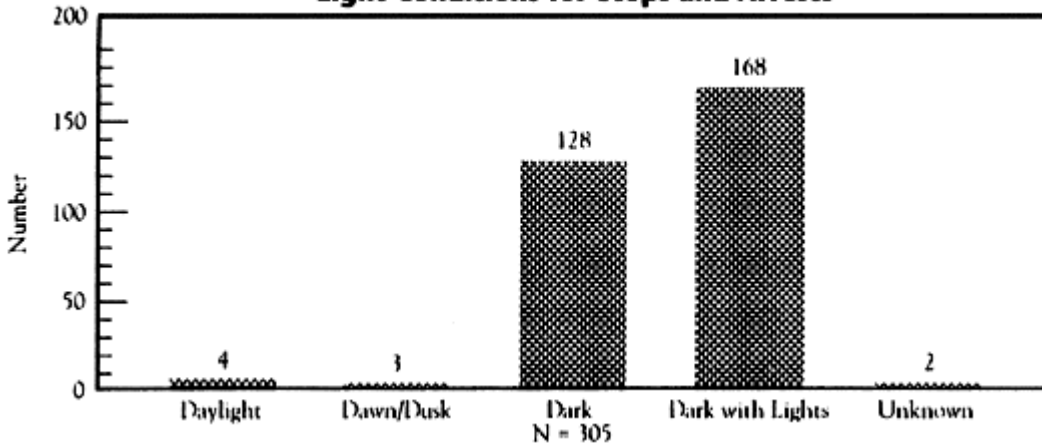


FIGURE 16
COLORADO VALIDATION STUDY OF THE SFSTs
Light Conditions for Stops and Arrests



as mild to moderate. The only exceptions were four occasions of heavy snow, and six occasions of strong wind. Five arrests and three releases made under those adverse conditions were correct, as confirmed by breath tests. One release was incorrect, and one arrested subject refused to provide a breath specimen. These very limited data suggest that Colorado law enforcement officers' decisions are not affected by severe weather.

or costs levied against a person convicted of a violation of subsection (1) or (2) of this section, sixty dollars shall be assessed by the judge against each such person for the cost of the presentence alcohol and drug evaluation and supervision services. After July 1, 1980, and each fiscal year thereafter, the amount shall remain at sixty dollars unless the division of alcohol and drug abuse has provided to the general assembly a statement of the cost of the program, including costs of administration for the past and current fiscal year to include a proposed change in the assessment. The general assembly shall then consider the proposed new assessment and approve the amount to be assessed against each person during the following fiscal year in order to ensure that the alcohol and drug driving safety program established in this subsection (10) shall be financially self-supporting. Any adjustment in the amount to be assessed shall be so noted in the appropriation to the division of alcohol and drug abuse as a footnote or line item related to this program in the general appropriation bill. The state auditor shall periodically audit the costs of the programs to determine that they are reasonable and that the rate charged is accurate based on these costs. Any other fines, fees, or costs levied against such person shall not be part of the program fund. The amount assessed for the alcohol and drug evaluation shall be transmitted by the court to the state treasurer to be credited to the alcohol and drug driving safety program fund. Fees charged under sections 25-1-306 (1), C.R.S., and 25-1-1102 (1), C.R.S., to approved alcohol and drug treatment facilities that provide level I and level II programs as provided in paragraph (c) of this subsection (10) shall be transmitted to the state treasurer, who shall credit the fees to the alcohol and drug driving safety program fund. Upon appropriation by the general assembly, these funds shall be expended by the division of alcohol and drug abuse for the administration of the alcohol and drug driving safety program. In administering the alcohol and drug driving safety program, the division of alcohol and drug abuse is authorized to contract with any agency within the judicial system for such services as the division deems necessary. Moneys deposited in the alcohol and drug driving safety program fund shall remain in said fund to be used for the purposes set forth in this subsection (10) and shall not revert or transfer to the general fund except by further act of the general assembly.

(e) The division of alcohol and drug abuse shall establish an alcohol and drug driving safety program suited to the needs of each judicial district. In establishing these programs, the division shall consult with local treatment programs. The division shall also insure that qualified personnel are placed in the judicial districts and shall establish criteria for evaluation techniques, drinker classification, data reporting, client supervision, and program evaluation.

(f) The alcohol and drug driving safety program shall cooperate in providing services to a defendant who resides in a judicial district other than the one in which the arrest was made. Alcohol and drug driving safety programs may cooperate in providing services to any defendant who resides at a location closer to another judicial district's program. The requirements of this subsection (10) shall not apply to persons who are not residents of Colorado at the time of sentencing.

(g) The provisions of this subsection (10) are also applicable to any defendant who receives a deferred prosecution in accordance with section 16-7-401, C.R.S., or who receives a deferred sentence in accordance with section 16-7-403, C.R.S., and the completion of any stipulated alcohol evaluation, level I

VI. Summary and Discussion

In 1995, there is a sound base of scientific evidence to support the use of 0.10%, 0.08%, and 0.05% BACs as presumptive and per se alcohol limits for drivers. There also appears to be strong support for those statutes among citizens throughout broad (though not all) segments of society. A clear-cut shift of attitude over the past ten to fifteen years has resulted in anti-drunk driving sentiments by much of the driving population. In many social circles drinking-and-driving now is unacceptable behavior.

Why then, in a largely pro-alcohol enforcement climate, are there negative views of traffic officers' related activities? Citizens often seem to believe that enforcement is hit-or-miss and that officers regularly fail to remove many, if not most, alcohol-impaired drivers from the roadway. Some also seem to believe that the activities at roadside are arbitrary and calculated to harass. Although the multifaceted social and individual variables that underlie this paradox of concurrent anti-enforcement sentiment and anti-drunk driving sentiment are beyond the scope of this report, it is germane to consider one set of factors. At least part of this view of alcohol enforcement is attributable to a general failure to recognize the importance of traffic officers' duties, and to understand not only what their duties encompass but also the difficulty of their task.

Legislators, regulatory agencies, activists groups, and safety-conscious citizens alike sometimes appear to overlook the fact that traffic officers are pivotal in the deterrence of drunk driving. Unless officers are able to detect and arrest impaired drivers, those drivers will never enter the system of sanctions and, therefore, the existence of enabling statutes and anti-drunk driving sentiment will be largely irrelevant to them. Unfortunately, it is also true that the escape of detection and arrest on multiple occasions serves to reinforce the risky behavior. In effect, if no accident and no arrest occur on one or more occasions of drinking and driving, the citizen may conclude that driving after drinking is acceptable behavior on other occasions.

For a number of reasons, the difficulties associated with traffic officers' alcohol-enforcement responsibilities typically are underestimated. One reason is the misnomer "drunk driving," which suggests that their duty is to apprehend "drunks" or obviously-intoxicated individuals. If that were indeed the sole definition of alcohol enforcement duties, the task would be fairly straightforward. In reality, the risks associated with drinking and driving are not limited to obviously-intoxicated drivers, nor are officers' enforcement responsibilities restricted to those drivers.

Traffic officers are responsible for removing alcohol-impaired drivers from the roadway, and the Colorado statute sets the criterion alcohol levels at 0.10% and 0.05% BAC. In other jurisdictions the BAC limit is 0.08%, with additional lower levels for lesser charges and specific driver groups. Enforcement problems arise in part from the fact that although the evidence clearly establishes that driving skills are impaired at 0.10% BAC and lower, many, possibly even most, individuals who are willing to drive after drinking are not obviously intoxicated at those levels.

Leaving aside the problem of detecting alcohol impairment by the observation of driving behaviors, consider officers' task once they stop vehicles and contact drivers at roadside. Working under widely-varying conditions without special measurement apparatus, they must decide within a few minutes whether a specific driver is impaired by alcohol. Impaired drivers may or may not display atypical speech, appearance, or other personal characteristics, but in either circumstance the officers have no knowledge of any given driver's sober appearance and behavior. The task is further complicated by the tolerant drinker's normal appearance even at very high BACs.

Are there signs and symptoms which are reliably associated with 0.05% and 0.10%? With what level of confidence can the officer arrest or release a driver? With a decision criterion that minimizes incorrect arrests, the risk of releasing impaired drivers rises. On the other hand, a very strict decision criterion will decrease the number of impaired drivers who are released but at the risk of unnecessarily detaining non-impaired drivers. Is one risk preferable to the other? These questions

define the context of traffic officers' alcohol enforcement activities and the background of the Colorado Validation Study of the SFSTs.

The records collected and analyzed during this study provide evidence that the SFSTs, as used at roadside by trained and experienced law enforcement officers, are valid indices of the presence of alcohol.

Records of all driver contacts, which resulted in administration of the SFSTs during the study period, were entered into the analysis. Overall, for 234 cases confirmed by breath or blood tests, officers' decisions to arrest and release were 86% correct, and 93% of their arrest decisions were correct.

It was not unexpected to find that officers were almost twice as likely to release incorrectly as to arrest incorrectly. Nonetheless, only 36% of the released drivers were at or above the statutory limit.

These findings obtained in the field with officers experienced with the use of SFSTs can be compared with findings from a laboratory setting with officers recently trained with the SFSTs. It should be kept in mind that the current data are not fully comparable to data from laboratory experiments, since there are differences other than time-since-training and laboratory vs. field. With that caution, the comparisons are instructive.

In an initial study of field sobriety tests with 238 laboratory subjects, officers' decisions overall were 76% correct (Burns and Moskowitz, 1977). Only 54% of their arrest decisions were correct, and only 8% of their release decisions were incorrect. In a second laboratory study, officers' decisions overall were 81% correct, their arrest decisions were 68% correct, and 14% of their release decisions were wrong (Tharp, Burns and Moskowitz, 1981). It is apparent that the arrest criterion was lower in the laboratory. The penalties for mistakes in a laboratory setting are, of course, fairly trivial compared to a real-world setting. The lower criterion, together with lack of experience with the tests, accounts for higher rates of incorrect arrests and lower rates of incorrect releases than found in this study. It is not surprising to find that officers in the field require more certainty about arresting a citizen and adopt a higher criterion with the result that they err in the direction of incorrect releases.

In summary, the data provide clear-cut findings about the use of SFSTs by officers in six Colorado communities. On a broader scale, they provide partial and tentative answers to some important questions. It is hoped that current data from a field setting will facilitate court proceedings with drivers arrested on DUI and DWAI charges. It is hoped, too, that the content of this report will add to the driving public's understanding of roadside enforcement activities, as well as to recognition of police officers' critical role in traffic safety.

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alcohol between the time that the defendant stopped driving and the time that testing occurred, such issue shall be an affirmative defense, and the prosecution must establish beyond a reasonable doubt that the minimum 0.10 blood or breath alcohol content required in this paragraph (a) was reached as a result of alcohol consumed by the defendant before the defendant stopped driving.

(b) In any prosecution for a violation of this subsection (2), the defendant shall be entitled to offer direct and circumstantial evidence to show that there is a disparity between what the tests show and other facts so that the trier of fact could infer that the tests were in some way defective or inaccurate. Such evidence may include testimony of nonexpert witnesses relating to the absence of any or all of the common symptoms or signs of intoxication for the purpose of impeachment of the accuracy of the analysis of the person's blood or breath. (c) Pursuant to section 16-2-106, C.R.S., in charging a violation of this subsection (2), it shall be sufficient to describe the offense charged as "drove a vehicle with excessive alcohol content".

(3) The offenses described in subsections (1) and (2) of this section are strict liability offenses. (4) Notwithstanding the provisions of section 18-1-408, C.R.S., during a trial of any person accused of violating paragraph (a) of subsection (1) and subsection (2) of this section, the court shall not require the prosecution to elect between the two violations. The court or a jury may consider and convict the person of either paragraph (a) or paragraph (b) of subsection (1) or subsection (2), or both paragraph (a) of subsection (1) and subsection (2), or both paragraph (b) of subsection (1) and subsection (2) of this section. If the person is convicted of more than one violation, the sentences imposed shall run concurrently.

(5) In any prosecution for a violation of paragraph (a) or (b) of subsection (1) of this section, the amount of alcohol in the defendant's blood or breath at the time of the commission of the alleged offense or within a reasonable time thereafter, as shown by analysis of the defendant's blood or breath, shall give rise to the following presumptions:

(a) If there was at such time 0.05 or less grams of alcohol per one hundred milliliters of blood as shown by analysis of such person's blood or if there was at such time 0.05 or less grams of alcohol per two hundred ten liters of breath as shown by analysis of such person's breath, it shall be presumed that the defendant was not under the influence of alcohol and that the defendant's ability to operate a vehicle was not impaired by the consumption of alcohol.

(b) If there was at such time in excess of 0.05 but less than 0.10 grams of alcohol per one hundred milliliters of blood as shown by analysis of such person's blood or if there was at such time in excess of 0.05 but less than 0.10 grams of alcohol per two hundred ten liters of breath as shown by analysis of such person's breath, such fact shall give rise to the presumption that the defendant's ability to operate a vehicle was impaired by the consumption of alcohol, and such fact may also be considered with other competent evidence in determining whether or not the defendant was under the influence of alcohol.

(c) If there was at such time 0.10 or more grams of alcohol per one hundred milliliters of blood as shown by analysis of such person's blood or if there was at such time 0.10 or more grams of alcohol per two hundred ten liters of breath as shown by analysis of such person's breath, it shall be presumed that the defendant was under the influence of alcohol.

Appendix I

Colorado Statute

ALCOHOL AND DRUG OFFENSES

42-4-1301. Driving under the influence - driving while impaired - driving with excessive alcoholic content - tests - penalties - useful public service program - alcohol and drug driving safety program. (1) (a) It is a misdemeanor for any person who is under the influence of alcohol or one or more drugs, or a combination of both alcohol and one or more drugs, to drive any vehicle in this state.

(b) It is a misdemeanor for any person who is impaired by alcohol or by one or more drugs, or by a combination of alcohol and one or more drugs, to drive any vehicle in this state.

(c) It is a misdemeanor for any person who is an habitual user of any controlled substance defined in section 12-22-303 (7), C.R.S., to drive any vehicle in this state.

(d) For the purposes of this subsection (1), one or more drugs shall mean all substances defined as a drug in section 12-22-303 (13), C.R.S., and all controlled substances defined in section 12-22-303 (7), C.R.S., and glue-sniffing, aerosol inhalation, and the inhalation of any other toxic vapor or vapors.

(e) The fact that any person charged with a violation of this subsection (1) is or has been entitled to use one or more drugs under the laws of this state shall not constitute a defense against any charge of violating this subsection (1).

(f) "Driving under the influence" means driving a vehicle when a person has consumed alcohol or one or more drugs, or a combination of alcohol and one or more drugs, which alcohol alone, or one or more drugs alone, or alcohol combined with one or more drugs affects the person to a degree that the person is substantially incapable, either mentally or physically, or both mentally and physically, to exercise clear judgment, sufficient physical control, or due care in the safe operation of a vehicle.

(g) "Driving while ability impaired" means driving a vehicle when a person has consumed alcohol or one or more drugs, or a combination of both alcohol and one or more drugs, which alcohol alone, or one or more drugs alone, or alcohol combined with one or more drugs, affects the person to the slightest degree so that the person is less able than the person ordinarily would have been, either mentally or physically, or both mentally and physically, to exercise clear judgment, sufficient physical control, or due care in the safe operation of a vehicle.

(h) Pursuant to section 16-2-106, C.R.S., in charging a violation of paragraph (a) of this subsection (1), it shall be sufficient to describe the offense charged as "drove a vehicle under the influence of alcohol or drugs or both". (i) Pursuant to section 16-2-106, C.R.S., in charging a violation of paragraph (b) of this subsection (1), it shall be sufficient to describe the offense charged as "drove a vehicle while impaired by alcohol or drugs or both".

(2) (a) It is a misdemeanor for any person to drive any vehicle in this state when the amount of alcohol, as shown by analysis of the person's blood or breath, in such person's blood is 0.10 or more grams of alcohol per hundred milliliters of blood or 0.10 or more grams of alcohol per two hundred ten liters of breath at the time of driving or within two hours after driving. During a trial, if the state's evidence raises the issue, or if a defendant presents some credible evidence, that the defendant consumed

(d) The limitations of this subsection (5) shall not be construed as limiting the introduction, reception, or consideration of any other competent evidence bearing upon the question of whether or not the defendant was under the influence of alcohol or whether or not the defendant's ability to operate a vehicle was impaired by the consumption of alcohol.

(6) Following the lawful contact with a person who has been driving a vehicle, and when a law enforcement officer reasonably suspects that a person was driving a vehicle while under the influence of or while impaired by alcohol, the law enforcement officer may conduct a preliminary screening test using a device approved by the executive director of the department of public health and environment after first advising the driver that the driver may either refuse or agree to provide a sample of the driver's breath for such preliminary test. The results of this preliminary screening test may be used by a law enforcement officer in determining whether probable cause exists to believe such person was driving a vehicle in violation of paragraph (a) or (b) of subsection (1) or subsection (2) of this section and whether to administer a test pursuant to paragraph (a) of subsection (7) of this section. Neither the results of such preliminary screening test nor the fact that the person refused such test shall be used in any court action except in a hearing outside of the presence of a jury, when such hearing is held to determine if a law enforcement officer had probable cause to believe that the driver committed a violation of paragraph (a) or (b) of subsection (1) or subsection (2) of this section. The results of such preliminary screening test shall be made available to the driver or the driver's attorney on request. The preliminary screening test shall not substitute for or qualify as the test or tests required by paragraph (a) of subsection (7) of this section.

(7) (a) (I) On and after July 1, 1983, any person who drives any motor vehicle upon the streets and highways and elsewhere throughout this state shall be deemed to have expressed such person's consent to the provisions of this paragraph (a).

(II) Any person who drives any motor vehicle upon the streets and highways and elsewhere throughout this state shall be required to take and complete, and to cooperate in the taking and completing of, any test or tests of such person's breath or blood for the purpose of determining the alcoholic content of the person's blood or breath when so requested and directed by a law enforcement officer having probable cause to believe that the person was driving a motor vehicle in violation of subsection (1) or (2) of this section. Except as otherwise provided in this section, if such person requests that said test be a blood test, then the test shall be of his or her blood; but, if such person requests that a specimen of his or her blood not be drawn, then a specimen of such person's breath shall be obtained and tested. If such person elects either a blood test or a breath test, such person shall not be permitted to change such election, and, if such person fails to take and complete, and to cooperate in the completing of, the test elected, such failure shall be deemed to be a refusal to submit to testing. If such person is unable to take, or to complete, or to cooperate in the completing of a breath test because of injuries, illness, disease, physical infirmity, or physical incapacity, or if such person is receiving medical treatment at a location at which a breath testing instrument certified by the department of public health and environment is not available, the test shall be of such person's blood.

(III) Any person who drives any motor vehicle upon the streets and highways and elsewhere throughout this state shall be

required to submit to and to complete, and to cooperate in the completing of, a test or tests of such person's blood, saliva, and urine for the purpose of determining the drug content within the person's system when so requested and directed by a law enforcement officer having probable cause to believe that the person was driving a motor vehicle in violation of paragraph (a), (b), or (c) of subsection (1) of this section and when it is reasonable to require such testing of blood, saliva, and urine to determine whether such person was under the influence of, or impaired by, one or more drugs, or one or more controlled substances, or a combination of both alcohol and one or more drugs, or a combination of both alcohol and one or more controlled substances.

(IV) Any person who is required to take and to complete, and to cooperate in the completing of, any test or tests shall cooperate with the person authorized to obtain specimens of such person's blood, breath, saliva, or urine, including the signing of any release or consent forms required by any person, hospital, clinic, or association authorized to obtain such specimens. If such person does not cooperate with the person, hospital, clinic, or association authorized to obtain such specimens, including the signing of any release or consent forms, such noncooperation shall be considered a refusal to submit to testing. No law enforcement officer shall physically restrain any person for the purpose of obtaining a specimen of such person's blood, breath, saliva, or urine for testing except when the officer has probable cause to believe that the person has committed a violation of section 18-3-105, 18-3-106 (1) (b), 18-3-204, or 18-3-205 (1) (b), C.R.S., and the person is refusing to take or to complete, or to cooperate in the completing of, any test or tests, then, in such event, the law enforcement officer may require a blood test. Evidence acquired through such involuntary blood test shall be admissible in any prosecution for a violation of subsection (1) or (2) of this section and for a violation of section 18-3-105, 18-3-106 (1) (b), 18-3-204, or 18-3-205 (1) (b), C.R.S.

(V) Any driver of a commercial motor vehicle requested to submit to a test as provided in subparagraph (II) of this paragraph (a) shall be warned by the law enforcement officer requesting the test that a refusal to submit to the test shall result in an out-of-service order as defined under section 42-2-402 (8) for a period of twenty-four hours and a revocation of the privilege to operate a commercial motor vehicle for one year as provided under section 42-2-126.

(b) (I) The tests shall be administered at the direction of a law enforcement officer having probable cause to believe that the person had been driving a motor vehicle in violation of subsection (1) or (2) of this section and in accordance with rules and regulations prescribed by the state board of health concerning the health of the person being tested and the accuracy of such testing. Strict compliance with such rules and regulations shall not be a prerequisite to the admissibility of test results at trial unless the court finds that the extent of noncompliance with a board of health rule has so impaired the validity and reliability of the testing method and the test results as to render the evidence inadmissible. In all other circumstances, failure to strictly comply with such rules and regulations shall only be considered in the weight to be given to the test results and not to the admissibility of such test results. It shall not be a prerequisite to the admissibility of test results at trial that the prosecution present testimony concerning the composition of any kit used to obtain blood, urine, saliva, or breath specimens. A sufficient evidentiary foundation

concerning the compliance of such kits with the rules and regulations of the department of public health and environment shall be established by the introduction of a copy of the manufacturer's or supplier's certificate of compliance with such rules and regulations if such certificate specifies the contents, sterility, chemical makeup, and amounts of chemicals contained in such kit.

(II) No person except a physician, a registered nurse, a paramedic, as certified in part 2 of article 3.5 of title 25, C.R.S., an emergency medical technician, as defined in part 1 of article 3.5 of title 25, C.R.S., or a person whose normal duties include withdrawing blood samples under the supervision of a physician or registered nurse shall be entitled to withdraw blood for the purpose of determining the alcoholic or drug content therein. In any trial for a violation of subsection (1) or (2) of this section, the testimony of a law enforcement officer that he or she witnessed the taking of a blood specimen by a person who the law enforcement officer reasonably believed was authorized to withdraw blood specimens shall be sufficient evidence that such person was so authorized, and testimony from the person who obtained the blood specimens concerning such person's authorization to obtain blood specimens shall not be a prerequisite to the admissibility of test results concerning the blood specimens obtained. No civil liability shall attach to any person authorized to obtain blood, breath, saliva, or urine specimens or to any hospital, clinic, or association in or for which such specimens are obtained as provided in this subsection (7) as a result of the act of obtaining such specimens from any person submitting thereto if such specimens were obtained according to the rules and regulations prescribed by the state board of health; except that this provision shall not relieve any such person from liability for negligence in the obtaining of any specimen sample.

(c) Any person who is dead or unconscious shall be tested to determine the alcohol or drug content of the person's blood or any drug content within such person's system as provided in this subsection (7). If a test cannot be administered to a person who is unconscious, hospitalized, or undergoing medical treatment because the test would endanger the person's life or health, the law enforcement agency shall be allowed to test any blood, urine, or saliva which was obtained and not utilized by a health care provider and shall have access to that portion of the analysis and results of any tests administered by such provider which shows the alcohol or drug content of the person's blood, urine, or saliva or any drug content within the person's system. Such test results shall not be considered privileged communications, and the provisions of section 13-90-107, C.R.S., relating to the physician-patient privilege shall not apply. Any person who is dead, in addition to the tests prescribed, shall also have the person's blood checked for carbon monoxide content and for the presence of drugs, as prescribed by the department of public health and environment. Such information obtained shall be made a part of the accident report.

(d) If a person refuses to take, or to complete, or to cooperate with the completing of any test or tests as provided in this subsection (7), the person shall be subject to license revocation pursuant to the provisions of section 42-2-126. Such revocation shall take effect prior to and shall stay the remainder of any previous suspension, or denial in lieu of suspension, and shall not run concurrently, in whole or in part, with any previous or subsequent suspensions, revocations, or denials which may be provided for by law, including any suspension, revocation, or

denial which results from a conviction of criminal charges arising out of the same occurrence for a violation of subsection (1) or (2) of this section. The remainder of any suspension, or denial in lieu of suspension, stayed pursuant to the provisions of this paragraph (d) shall be reinstated following the completion of any revocation provided for in section 42-2-126. Any revocation taken under said section shall not preclude other actions which the department is required to take in the administration of the provisions of this title.

(e) If a person refuses to take or to complete, or to cooperate with the completing of, any test or tests as provided in this subsection (7) and such person subsequently stands trial for a violation of subsection (1) of this section, the refusal to take or to complete, or to cooperate with the completing of, any test or tests shall be admissible into evidence at the trial, and a person may not claim the privilege against self-incrimination with regard to admission of refusal to take or to complete, or to cooperate with the completing of, any test or tests.

(8) No court shall accept a plea of guilty to a non-alcohol-related or non-drug-related traffic offense from a person charged with a violation of subsection (1) or (2) of this section; except that the court may accept a plea of guilty to a non-alcohol-related or non-drug-related traffic offense upon a good faith representation by the prosecuting attorney that the attorney could not establish a prima facie case if the defendant were brought to trial on the original alcohol-related or drug-related offense.

(9) (a) (I) Every person who is convicted of a violation of paragraph (a) or (c) of subsection (1) or subsection (2) of this section shall be punished by imprisonment in the county jail for not less than five days nor more than one year, and, in addition, the court may impose a fine of not less than three hundred dollars nor more than one thousand dollars. Except as provided in subparagraph (II) of paragraph (f) of this subsection (9), the minimum period of imprisonment provided for such violation shall be mandatory. In addition to any other penalty which is imposed, every person who is convicted of a violation to which this subparagraph (I) applies shall perform not less than forty-eight hours nor more than ninety-six hours of useful public service. The performance of the minimum period of service shall be mandatory, and the court shall have no discretion to suspend the mandatory minimum period of performance of such service.

(II) Upon a conviction of a violation of paragraph (a) or (c) of subsection (1) or subsection (2) of this section, which violation occurred within five years of the date of a previous violation, for which there has been a conviction, of paragraph (a) or (c) of subsection (1) or subsection (2) of this section, or of section 18-3-106 (1) (b) (I) or 18-3-205 (1) (b) (I), C.R.S., the offender shall be punished by imprisonment in the county jail for not less than ninety days nor more than one year, and, in addition, the court may impose a fine of not less than five hundred dollars nor more than one thousand five hundred dollars. The minimum period of imprisonment as provided for such violation shall be mandatory, but the court may suspend up to eighty-three days of the period of imprisonment if the offender complies with the provisions of subparagraph (I) of paragraph (f) of this subsection (9). In addition to any other penalty which is imposed, every person who is convicted of a violation to which this subparagraph (II) applies shall perform not less than sixty hours nor more than one hundred twenty hours of useful public service. The performance of the minimum period of

service shall be mandatory, and the court shall have no discretion to suspend the mandatory minimum period of performance of such service.

(III) Upon conviction of a violation of paragraph (a) or (c) of subsection (1) or subsection (2) of this section, which violation occurred within five years of the date of a previous violation, for which there has been a conviction, of paragraph (b) of subsection (1) of this section, the offender shall be punished by imprisonment in the county jail for not less than seventy days nor more than one year, and, in addition, the court may impose a fine of not less than four hundred fifty dollars nor more than one thousand five hundred dollars. The minimum period of imprisonment as provided for such violation shall be mandatory, but the court may suspend up to sixty-three days of the period of imprisonment if the offender complies with the provisions of subparagraph (I) of paragraph (f) of this subsection (9). In addition to any other penalty which is imposed, every person who is convicted of a violation to which this subparagraph (III) applies shall perform not less than fifty-six hours nor more than one hundred twelve hours of useful public service. The performance of the minimum period of service shall be mandatory, and the court shall have no discretion to suspend the mandatory minimum period of performance of such service.

(b) (I) Every person who is convicted of a violation of paragraph (b) of subsection (1) of this section shall be punished by imprisonment in the county jail for not less than two days nor more than one hundred eighty days, and, in addition, the court may impose a fine of not less than one hundred dollars nor more than five hundred dollars. Except as provided in subparagraph (II) of paragraph (f) of this subsection (9), the minimum period of imprisonment provided for such violation shall be mandatory. In addition to any other penalty which is imposed, every person who is convicted of a violation to which this subparagraph (I) applies shall perform not less than twenty-four hours nor more than forty-eight hours of useful public service. The performance of the minimum period of service shall be mandatory, and the court shall have no discretion to suspend the mandatory minimum period of performance of such service.

(II) Upon a conviction of a second or subsequent violation of paragraph (b) of subsection (1) of this section, which violation occurred within five years of the date of a previous violation, for which there has been a conviction, of paragraph (b) of subsection (1) of this section, the offender shall be punished by imprisonment in the county jail for not less than forty-five days nor more than one year, and, in addition, the court may impose a fine of not less than three hundred dollars nor more than one thousand dollars. The minimum period of imprisonment as provided for such violation shall be mandatory, but the court may suspend up to forty days of the period of imprisonment if the offender complies with the provisions of subparagraph (I) of paragraph (f) of this subsection (9). In addition to any other penalty which is imposed, every person who is convicted of a violation to which this subparagraph (II) applies shall perform not less than forty-eight hours nor more than ninety-six hours of useful public service. The performance of the minimum period of service shall be mandatory, and the court shall have no discretion to suspend the mandatory minimum period of performance of such service.

(III) Upon conviction of a violation of paragraph (b) of subsection (1) of this section, which violation occurred within

five years of the date of a previous violation, for which there has been a conviction, of paragraph (a) or (c) of subsection (1) or subsection (2) of this section, or of section 18-3-106 (1) (b) (I) or 18-3-205 (1) (b) (I), C.R.S., the offender shall be punished by imprisonment in the county jail for not less than sixty days nor more than one year, and, in addition, the court may impose a fine of not less than four hundred dollars nor more than one thousand two hundred dollars. The minimum period of imprisonment as provided for such violation shall be mandatory, but the court may suspend up to fifty-four days of the period of imprisonment if the offender complies with the provisions of subparagraph (I) of paragraph (f) of this subsection (9). In addition to any other penalty which is imposed, every person who is convicted of a violation to which this subparagraph (III) applies shall perform not less than fifty-two hours nor more than one hundred four hours of useful public service. The performance of the minimum period of service shall be mandatory, and the court shall have no discretion to suspend the mandatory minimum period of performance of such service.

(c) The provisions of this subsection (9) relating to the performance of useful public service are also applicable to any defendant who receives a deferred prosecution in accordance with section 16-7-401, C.R.S., or who receives a deferred sentence in accordance with section 16-7-403, C.R.S., and the completion of any stipulated amount of useful public service hours to be completed by the defendant shall be ordered by the court in accordance with the conditions of such deferred prosecution or deferred sentence as stipulated to by the prosecution and the defendant.

(d) For the purposes of paragraphs (a) and (b) of this subsection (9), a person shall be deemed to have a previous conviction of subsection (1) or (2) of this section, or section 18-3-106 (1) (b) (I) or 18-3-205 (1) (b) (I), C.R.S., if such person has been convicted under the laws of any other state, the United States, or any territory subject to the jurisdiction of the United States of an act which, if committed within this state, would be a violation of subsection (1) or (2) of this section, or section 18-3-106 (1) (b) (I) or 18-3-205 (1) (b) (I), C.R.S.

(e) (I) Upon conviction of a violation of subsection (1) or (2) of this section, the court shall sentence the defendant in accordance with the provisions of paragraphs (a) and (b) of this subsection (9). The court shall consider the alcohol and drug evaluation required pursuant to subsection (10) of this section prior to sentencing; except that the court may proceed to immediate sentencing without considering such alcohol and drug evaluation if the defendant has no prior or pending charges under this section and neither the defendant nor the prosecuting attorney objects. If the court proceeds to immediate sentencing, without considering such alcohol and drug evaluation, such alcohol and drug evaluation shall be conducted after sentencing, and the court shall order the defendant to complete the education and treatment program recommended in such alcohol and drug evaluation. If the defendant disagrees with the education and treatment program recommended in such alcohol and drug evaluation, the defendant may request the court to hold a hearing to determine which education and treatment program should be completed by the defendant.

(II) For sentencing purposes concerning convictions for second and subsequent offenses, prima facie proof of a defendant's previous convictions shall be established when the prosecuting

attorney and the defendant stipulate to the existence of the prior conviction or convictions or the prosecuting attorney presents to the court a copy of the driving record of the defendant provided by the motor vehicle division of the department of revenue of this state, or provided by a similar agency in another state, which contains a reference to such previous conviction or convictions or presents an authenticated copy of the record of the previous conviction or judgment from any court of record of this state or from a court of any other state, the United States, or any territory subject to the jurisdiction of the United States. The court shall not proceed to immediate sentencing when there is not a stipulation to prior convictions or if the prosecution requests an opportunity to obtain a driving record or a copy of a court record. The prosecuting attorney shall not be required to plead or prove any previous convictions at trial, and sentencing concerning convictions for second and subsequent offenses shall be a matter to be determined by the court at sentencing.

(f) (I) The sentence of any person subject to the provisions of subparagraph (II) or (III) of paragraph (a) or subparagraph (II) or (III) of paragraph (b) of this subsection (9) may be suspended to the extent provided for in said subparagraphs if the offender receives a presentence alcohol and drug evaluation; based on that evaluation, satisfactorily completes an appropriate level I or level II alcohol and drug driving safety education or treatment program; and abstains from the use of alcohol for a period of one year from the date of sentencing. Such abstinence shall be monitored by the treatment facility by the administration of disulfiram or by any other means that the director of the treatment facility deems appropriate. If, at any time during the one-year period, the offender does not satisfactorily comply with the conditions of the suspension, that sentence shall be reimposed, and the offender shall spend that portion of such offender's sentence which was suspended in the county jail.

(II) In the case of any person who is sentenced pursuant to the provisions of subparagraph (I) of paragraph (a) or subparagraph (I) of paragraph (b) of this subsection (9), the court may suspend the mandatory minimum of any sentence of imprisonment if, as a condition thereof, the offender has a presentence or postsentence alcohol and drug evaluation and satisfactorily completes and meets all financial obligations of a level I or level II program as is determined appropriate by the alcohol and drug evaluation required pursuant to subsection (10) of this section.

(g) In addition to the penalties prescribed in this subsection (9), persons convicted of violations of subsection (1) or (2) of this section are subject to the costs imposed by section 24-4.1-119 (1) (c), C.R.S., relating to the crime victim compensation fund.

(h) In addition to any other penalty provided by law, the court may sentence a defendant who is convicted pursuant to this section to a period of probation for purposes of treatment not to exceed two years. As a condition of probation, the defendant shall be required to make restitution in accordance with the provisions of section 16-11-204.5, C.R.S. In addition to any other penalty provided by law, the court may sentence a defendant to attend and pay for one appearance at a victim impact panel approved by the court, for which the fee assessed to the defendant shall not exceed twenty-five dollars.

(i) (I) For the purposes of this subsection (9), "useful public service" means any work which is beneficial to the public and

which involves a minimum of direct supervision or other public cost. "Useful public service" does not include any work which would endanger the health or safety of any person convicted of a violation of any of the offenses specified in subsection (1) or (2) of this section.

(II) (A) The sentencing court, the probation department, the county sheriff, and the board of county commissioners shall cooperate in identifying suitable work assignments. An offender sentenced to such work assignment shall complete the same within the time established by the court.

(B) There may be established in the probation department of each judicial district in the state a useful public service program under the direction of the chief probation officer. It is the purpose of the useful public service program: To identify and seek the cooperation of governmental entities and political subdivisions thereof, as well as corporations organized not for profit, for the purpose of providing useful public service jobs; to interview and assign persons who have been ordered by the court to perform useful public service to suitable useful public service jobs; and to monitor compliance or noncompliance of such persons in performing useful public service assignments within the time established by the court.

(C) Any general public liability insurance policy obtained pursuant to this subsection (9) shall be in a sum of not less than the current limit on government liability under the "Colorado Governmental Immunity Act", article 10 of title 24, C.R.S.

(III) For the purposes of the "Colorado Governmental Immunity Act", article 10 of title 24, C.R.S., "public employee" does not include any person who is sentenced pursuant to this subsection (9) to participate in any type of useful public service.

(IV) No governmental entity shall be liable under the "Workers' Compensation Act of Colorado", articles 40 to 47 of title 8, C.R.S., or under the "Colorado Employment Security Act", articles 70 to 82 of title 8, C.R.S., for any benefits on account of any person who is sentenced pursuant to this subsection (9) to participate in any type of useful public service, but nothing in this subparagraph (IV) shall prohibit a governmental entity from electing to accept the provisions of the "Workers' Compensation Act of Colorado" by purchasing and keeping in force a policy of workers' compensation insurance covering such person.

(V) On and after July 1, 1984, in addition to any other penalties prescribed in this subsection (9), the court shall assess an amount, not to exceed sixty dollars, upon any person required to perform useful public service. Such amount shall be used by the operating agency responsible for overseeing such person's useful public service program to pay the cost of administration of the program, a general public liability policy covering such person, and, if such person will be covered by workers' compensation insurance pursuant to subparagraph (IV) of this paragraph (i) or an insurance policy providing such or similar coverage, the cost of purchasing and keeping in force such insurance coverage. Such amount shall be adjusted from time to time by the general assembly in order to insure that the useful public service program established in this subsection (9) shall be financially self-supporting. The proceeds from such amounts shall be used by the operating agency only for defraying the cost of personal services and other operating expenses related to the administration of the program and the

cost of purchasing and keeping in force policies of general public liability insurance, workers' compensation insurance, or insurance providing such or similar coverage and shall not be used by the operating agency for any other purpose.

(10) (a) The division of alcohol and drug abuse in the department of human services shall establish in each judicial district an alcohol and drug driving safety program which provides presentence alcohol and drug evaluations on all persons convicted of a violation of subsection (1) or (2) of this section. The alcohol and drug driving safety program shall further provide supervision and monitoring of all such persons whose sentences or terms of probation require completion of a program of alcohol and drug driving safety education or treatment.

(b) The presentence alcohol and drug evaluation shall be conducted by such persons certified by the division of alcohol and drug abuse as qualified to provide evaluation and supervision services as described in paragraph (c) of this subsection (10). In establishing qualifications for such persons, the division shall give consideration to those persons who have had practical experience in alcohol and drug treatment.

(c) Upon the establishment of an alcohol and drug driving safety program, an alcohol and drug evaluation shall be conducted on all persons convicted of a violation of subsection (1) or (2) of this section. The report shall be made available to and shall be considered by the court prior to sentencing unless the court proceeds to immediate sentencing pursuant to the provisions of paragraph (e) of subsection (9) of this section. The report shall contain an evaluation of the defendant concerning the defendant's prior traffic record, characteristics and history of alcohol or drug problems, and amenability to rehabilitation. The report shall include a recommendation as to alcohol and drug driving safety education or treatment for the defendant. The alcohol evaluation shall be prepared by a person who is knowledgeable in the diagnosis of chemical dependency. Such person's duties may also include appearing at sentencing and probation hearings as required, referring defendants to education and treatment agencies in accordance with orders of the court, monitoring defendants in education and treatment programs, notifying the probation department and the court of any defendant failing to meet the conditions of probation or referral to education or treatment, appearing at revocation hearings as required, and providing assistance in data reporting and program evaluation. For the purpose of this subsection (10), "alcohol and drug driving safety education or treatment" means either level I or level II education or treatment programs. Level I programs are to be short-term, didactic education programs. Level II programs are to be therapeutically oriented education, long-term outpatient, and comprehensive inpatient programs. Any defendant sentenced to level I or level II programs shall be instructed by the court to meet all financial obligations of such programs. If such financial obligations are not met, the sentencing court shall be notified for the purpose of collection or review and further action on the defendant's sentence. Nothing in this section shall prohibit treatment agencies from applying to the state for funds to recover the costs of level II treatment for defendants determined to be indigent by the court.

(d) There is hereby created an alcohol and drug driving safety program fund in the office of the state treasurer to the credit of which shall be deposited all moneys as directed by this paragraph (d). Until July 1, 1980, in addition to any fines, fees,

or level II education program, or level I or level II treatment program to be completed by the defendant shall be ordered by the court in accordance with the conditions of such deferred prosecution or deferred sentence as stipulated to by the prosecution and the defendant.

(11) In all actions, suits, and judicial proceedings in any court of this state concerning alcohol-related or drug-related traffic offenses, the court shall take judicial notice of methods of testing a person's alcohol or drug level and of the design and operation of devices, as certified by the department of public health and environment, for testing a person's blood, breath, saliva, or urine to determine such person's alcohol or drug level. This subsection (11) shall not prevent the necessity of establishing during a trial that the testing devices used were working properly and that such testing devices were properly operated. Nothing in this subsection (11) shall preclude a defendant from offering evidence concerning the accuracy of testing devices.

(12) (Deleted by amendment, L. 95, p. 315, 3, effective July 1, 1995.)

(13) As used in this section, "convicted" includes a plea of no contest accepted by the court.

Appendix II

Study Documents

Summary of Study Documents

Certification of Complete Records

Informed Consent

Observer Checklist

Officer Checklist

Officer Information

TABLE 9
COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY
Environment/Weather Conditions

		(Number of Cases)						
Type Roadway	Freeway	Interstate	City Street	Rural Road	Other	Not Recorded		
	29	16	202	41	15	2		
Light	Daylight	Dawn/Dusk	Dark	Dark w/Lights		Not Recorded		
	4	3	128	168		2		
Weather	Clear	Cloudy	Wind	Fog	Rain	Snow	Sleet	
	179	114	71	2	15	25	2	
Light		53	51			15		
Moderate		33	12	2	2	6	2	
Strong		19	6			4		
Roadway conditions	Dry	Wet	Snow	Icy	Other			
	242	50	15	4	6			
SFST Surface Condition	Dry	Wet	Snow	Icy				
	236	49	11	4				
	Level	Slight Slope	Moderate Slope	Uneven				
	202	41	11	13				
	Dry—Level	160	Snow—Level		6			
	Dry—Slight Slope	0	Snow—Slight Slope		2			
	Dry—Moderate Slope	8	Snow—Moderate Slope		0			
	Dry—Uneven	4	Snow—Uneven		1			
	Wet—Level	33	Icy—Level		1			
	Wet—Slight Slope	6	Icy—Slight Slope		1			
	Wet—Moderate Slope	1	Icy—Moderate Slope		1			
	Wet—Uneven	1	Icy—Uneven		0			
Temperature (degrees)	<10	10–20	21–30	31–40	41–50	51–60	61–70	71–80
	4	29	43	78	70	16	9	2

Almost two-thirds of the temperatures associated with the SFSTs can be characterized as being neither extremely cold nor extremely hot, falling as they did between 31 and 60 degrees. The weather was clear on 179 occasions. The roadway was dry 80% of the time. The surfaces where the SFSTs were given were most often dry (236 occasions) and level (202 occasions).

When inclement weather was reported, it typically was described

COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY

Study Documents

Conditions	Required Documents:	
of stop:	<u>From Officer</u>	<u>From Observer</u>
No SFSTs	None	None
SFSTs	Sobriety Exam.	None
Driver arrested	BAC by	
No observer	Intoxilyzer or Blood Officer checklist	
SFSTs	Sobriety Exam.	Observer checklist
Driver arrested	BAC by	
Observer	Intoxilyzer or Blood Officer checklist	
SFSTs	Sobriety Exam.	None
Driver not arrested	Officer checklist	
No observer		
SFSTs	Sobriety Exam.	Observer Checklist (with BAC from PBT)
Driver not arrested	Officer checklist	Consent for breath testing
Observer		

CERTIFICATION OF DATA
Colorado SFST Revalidation Study

I participated in the SFST Study as an

- Officer
- Observer
- Both, during the course of the project

If you participated as an Officer, please complete the following:

I certify that for each and every time I administered the SFSTs as part of this research project, I submitted the required documentation. I left no administration of the SFSTs undocumented.
Yes No

I further certify that I used the three-test battery of the SFSTs (horizontal gaze nystagmus, walk-and-turn, and one-leg stand) as my basis for making my decision to arrest or release subjects. I did NOT use any kind of preliminary breath-testing device to help me make those decisions.

Yes No

If you participated as an Observer, please complete the following:

I certify that for each and every time I observed the SFSTs being administered by an officer as part of this research project, I submitted the required documentation. I left no observation of the SFSTs undocumented.

Yes No

I further certify that I asked subjects if they would voluntarily consent to a Preliminary Breath Test ONLY AFTER the Officer had made his/her decision to arrest or release.

Yes No

If you participated at various times during the project as Officer and Observer, please complete both Officer and Observer questions above.

_____ Name – Print

_____ Name – Signature

_____ Today's Date

IF "NO" TO ANY QUESTION, USE BACK OF PAGE TO EXPLAIN. Thanks.

Consent for Breath Testing

Based upon observations and the results of a roadside investigation, including field sobriety tests, Officer _____ determined that there is insufficient evidence to arrest me for Driving Under the Influence of or Driving While Ability Impaired by Alcohol and/or Drugs.

I understand that my stop and roadside detention were included is part of a study to determine the accuracy of field sobriety tests. I hereby agree to assist in determining the accuracy of the officer's evaluation of the field sobriety tests administered to me by agreeing to take a preliminary breath test.

I understand that if the results of the preliminary breath test indicate a blood alcohol content less than .05% wt./vol., I will be released and allowed to continue driving.

I understand that if the results of the preliminary breath test indicate a blood alcohol content of .05% wt./vol. or greater, I will not be allowed to drive. I will either be released to a sober licensed driver or be given a ride to _____.

In no event will I be arrested for Driving Under the Influence of or Driving While Ability Impaired by Alcohol and/or Drugs at this time unless the preliminary breath test indicates a blood alcohol content of .05% wt./vol. AND I insist on trying to drive away rather than consenting to be released to a sober licensed driver or given a ride to the location described above.

Date _____, 1995.

Time: _____

Law Enforcement Officer

Subject

CAD # _____

(Ask Dispatch)

Observer's Checklist

COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY

Date ____/____/____

Agency APD PCSO SVPD BPD CSP LPD BCSO Officer Badge # _____

Circle One

Horizontal Gaze Nystagmus

Instructions correct?

1. Yes _____

2. No _____

Describe Errors _____

Administration correct?

3. Yes _____

4. No _____

Describe Errors: _____

5. Nystagmus test not given _____

Reason _____

6. Nystagmus test given but not observed _____

Reason: _____

Walk-and-Turn (WAT)

Instructions correct?

7. Yes _____

8. No _____

11. WAT not given _____

Reason: _____

12. WAT given but not observed _____

Reason: _____

One-Leg Stand (OLS)

Instructions correct? _____

13. Yes _____

14. No _____

Describe Errors: _____

17. OLS not given _____

Reason: _____

18. OLS given but not observed _____

Reason: _____

19. PBT reading: 1) _____ 0. _____ %

2) _____ 0. _____ %

20. Subject refused PBT _____

Reason _____

21. PBT not offered _____

Reason: _____

NOTE: If you have a camera, you may document surface on which SFSTs were performed, but this is not required.

Observer – Print Name

Observer – Signature

Fill out and submit this form for every time you witness an officer administering the SFSTs. If SFSTs not done, do not use this

CAD # _____

(Ask Dispatch)

Officer's Checklist

COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY

1. Date ____/____/____
2. Time ____ (2400 hr)
3. Day of Wk: a) Mon ____ b) Tu ____ c) Wed ____ d) Th ____ e) Fri ____ f) Sat ____ g) Su ____
4. Light Conditions
a) Daylight ____ b) Dawn or Dusk ____
c) Dark, No Lights ____ d) Dark, with Lights ____
5. Temperature ____ F
6. Weather
a) Clear ____
b) Clouds ____ 1) Scattered ____ 2) Moderate ____ 3) Heavy ____
c) Wind ____ 1) Light ____ 2) Moderate ____ 3) Strong ____
d) Fog ____ 1) Light ____ 2) Moderate ____ 3) Strong ____
e) Rain ____ 1) Light ____ 2) Moderate ____ 3) Strong ____
f) Snow ____ 1) Light ____ 2) Moderate ____ 3) Strong ____
g) Sleet ____ 1) Light ____ 2) Moderate ____ 3) Strong ____
Describe combinations/other conditions: _____
7. Type of Roadway
a) Freeway ____ b) Interstate ____ c) City Street ____
d) Rural Road ____
e) Other (Describe) _____
8. Roadway Conditions
a) Dry ____ b) Wet ____ c) Snow ____ d) Icy ____ e) Other ____
f) Describe "Snow" or "Other" _____
9. Condition of Surface Where SFSTs are performed
a) Dry ____ e) Level Surface ____
b) Wet ____ f) Slight Slope ____
c) Icy ____ g) Moderate Slope ____
d) Snow ____ h) Uneven Surface ____
i) Other (Describe) _____
10. Reasons for Stop _____ Brief description
a) Driving behavior _____
b) Equipment violation _____
c) Other reasonable susp. _____
11. Circumstances
a) Recreational event ____ d) Bars/taverns nearby ____
b) Other public event ____ e) Open containers ____
c) Holiday/H. weekend ____
f) Other (describe) _____
12. Driver Clothing
a) Adequate for weather ____
b) Not adequate for weather ____
13. Driver Footwear
a) Street shoes ____ d) High heels ____ (heel ht. = __ in.)
b) Running/sneaker ____ e) Cowboy boot ____ (heel ht. = __ in.)
c) Winter boots ____
14. Driver Residence
a) Local ____
(adapted to altitude)
b) Tourist
Date of arrival in the mountain area ____/____/____
c) Other circumstances (such as "local" who has been at sea level recently or a "tourist" who for some reason is already acclimated) _____
15. Anything else you'd like to comment on or suggest? _____

COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY
OFFICER DATA

1. Date ____ / ____ / 95 2. Agency _____
3. Name _____ 4. Badge No. _____
5. Mail Address _____ 6. Phone _____
7. How many years/months have you been employed in law enforcement (as a sworn officer)? _____
8. When were you trained with SFSTs (3 test battery: nystagmus, walk-and-turn, one-leg stand)? _____
(dates)
9. Where were you trained with SFSTs? _____
(location)
10. How many DUI arrests (approximate) have you made since the above SFST training?

Please provide any additional information about your law enforcement experience, SFST training, and DUI arrests, which you consider important.

Fill out this form only once for your participation in this project.

Appendix III

Training Protocol

COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY

“Help” Phone Numbers and Addresses

Deputy Ellen W. Anderson – Project Manager
Pitkin County Sheriff’s Office
506 East Main Street
Aspen, Colorado 81611
Phone: 303/920-5300
FAX: 303/920-5307
Home: 303/923-5064

Dr. Marcelline Burns – Project Scientist
Southern California Research Institute
11914 West Washington Blvd.
Los Angeles, California 90066
Phone: 310/390-8481
FAX: 310/398-6651

COLORADO VALIDATION STUDY OF THE
STANDARDIZED FIELD SOBRIETY TEST (SFST) BATTERY

Training Session Agenda

Anderson 15 mins

Greetings

Introductions

Overview of training session

Brief summary of how the project developed:

The SFST Validation study originated in Colorado within law enforcement. The 60 days of data collection will involve extra work, but it is a project which is expected to gain national attention and reflect favorably on Colorado law enforcement and the participating agencies.

Burns 20 mins

SFST background

Scientific requirements of study

data integrity

data completeness

standardization of SFSTs

Anderson 20 mins

Project methods and procedures

Data forms

SFST Instructor 50 mins

SFST review

Anderson 15 mins

Logistics/communication

Questions

Wrap-up



CITY OF PHOENIX Cliff Vanelli, Editor Eugene V. Adler, Technical Editor Sgt. Joseph Klima, DRE



HORIZONTAL GAZE NYSTAGMUS

The Controversy
and the Issues

Marcelline Burns, Southern California Research Institute

MAY/JUNE 1991

Horizontal gaze nystagmus (HGN) appeared in traffic enforcement as a field sobriety test (FST) for suspected alcohol-impaired drivers more than ten years ago. It gained favor and now is widely used throughout the United States. It has also become the focus of controversy in the courtroom.

Law enforcement, prosecutors, and defense attorneys view driving-under-the-influence (DUI) cases with differing objectives. Challenges to HGN as a FST are an expected part of defining its role in DUI enforcement. Misinformation within that process, however, is counter-productive to the larger goal of safe roadways.

Evaluations of HGN by attorney William Pangman^(1,2) are marked by generalizations, misinterpretations and factual omissions, which suggest at best a failure to comprehend and at worst a deliberate effort to misrepresent. In either case, the errors pointlessly inflate the time allocated to the topic by the judicial system.

Legitimate questions about HGN focus on its validity, reliability, sensitivity and specificity as an index of impairment:

- *Does HGN indicate the presence of alcohol or other drugs at levels associated with driving impairment?*
- *Does it do so from person-to-person and time-to-time without confusing alcohol and drug impairment with non-impairing conditions?*
- *Is the observation and interpretation of HGN a skill which police officers can learn? What training and experience qualify an officer to use HGN?*
- *Does the angle of the eye's gaze at the onset of nystagmus correlate with blood alcohol concentration (BAC)?*
- *Are there interacting variables which alter either HGN or officers' observations of it?*

It is proper to ask these questions and to require evidence that HGN meets appropriate criteria, and the core research does so.^(3,4,5) It is unfortunate when pseudo-issues usurp attention. Some arise because the merits of HGN are not recognized, and some arise as efforts to discredit the test. In either case, it is wasteful of court time to ask these questions within every DUI trial. The following discussion attempts to put some issues to rest.

HGN Defined

Nystagmus is a rapid involuntary oscillation of the eyeballs as defined by Webster. Dorland's Medical Dictionary, 25th Edition, notes that the jerking movement may be horizontal, vertical, rotatory, or mixed. Differing types have different physiological origins and occur in response to different stimulus conditions.

HGN, the sobriety test nystagmus, is evoked by requiring a suspect to turn his eyes to the side as he watches a moving stimulus. The specific signs of dysfunction are:

1. An inability of the eyes to follow the stimulus smoothly.
2. A jerking movement which begins prior to deviation of the eyes in the horizontal plane as much as 45 degrees.
3. An increase in the distinctness of the jerking at the most extreme deviation of the eyes.

Origin and Causes

HGN does not result from disturbance of the vestibular system. The types which are due to inner ear problems require stimulus conditions such as recent rapid rotation of the body or hot and cold water in the ear canals. It is unlikely in the extreme that such conditions will occur during roadside testing, or that vestibular nystagmus will coincide with deviation of the eyes to the side.

Central nervous system depressants, phencyclidine, inhalants and possibly other drugs (at dose levels not yet studied) produce HGN. However, when observed in an impaired driver, it is most likely to be due to alcohol, the most widely used of all drugs.

The fact that HGN occurs due to impairing substances other than alcohol does not discredit it as a sobriety test. Rather, its value is enhanced since its presence (or absence) provides an important clue as to the type of substance a driver has used. HGN is an important clue in drug recognition methods.

Brain injury and disease also give rise to HGN. Again, this characteristic does not discredit the test. HGN reflects dysfunction, and the objective of FSTs is to identify unsafe drivers whatever the cause of their impairment. Individuals with injury or illness so severe as to cause HGN generally will not be driving, and their numbers certainly will be small in comparison to alcohol-impaired drivers. If a sick or injured person does drive in a manner which provokes a roadside stop, it is possible that he should be deterred from further driving in the interest of safety. Furthermore, a trained officer is unlikely to mistake injury or disease for alcohol impairment. A suspect's claim of illness or injury will be heeded, as will the lack of odor and other common symptoms of alcohol.

The eyes are only one source of information, albeit an important source. An officer rarely, if ever, bases a decision to arrest

on a single symptom. Rather, he evaluates all of the evidence in terms of illness or injury, as well as alcohol and drug influence or, for that matter, simply careless driving.

Issues and Pseudo-Issues

In an introductory note to one of Mr. Pangman's articles⁽¹⁾, the editor criticizes HGN for being "completely subjective". The description is neither entirely wrong nor necessarily pejorative.

Observations of behavior, including roadside behavioral tests, are subjective in varying degrees. An officer observes a suspect walk, balance, and touch finger-to-nose, reports his subjective evaluation of those behaviors, and testifies about the FSTs in court. He observes and reports HGN in the same manner. The subjectivity of HGN is neither greater nor less than more traditional FSTs.

"No decision" is not an option at roadside. An officer must make a decision to arrest or release the motorist he has stopped, and he bases his decision on the information available to him, i.e., his "subjective" observations. FSTs are essential to the decision process, and research demonstrates that the eyes provide the most accurate symptoms of intoxication.

The claim that caffeine, nicotine, aspirin and other widely-used substances cause nystagmus is not supported either by scientific studies or common sense. Consider the large numbers of coffee drinkers and smokers. If the caffeine and nicotine assertions were true, a great many people would have jerky eyeballs most of the time. That they do not can be readily confirmed by examining individuals who use these substances.

The validity of any test ultimately depends on the officer's integrity and skill, and this issue raises the specter of "fudged" results⁽¹⁾. The critical point, of course, is that it applies equally to all roadside activities. The concern may be legitimate in any given case, but it does not affect the validity of HGN as a test.

Questions about officer skill are appropriate and answerable. They also apply to all roadside activities, and their answers require information about training. The HGN literature precisely describes the required training. In obvious contrast, spurious reports offered by critics of HGN include no information about officer training and skill.

**HGN is neither
mysterious nor
magic, nor is it
"voodoo science"**

Rigorous training together with regular application of the training increases the probability that observations will be accurate and reliable, and assists officers in building competence and confidence.
Nystagmus training is mandatory.

In no circumstance should an officer rely on HGN or give court testimony about it without training in accordance with the guidelines established by the NHTSA.

It is now possible to obtain accurate, objective measurements of eye characteristics by using apparatus which measures pupil size and responsivity, pursuit movements, and nystagmus⁽⁶⁾. Laboratory experiments with the device confirm the BAC - HGN relationship established by observation. Additional study with objective measuring devices can be expected to further define that relationship and specify the range of error of human observation of HGN.

Opponents of the use of HGN as a sobriety test incorrectly describe it as a mysterious "eye twitch", but proponents also err if they claim almost magical attributes for it. HGN is neither mysterious nor magic, nor is it "voodoo science"⁽¹⁾ it is nothing more nor less than a reliable symptom which correlates with the presence of alcohol and certain other drugs.

HGN has been criticized because "...use of the procedure spread like wildfire to law enforcement agencies in over half of the jurisdictions in this country."⁽¹⁾ The wildfire claim is overstated and gives rise to a simple question. If HGN is not a valid, reliable symptom of intoxication, why has it been accepted by police officers?

Law enforcement is a difficult task, most officers are pragmatic, ambitious men and women who seek career advances. They are subject to censure by partners, sergeants, review boards, and citizens. If new equipment and procedures facilitate their job performance, they will adopt them but they will also promptly abandon what does not serve them well. If HGN did not correlate with chemical tests or if it led to incorrect roadside decisions it is unlikely that they would continue to use it.

The Research

Critics of HGN claim "...very little thorough research has yet been conducted on its effectiveness as a field sobriety test." This is a strange allegation since a Finnish study examined more than 6000 cases⁽⁷⁾, and two U. S. studies examined more than 500 subjects^(4,5). The criticism is valid only in the sense that important questions remain unanswered, as they frequently do for substantive topics. The issues of alcohol tolerance and HGN thresholds, alcohol-drug interactions, and effects of abuse levels of prescrip-

tion and OTC drugs require further study. There is no indication that additional study will negate the research already accomplished, only that it may further define a valuable test.

The question of thoroughness actually is a question of the quality of the research, and it is best addressed by a review of the literature. In contrast to critics from the defense community, who have an obvious interest in discrediting the test, the credibility of research sponsors, investigators, and publishing journals of the FST/HGN literature attest to the quality of the work.

HGN was not invented and its use as a sobriety test did not originate in the United States. The first such use was reported from Finland where a large scale research project was undertaken, because “a clinical examination system for drunken drivers has often been deemed questionable or worthless”^(7, pp 1-2). The Finnish investigators recommended that sobriety tests include balance and walking tests and nystagmus, recommendations almost identical with those from the U.S. research. The following excerpts from the Finnish report merit attention:

“Because the nystagmus tests proved to be the most valuable ...” (p 28)

“In cases with blood alcohol lower than 1.26 or 1.51 0/00 the nystagmus tests proved to be the only adequate tests on the basis of the results of several regression analyses.” (p 29)

“... the nystagmus tests were the most valuable and objective” tests on various blood alcohol levels ...” (p 38)

Serious, thoughtful criticism and questioning of HGN ultimately will strengthen it as a FST, and as such are welcomed. On the other hand, the courts should not have to consider, and research should not have to address, irresponsible, self-serving misrepresentations about what it is and how it is used.

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Marcelline (Marcy) Burns is a Research Psychologist at the Southern California Research Institute (SCRI). She was a cofounder of the Institute and has been continuously engaged in conducting research there since 1973. The focus of her research and that of her SCRI colleagues is the effects of alcohol and other drugs on human performance, including driving performance. Current projects include a NIDA funded study of cocaine effects and symptoms and a NHTSA funded study of the certification phase of DRE training.

She also conducts research, consults, and serves as a scientific witness on matters of field sobriety testing (including HGN) and drug recognition. Since 1980, Dr. Burns and associates in the DARTS group have conducted alcohol and drug training nationwide. She publishes and lectures widely.

Her degrees in Psychology were earned at the University of California at Irvine (Ph.D), California State University at Los Angeles (M.A.), and California State University at San Diego (B.A.). During leisure hours, she and her husband most enjoy their children and grandchildren, sailing, and travel ... in that order.

She invites police officers and other interested professionals, who have questions in her areas of expertise, to telephone or write to her at:

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DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
TECHNICAL SUMMARY

CONTRACTOR SOUTHERN CALIFORNIA RESEARCH INSTITUTE	CONTRACT NUMBER DOT-HS-5-01242
REPORT TITLE "Psychophysical Tests for DWI Arrest"	REPORT DATE January 1977.
REPORT AUTHOR(S) Marcelline Burns, Ph.D. and Herbert Moskowitz, Ph.D.	

The objectives of "Psychophysical Tests for DWI Arrest" were:

- (1) To evaluate currently used physical coordination tests to determine their relationship to intoxication and driving impairment.
- (2) To develop more sensitive tests that would provide more reliable evidence of impairment, and
- (3) To standardize the tests and observation.

Criteria for the selection of sobriety tests and an initial list of potential tests were derived from field observations, interviews with law enforcement officers and from a literature review. Administration and scoring procedures were standardized during laboratory pilot studies of the tests. On the basis of these preliminary investigations the following tests were chosen for an evaluation study: One-Leg Stand, Walk-and-Turn, Finger-to-Nose, Finger Count, Alcohol Gaze Nystagmus (AGN), Tracing, and alternate tests (Romberg body sway, Subtraction, Counting Backward, Letter Cancellation).

For the evaluation study ten officers (police, sheriff, and highway patrol) served as examiners, administering the tests of impairment to 238 participants who were Light, Moderate and Heavy and drinkers. Placebo or alcohol treatments produced BAC's in the range 0-.15%. The officer scored an individual's performance of each test on a 1-10 scale, and after administering the entire battery recorded his decision as to whether the individual should be arrested or released if the testing were occurring at roadside, assuming a legal criterion of .10% BAC.

All of the tests were found to be alcohol sensitive. The arrest/release decisions were correct for 76% of the participants, but the officers' scoring indicated that they had adopted a lower level of impairment as a decision criterion for arrest than would typically be applied in the field. This resulted in a high rate of false-arrest decisions.

(Continue on additional pages)

"PREPARED FOR THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION UNDER CONTRACT NO.: DOT-HS-5-01242. THE OPINIONS, FINDINGS, AND CONCLUSIONS EXPRESSED IN THIS PUBLICATION ARE THOSE OF THE AUTHORS AND NOT NECESSARILY THOSE OF THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

A second approach to an arrest/release classification of participants used a test-score criterion as determined by linear regression calculations. On the basis of this analysis a total score greater than the criterion of 28 caused the individual to be classified as at or above .10% BAC and thus subject to arrest. Eighty-three percent of the classifications were correct, and neither false arrest nor false release decisions were unduly high.

A reduced "best" test set was determined by stepwise discriminant analysis. It includes One-Leg Stand, Walk-and-Turn, and Alcohol Gaze Nystagmus. This final, recommended sobriety test battery can be administered without special equipment in most roadside environments, and it can be adapted to yield more precise measurement if administered in the station. The total test time in most cases will be no more than five minutes. More than 83% of the evaluation study participants can be correctly classified on the basis of just these three tests.

If balance and walking skills are examined, and the eyes are checked for the jerking nystagmus movement, the officer will have as much information about intoxication level as can be obtained at roadside. Alcohol gaze nystagmus is a particularly valuable measure, which is underutilized in law enforcement and which merits additional study and application.

The evaluation study data show that substantial impairment typically occurs at a BAC lower than .10%, the current arbitrarily defined level for DWI arrest. It is suggested that a more appropriate legal BAC limit would be .08%.

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle DEVELOPMENT AND FIELD TEST OF PSYCHOPHYSICAL TESTS FOR DWI ARREST		5. Report Date March 1981	
		6. Performing Organization Code	
7. Author(s) V. Tharp, M. Burns, and H. Moskowitz		8. Performing Organization Report No. SCRI-TR81-	
9. Performing Organization Name and Address Southern California Research Institute 6305 Arizona Place Los Angeles, California 90045		10. Work Unit No.	
		11. Contract or Grant No. DOT-HS-8-01970	
12. Sponsoring Agency Name and Address Department of Transportation National Highway Traffic Safety Administration Washington, D. C. 20590		13. Type of Report and Period Covered Final Report Aug. 1978 - March 1981	
		14. Sponsoring Agency Code	
15. Supplementary Notes none			
16. Abstract Administration and scoring procedures were standardized for a sobriety test battery consisting of the walk-and-turn test, the one leg stand test, and horizontal gaze nystagmus. The effectiveness of the standardized battery was then evaluated in the laboratory and, to a limited extent, in the field. Ten police officers administered the tests in the laboratory to 297 drinking volunteers with blood alcohol concentrations (BACs) ranging from 0 to 0.18%. The officers were able to classify 81% of these volunteers, on the basis of their test scores, with respect to whether their BACs were above or below 0.10%. Officer estimates of the BACs of people they tested differed by 0.03% on the average from the actual BAC. Interrater and test-retest reliabilities for the test battery ranged from 0.60 to 0.80. In a limited field evaluation police officers filled out 3128 data forms, each represented a driver stopped during a three month period. Police officers, after training on the administration and scoring procedures for the test battery, tended to increase their arrest rates and appeared to be more effective in estimating BACs of stopped drivers than they were before training. Anonymous breath testing of released drivers who were stopped indicated that many of the drinking drivers were never given a sobriety test.			
17. Key Words sobriety test standardization alcohol police walk and turn one leg stand horizontal gaze nystagmus		18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161	
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DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

TECHNICAL SUMMARY

CONTRACTOR
SOUTHERN CALIFORNIA RESEARCH INSTITUTE

CONTRACT NUMBER
DOT HS 8-01970

REPORT TITLE
Development and Field Test of Psychophysical Tests for
DWI Arrest

REPORT DATE
March 1981

REPORT AUTHOR(S)
Van K. Tharp, Ph.D., Marcelline Burns, Ph.D., and Herbert Moskowitz, Ph.D.

The objectives of "Development and Field Test of Psychophysical Tests for DWI Arrest" were: (1) to standardize the administration and scoring procedures for the sobriety test battery identified under contract DOT-HS-5-01242; (2) to determine the reliability and validity of the standardized test battery in the laboratory; and (3) to assess its feasibility, utility, and validity in the field.

The recommended test battery consisted of the walk-and-turn test, the one leg stand test, and the gaze nystagmus test. Standardized administration and scoring procedures were developed by determining the most sensitive administration and scoring procedures with 25 pilot subjects at various blood alcohol levels.

Ten police officers participated in a laboratory evaluation in which 297 individuals were given alcohol and tested using the standardized procedures. The 297 participants, after drinking, had blood alcohol concentrations (BACs) ranging from 0 to 0.18%. Interrater reliability was assessed by comparing the test scores of each police officer with the test scores of an observer who witnessed the test administration. Half of the participants returned for a second test session under the same alcohol dose conditions for the purpose of assessing test-retest reliability. The effectiveness of the test battery was assessed by determining the ability of the officers to classify the participants as being above or below a 0.10% BAC.

The officers' estimates of the BACs of the people they tested differed

(Continue on additional pages)

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by 0.03% on the average from the actual BACs, measured by an Intoximeter. The officers were able to classify 81% of the laboratory subjects with respect to whether their BACs were above or below 0.10%. Reliability measures produced correlations in the range of 0.60 to 0.80 for interrater and test-retest reliabilities. Based upon an exhaustive analysis of the laboratory data, it is concluded that the tests are optimally developed and standardized. No further laboratory work is recommended.

A limited field evaluation was carried out as a three phase study. The three phases, each approximately a month long, involved 1) baseline data collection; 2) data collection with only half of the officers trained to administer and score the test battery; and 3) data collection with all of the officers trained. The police officers were asked to fill out data forms for every driver stopped during the field evaluation. In addition, trained observers rode with each officer during each phase of the study to observe the officer administering and scoring the tests in the field and to obtain anonymous breath samples from each driver stopped.

The officers filled out 3128 data forms during the three month study. This represented an average of 4.56 forms per shift worked. Since officers made over 7 stops per shift during the ridealongs, the police data forms are probably about 65% complete. During the ridealongs, 85% of the stopped drivers who were asked to provide breath samples agreed to do so.

Because of the limited nature of the field study and incomplete data, only trends were suggested in the data analysis. These trends do suggest that positive results will be obtained if the test battery is widely used. For example, a 20% increase in arrest rates occurred after the test battery was introduced. Trained officers were able to make more accurate decisions relative to a BAC of 0.10% and they were able to better estimate the BAC of stopped drivers.

Major effort is needed for a subsequent field evaluation, repeating the same study design with a larger and broader sample. Future research should take into account police attitude and motivation, an adequate time frame for data collection, and numerous issues involved in obtaining law enforcement cooperation in such an effort.

Appendix IV

**List of Records by
Control Number, BAC,
and Disposition**

COLORADO VALIDATION STUDY OF THE SFSTs
BAC Distribution, by Officer Decisions to Arrest or Release

CORRECT DECISIONS

<u>Control</u>	<u>BAC</u>	
79	.100	
150	.100	
177	.100	
266	.101	
105	.102	
151	.105	
6	.106	n = 13
93	.107	
53	.107	$\bar{x} = 0.105\%$
152	.107	
28	.108	
188	.108	
217	.108	
<hr/>		
190	.110	
206	.110	
248	.110	
118	.112	
156	.112	
169	.112	
179	.112	n = 13
68	.113	
241	.113	$\bar{x} = 0.113\%$
47	.114	
208	.116	
153	.117	
102	.119	
<hr/>		
23	.120	
94	.120	
258	.120	
260	.120	
127	.122	
130	.123	
125	.123	
61	.124	n = 16
205	.125	
303	.125	$\bar{x} = 0.124\%$
122	.126	
27	.126	
247	.128	
249	.128	
58	.129	
207	.129	

COLORADO VALIDATION STUDY OF THE SFSTs
 BAC Distribution, by Officer Decisions to Arrest or Release
 CORRECT DECISIONS (cont'd)

		<u>HITS: Arrested for DUI, Measured BAC > 0.10% (cont'd)</u>	
9	.130		
291	.134		
189	.135		
82	.136	n = 8	
107	.136		
160	.136	$\bar{x} = 0.135\%$	
250	.136		
234	.138		
<hr/>			
289	.140		
126	.144		
44	.145		
235	.145		
45	.146	n = 9	
228	.147		
24	.148	$\bar{x} = 0.146\%$	
120	.149		
199	.149		
<hr/>			
75	.150		
139	.151		
300	.151		
115	.152		
195	.152	n = 9	
296	.155		
42	.156	$\bar{x} = 0.154\%$	
70	.157		
170	.159		
<hr/>			
242	.160		
274	.160		
7	.162		
209	.162		
211	.162	n = 10	
184	.164		
12	.168	$\bar{x} = 0.164\%$	
40	.168		
245	.169		
10	.169		
<hr/>			
191	.176		
198	.176		
202	.177	n = 5	
271	.177		
181	.179	$\bar{x} = 0.177\%$	
<hr/>			

COLORADO VALIDATION STUDY OF THE SFSTs
 BAC Distribution, by Officer Decisions to Arrest or Release
 CORRECT DECISIONS (cont'd)

<u>HITS: Arrested for DUI, Measured BAC > 0.10% (cont'd)</u>		
119	.180	
238	.182	
221	.182	
48	.183	
57	.183	n = 10
164	.183	
261	.183	$\bar{x} = 0.183\%$
154	.184	
232	.186	
218	.187	
<hr/>		
178	.194	n = 2
46	.195	
		$\bar{x} = 0.195\%$
<hr/>		
65	.201	
158	.205	
194	.205	
142	.207	
174	.208	n = 13
67	.210	
237	.211	$\bar{x} = 0.210\%$
171	.212	
301	.212	
172	.215	
272	.215	
54	.217	
264	.218	
<hr/>		
97	.220	
223	.221	
224	.225	
51	.226	
19	.229	n = 10
163	.229	
226	.231	$\bar{x} = 0.228\%$
267	.231	
253	.235	
297	.235	
<hr/>		
43	.240	
167	.242	
305	.245	n = 5
227	.248	
293	.259	$\bar{x} = 0.247\%$
<hr/>		

COLORADO VALIDATION STUDY OF THE SFSTs
 BAC Distribution, by Officer Decisions to Arrest or Release

CORRECT DECISIONS (cont'd)

<u>HITS: Arrested for DUI, Measured BAC > 0.10% (cont'd)</u>																													
193	.263																												
95	.266																												
222	.272	n = 5																											
8	.280																												
56	.290	\bar{x} = 0.274%																											
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">246</td> <td style="width: 15%;">.304</td> <td></td> </tr> <tr> <td>244</td> <td>.306</td> <td></td> </tr> <tr> <td>132</td> <td>.314</td> <td style="text-align: right;">n = 5</td> </tr> <tr> <td>225</td> <td>.324</td> <td></td> </tr> <tr> <td>252</td> <td>.343</td> <td style="text-align: right;">\bar{x} = 0.318%</td> </tr> <tr> <td colspan="3" style="border-top: 1px solid black; padding-top: 10px;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="text-align: right;">n = 133</td> </tr> <tr> <td></td> <td></td> <td style="text-align: right;">\bar{x}BAC = 0.170%</td> </tr> <tr> <td></td> <td></td> <td style="text-align: right;">Std. dev. = 0.055%</td> </tr> </table> </td> </tr> </table>			246	.304		244	.306		132	.314	n = 5	225	.324		252	.343	\bar{x} = 0.318%	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="text-align: right;">n = 133</td> </tr> <tr> <td></td> <td></td> <td style="text-align: right;">\bar{x}BAC = 0.170%</td> </tr> <tr> <td></td> <td></td> <td style="text-align: right;">Std. dev. = 0.055%</td> </tr> </table>					n = 133			\bar{x} BAC = 0.170%			Std. dev. = 0.055%
246	.304																												
244	.306																												
132	.314	n = 5																											
225	.324																												
252	.343	\bar{x} = 0.318%																											
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="text-align: right;">n = 133</td> </tr> <tr> <td></td> <td></td> <td style="text-align: right;">\bar{x}BAC = 0.170%</td> </tr> <tr> <td></td> <td></td> <td style="text-align: right;">Std. dev. = 0.055%</td> </tr> </table>					n = 133			\bar{x} BAC = 0.170%			Std. dev. = 0.055%																		
		n = 133																											
		\bar{x} BAC = 0.170%																											
		Std. dev. = 0.055%																											

COLORADO VALIDATION STUDY OF THE SFSTs
BAC Distribution, by Officer Decisions to Arrest or Release

CORRECT DECISIONS (cont'd)

HITS: Arrested for DWAI, Measured BAC 0.050% - 0.099% BAC

20	.050	
131	.050	
140	.050	n = 5
295	.052	
233	.058	$\bar{X} = 0.052\%$

299	.063	n = 2
287	.069	$\bar{X} = 0.066\%$

80	.070	
268	.070	
269	.070	
270	.071	
78	.074	n = 11
236	.075	
290	.075	$\bar{X} = 0.074\%$
96	.076	
288	.077	
22	.079	
74	.079	

81	.080	
60	.081	
183	.081	n = 6
196	.082	
187	.087	$\bar{X} = 0.083\%$
14	.089	

215	.092	
32	.093	
29	.095	n = 6
257	.095	
129	.096	$\bar{X} = 0.094\%$
292	.097	

n = 30 $\bar{X}BAC = 0.076\%$
Std. dev. = 0.014%

TOTAL CORRECT ARRESTS

N = 163 $\bar{X}BAC = 0.152\%$
Std. dev. = 0.062%

COLORADO VALIDATION STUDY OF THE SFSTs
BAC Distribution, by Officer Decisions to Arrest or Release

CORRECT REJECTIONS: Released, Measured BAC < 0.050%		
3	.000	
5	.000	
62	.000	
85	.000	
87	.000	n = 7
124	.000	
275	.000	zero BAC
<hr/>		
35	.001	
50	.001	
136	.001	n = 6
117	.004	
84	.005	\bar{x} = 0.003%
251	.006	
<hr/>		
52	.011	
113	.012	n = 5
147	.014	
263	.017	\bar{x} = 0.014%
185	.018	
<hr/>		
63	.020	
262	.020	
71	.025	
114	.025	n = 9
88	.026	
89	.026	\bar{x} = 0.025%
162	.027	
137	.028	
186	.029	
<hr/>		
86	.032	n = 4
33	.033	
159	.035	\bar{x} = 0.035%
59	.038	
<hr/>		
77	.040	
121	.041	
279	.041	n = 7
231	.046	
138	.047	\bar{x} = 0.045%
30	.048	
21	.049	
<hr/>		
TOTAL CORRECT DECISIONS TO RELEASE	n = 38	\bar{x} BAC = 0.020% Std. dev. = 0.017%

COLORADO VALIDATION STUDY OF THE SFSTs
BAC Distribution, by Officer Decisions to Arrest or Release

INCORRECT DECISIONS

DWAI FALSE NEGATIVE: Subject Released, Measured BAC .050 - .099%

17	.050	
155	.052	
91	.053	
18	.059	
90	.061	
220	.061	n = 15
25	.062	
230	.066	\bar{x} = 0.068%
216	.066	
123	.067	
37	.070	
168	.075	
83	.087	
4	.097	
72	.099	

DUI FALSE NEGATIVE: Subject Released, Measured BAC \geq .10%

280	.100	
41	.102	
49	.111	n = 6
135	.111	
39	.112	\bar{x} = 0.117%
161	.165	

TOTAL FALSE NEGATIVE n = 21 \bar{x} BAC = 0.082%
Std. dev. = 0.028%

FALSE POSITIVES: Subject Arrested, Measured BAC < 0.050%

166	.000
99	.003
284	.011
104	.012
103	.019
255	.024
180	.029
294	.035
302	.039
116	.042
112	.045
298	.048

TOTAL FALSE POSITIVES n = 12 \bar{x} BAC = 0.026% BAC
Std. dev. = 0.017% BAC

COLORADO VALIDATION STUDY OF THE SFSTs
BAC Distribution, by Officer Decisions to Arrest or Release

38 SUBJECTS RELEASED, NO OBSERVER
22 SUBJECTS REFUSED EVIDENTIAL TEST
7 SUBJECTS REFUSED PRELIMINARY BREATH TEST AT ROADSIDE
67
3 SUBJECTS ARRESTED ON DRUG CHARGE

Appendix V

Distribution of Records by Month, day, and Officer

Distribution of Records By Month, Day, and Officer

<u>MONTH</u>	<u>Date</u>	<u>Day</u>	Number		
			<u>Records</u> (Total)	<u>Officers</u> (Total)	<u>Records</u> (\bar{x})
FEBRUARY	.				
	22	Wed.	4	4	1
	23	Thurs.	5	3	1 . 7
	24	Fri.	5	4	1 . 3
	25	Sat.	9	4	2 . 3
	26	Sun.	5	4	1 . 3
	27	Mon.	1	1	1
			n = 29		
				\bar{x} records/ officer day = 1 . 5	
MARCH	1	Wed.	2	2	1
	2	Thurs.	2	2	1
	3	Fri.	7	6	1 . 2
	4	Sat.	11	8	1 . 4
	5	Sun.	12	8	1 . 5
	6	Mon.	3	3	1
	7	Tues.	3	3	1
	8	Wed.	8	6	1 . 3
	9	Thurs.	3	3	1
	10	Fri.	10	6	1 . 7
	11	Sat.	8	6	1 . 3
	12	Sun.	5	5	1
	13	Mon.	7	4	1 . 8
	14	Tues.	9	5	1 . 8
	.				
	17	Fri.	6	4	1 . 5
	18	Sat.	7	4	1 . 8
	19	Sun.	6	6	1
	20	Mon.	3	2	1 . 5
	21	Tues.	5	4	1 . 3
	22	Wed.	4	3	1 . 3
	23	Thurs.	8	7	1 . 1
	24	Fri.	1	1	1
	25	Sat.	6	5	1 . 2
	26	Sun.	4	3	1 . 3
	27	Mon.	2	2	1
	30	Thurs.	1	1	1
	31	Fri.	1	1	1
			n = 144		
				\bar{x} records/ officer day = 1 . 3	

Distribution of Records by Month, Day, and Officer (cont'd)

<u>MONTH</u>	<u>Date</u>	<u>Day</u>	Number			
			<u>Records (Total)</u>	<u>Officers (Total)</u>	<u>Records (\bar{X})</u>	
APRIL	1	Sat.	5	3	1 . 7	
	2	Sun.	4	4	1	
	3	Mon.	4	2	2	
	4	Tues.	1	1	1	
	5	Wed.	1	1	1	
	6	Thurs.	4	4	1	
	7	Fri.	3	3	1	
	8	Sat.	5	4	1 . 25	
	9	Sun.	3	3	1	
	10	Mon.	2	1	2	
	11	Tues.	2	2	1	
	12	Wed.	3	3	1	
	13	Thurs.	2	2	1	
	14	Fri.	1	1	1	
	15	Sat.	5	4	1 . 25	
	16	Sun.	3	3	1	
	17	Mon.	2	2	1	
	18	Tues.	2	2	1	
	19	Wed.	3	2	1 . 5	
	20	Thurs.	2	2	1	
	21	Fri.	4	4	1	
	22	Sat.	6	4	1 . 5	
	23	Sun.	2	2	1	
	26	Wed.	3	2	1 . 5	
	27	Thurs.	1	1	1	
				n = 73		
						\bar{X} records/ officer day = 1 . 2
MAY	2	Tues.	1	1	1	
	3	Wed.	1	1	1	
	4	Thurs.	1	1	1	
	18	Thurs.	1	1	1	
	21	Sun.	1	1	1	
	24	Wed.	2	2	1	
	25	Thurs.	2	2	1	
	26	Fri.	5	3	1 . 7	
	27	Sat.	5	4	1 . 3	
	28	Sun.	5	3	1 . 7	
	29	Mon.	1	1	1	
30	Tues.	1	1	1		
31	Wed.	1	1	1		
			n = 27			
					\bar{X} records/ officer day = 1 . 2	

Distribution of Records by Month, Day, and Officer

<u>MONTH</u>	<u>Date</u>	<u>Day</u>	Number		
			<u>Records (Total)</u>	<u>Officers (Total)</u>	<u>Records \bar{x}</u>
JUNE	1	Thurs.	2	2	1
	3	Fri.	2	2	1
	4	Sat.	2	2	1
	14	Wed.	1	1	1
	16	Fri.	2	2	1
	17	Sat.	2	2	1
	18	Sun.	1	1	1
	21	Wed.	1	1	1
	22	Thurs.	1	1	1
	23	Fri.	2	2	1
	24	Sat.	2	2	1
	25	Sun.	1	1	1
	26	Mon.	1	1	1
	29	Thurs.	1	1	1
			n = 20		\bar{x} records/ officer day = 1
JULY	1	Sat.	2	2	1
	4	Tues.	1	1	1
	6	Thurs.	1	1	1
	7	Fri.	1	1	1
	15	Sat.	2	2	1
	16	Sun.	1	1	1
	23	Sun.	1	1	1
	28	Fri.	1	1	1
	29	Sat.	1	1	1
	30	Sun.	1	1	1
			n = 12		\bar{x} records/officer day = 1
			N = 305		

Appendix VI

**Circumstances and
Characteristics of
12 Incorrect Arrests**

Circumstances and Characteristics
of 12 Incorrect Arrests

Control No. 99
Subject Gender Male
Age 33

Time

Arrest 2310
Breath/Blood Specimen 0007
BAC 0.003%

Weather Clear, dry

Observations

Driving Rode center line for 300', crossed center line by 3', over shoulder line
Subject alcohol odor; bloodshot, watery eye
FSTs poor performance
HGN Lack of smooth pursuit
Subject said he had one beer. He was wearing cowboy boots

Control No. 103
Subject Gender Female
Age 40

Time

Arrest 2205
Breath/Blood Specimen 2235
BAC 0.019%

Weather Clear, dry

Observations

Driving weaving
Subject
FSTs very poor
HGN Lack of smooth pursuit
Distinct jerking at maximum deviation
Subject said she had 3 glasses wine and champagne, was very tired.

Control No. 104
Subject Gender Male
Age 35

Time

Arrest 0130
Breath/Blood Specimen 0208
BAC 0.012%

Weather Dry, clear

Observations

Driving Ran stop sign.
Subject Strong alcohol odor; red, watery eyes
FSTs Poor
HGN Lack of smooth pursuit
Distinct jerking at maximum deviation
Subject said he went out after argument with wife, had two beers.

<u>Control No.</u>	112
<u>Subject Gender</u>	Male
Age	44
<u>Time</u>	
Arrest	0035
Breath/Blood Specimen	0135 (Subject belched. Asked for water.)
BAC	0.045%
<u>Weather</u>	Clear, dry
<u>Observations</u>	
Driving	Headlight out
Subject	Alcohol odor; red, watery eyes, slurred speech, clumsy
FSTs	Poor performance
HGN	Lack of smooth pursuit

Subject said he had 4 beers, limiting himself to one per hour.

<u>Control No.</u>	116
<u>Subject Gender</u>	Female
Age	72
<u>Time</u>	
Arrest	2225
Breath/Blood Specimen	
BAC	0.042%
<u>Weather</u>	Clear, dry
<u>Observations</u>	INCOMPLETE RECORD

<u>Control No.</u>	116
<u>Subject Gender</u>	Female
Age	
<u>Time</u>	
Arrest	2143
Breath/Blood Specimen	2205
BAC	0.000
<u>Weather</u>	Clear, dry
<u>Observations</u>	
Driving	Speeding
Subject	Alcohol odor
FSTs	Poor
HGN	-

Subject said she had a glass of wine with dinner.

<u>Control No.</u>	180
<u>Subject Gender</u>	Male
Age	22
<u>Time</u>	
Arrest	2111
Breath/Blood Obtained	2149
BAC	0.029%
<u>Weather</u>	Clear, dry
<u>Observations</u>	
Driving	One headlight and one taillight out
Subject	Alcohol odor, bloodshot eyes, slurred speech, confused
FSTs	Could not do WAT, said "arrest me"
HGN	Lack of smooth pursuit

<u>Control No.</u>	255
<u>Subject Gender</u>	Male
Age	26
<u>Time</u>	
Arrest	0120
Breath/Blood Specimen	0149
BAC	0.024%
<u>Weather</u>	Clear, roadway and SFST surface wet
<u>Observations</u>	
Driving	Ran stop sign.
Subject	Moderate alcohol odor, watery eyes
FSTs	Stopped two times on WAT Food down two times on OLS
HGN	Lack of smooth pursuit Distinct jerking at maximum deviation

Subject said she had four white Russians.

<u>Control No.</u>	284
<u>Subject Gender</u>	Male
Age	21
<u>Time</u>	
Arrest	0300
Breath/Blood Specimen	0336
BAC	0.011%
<u>Weather</u>	Clear, dry
<u>Observations</u>	
Driving	Headlight and taillight out
Subject	Strong alcohol odor; red, watery eyes
FSTs	Poor performance
HGN	Lack of smooth pursuit Distinct jerking at maximum deviation

Subject said he had 3 mixed drinks.

Control No. 294
Subject Gender Male
Age 43
Time
Arrest 2240
Breath/Blood Specimen 2338
BAC 0.035%
Weather Clear, dry
Observations
Driving Over center lane by 4 ft.
Subject Odor; red, watery eyes; slurred speech
FSTs Poor
HGN Lack of smooth pursuit.
Distinct jerking at maximum deviation Onset angle of gaze prior to 45 degrees
Subject said he had 3 beers between 2000-2130, not used to new car

Control 298
Subject Gender Male
Age 31
Time
Arrest 0122
Breath/Blood Specimen 0204
BAC 0.048%
Weather Rain, wet
Observations
Driving weaving
Subject Alcohol odor; bloodshot eyes
FSTs Poor
HGN Lack of smooth pursuit.
“Vehicle needs alignment work. I was holding my girl friend’s hand.”

Control 302
Subject Gender male
Age 61
Time
Arrest 0158
Breath/Blood Specimen 0251
BAC 0.039%
Weather Clear, dry
Observations
Driving Weaving, crossed center line 3 times, shoulder line twice, 70 in 55 mph zone
Subject Alcohol odor; bloodshot eyes; slurred speech; clumsy and uncoordinated
FSTs Poor
HGN Lack of smooth pursuit
Distinct jerking at maximum deviation
“I had one beer. I had more than one beer.”

FIGURE 3
COLORADO VALIDATION STUDY OF THE SFSTs
Officer Experience in Law Enforcement

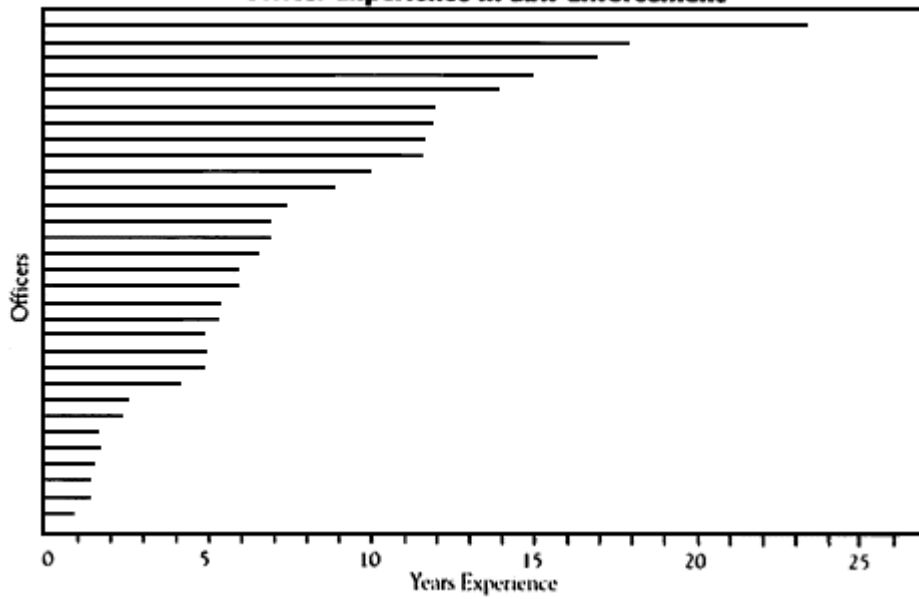


FIGURE 4
COLORADO VALIDATION STUDY OF THE SFSTs
Reported Total Number of DUI Arrests, by Officer

