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# PILOT TEST OF SELECTED DWI DETECTION PROCEDURES FOR USE AT SOBRIETY CHECKPOINTS

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16. Abstract

This report presents the results of a study designed to evaluate a variety of potential screening procedures police officers could use at the brief initial stop at a sobriety checkpoint to discriminate between impaired and sober drivers. The potential checkpoint screening procedures examined in the study included the horizontal gaze nystagmus test, observations of driving and stopping behavior, the driver's personal appearance, a divided attention task and a passive alcohol sensor.

In the study, dosed and sober drivers drove their own cars down a closed street and were stopped by police officers at a sobriety checkpoint. The setting of the experiment and the procedures used were designed to closely simulate the conditions found at real checkpoints.

The results indicated that the officers using a test screening procedure were able to accurately discriminate between impaired drivers (those with a breath alcohol level of 0.10% or higher) and sober drivers. The officers correctly identified 95% of the impaired drivers while misidentifying few of the sober drivers. The accurate performance of these officers appeared to be primarily due to the use of the gaze nystagmus test. Also, the passive alcohol sensor was accurate in detecting whether the driver had been drinking. The sensor correctly identified 94% of the impaired drivers (who had BACs of 0.10% or higher) as having been drinking, while misidentifying 10% of the sober drivers. These screening procedures produced a more accurate discrimination between impaired and sober drivers than did police officers using a common technique of stopping a vehicle, speaking briefly with driver and then making a subjective judgment. These results suggest that the typical checkpoint screening procedure (where the officers simply observe the driver and form a subjective opinion) can be improved by the use of techniques like the nystagmus test or a properly designed and used passive sensor.

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## PREFACE

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## EXECUTIVE SUMMARY

In recent years there has been a growing interest across the country in the use of DWI sobriety checkpoints to both catch drunk drivers and to deter potential drunk drivers from driving while impaired. The long-term success of this enforcement technique will require that police officers stationed at sobriety checkpoints be properly trained in effective DWI detection procedures so they can detect and arrest most of the impaired drivers stopped at the checkpoint. Otherwise, drinking drivers will eventually learn that many drunk drivers get through the checkpoints and perceive them to be ineffective.

At a sobriety checkpoint a police officer must quickly determine whether a driver is likely to be under the influence of alcohol in order to have sufficient cause to detain the motorist for further investigation. Little information is currently available regarding the effectiveness of different detection techniques used at sobriety checkpoints. This study evaluated a variety of potential screening procedures to determine the extent to which they discriminated between impaired and sober drivers during the brief initial stop at a sobriety checkpoint.

As part of the study, four different types of measurements were combined into a "test" screening procedure designed to maximize the detection of the alcohol-impaired driver. The resulting procedure made use of several techniques known or expected to detect alcohol intoxication. Each component could potentially provide the officer with reason to believe the driver was under the influence of alcohol and hence, with cause to detain the driver after the initial stop.

This "test" screening procedure, involved the use of the horizontal gaze nystagmus test, a divided attention task, and observations of the driving behavior and personal appearance of the driver. These components are described briefly below:

- Driving Behavior - The officer observed and recorded the driving behavior of the motorist while he approached and stopped at the checkpoint. This brief glimpse of driving behavior may provide the first indication of alcohol impairment. Previous research has shown that certain behaviors exhibited by drivers (at night) indicate a high likelihood that the driver has a BAC of 0.10%, or above. Some of these behaviors appeared likely to occur at a checkpoint (e.g., weaving, improper speed, decelerating rapidly, braking erratically, drifting, stopping inappropriately, etc.).

- Driver Appearance - The officers also observed and recorded the driver's appearance for signs of alcohol intoxication. Intoxicated drivers often appear to be drunk to an experienced officer. While no precise description of an intoxicated person has been developed, experience and judgement may allow an officer to observe certain

signs that are indicative of intoxication. Examples of the sort of things an officer may notice include the odor of alcoholic beverages, a flushed appearance of the face, slurred speech, nervous or excited demeanor, poor dexterity, etc.

- o Horizontal Gaze Nystagmus - The officers administered this simple eye test through the open car window to the driver seated in his vehicle. This test is relatively nonintrusive, is easily scored on a six-point scale, and has been shown to reliably indicate alcohol intoxication when used with suspected drunk drivers. It was initially designed for use at the roadside after the driver has stepped out of his car, but because of the accuracy and ease of administration of this test, it appeared promising for use as an initial screening device at sobriety checkpoints.

- o Divided Attention - One of the more pronounced and reliable effects of alcohol on behavior is to reduce a person's ability to attend to, and do, two different things at once. The officers gave the driver a simple divided attention task by requesting the driver to produce his driver's license and vehicle registration while engaging him in conversation (questioning the driver in a way that he can not respond without thinking).

Two additional measurements were made by researchers for each driver stopped at the checkpoints in order to assess the extent to which these measurements correlated with the driver's BAC. They were:

- o Stopping Distance - A researcher located at each checkpoint measured the distance each vehicle stopped from the point where the officer stood. The intent was to determine whether the impaired drivers had a greater tendency to stop before or beyond this point. Previous research on the effects of alcohol on driving performance have repeatedly reported detrimental effects on stopping performance.

- o Passive Alcohol Sensor - A researcher also took a reading with a passive alcohol sensor (PAS), a breath alcohol measurement device designed to detect whether a person has been drinking or not. This device has been suggested as a promising screening tool for use at sobriety checkpoints. The PAS detects the presence of alcohol in the air passing over a sensor (e.g., in exhaled breath). It does not require a person to blow into a mouthpiece, rather, a person provides a sample by breathing or talking normally while the unit is held about six inches from his/her face. Traditional portable breath testing devices require the person to provide a sample of deep lung air by blowing into a tube. It was felt that the PAS may be useable through the open car window by an officer who is conversing with the driver.

## Design

In the study, dosed and sober drivers drove their own cars down a closed street and were stopped by police officers at a sobriety checkpoint. The setting of the experiment and the procedures used were designed, to the extent possible, to simulate the conditions found at real checkpoints. The officers at the checkpoints came from three police agencies and knew only that sober and dosed drivers would be driving through the checkpoints. These officers were, for the most part, experienced in conducting sobriety checkpoints as part of their regular police duties. Their task, as participants in this study, was to briefly stop and screen the drivers passing through the checkpoint, using the assigned screening procedure. Once this procedure was completed, the driver was sent on his way. No further investigation took place in the study.

The study compared two checkpoint screening procedures. One was the "test" procedure described above, the other was a "typical" police procedure, involving a brief stop and quick observation of the driver by the officer. This was the procedure actually employed in the field by the officers participating in our study. In it the officer looked at the driver, engaged him in brief conversation (in order to smell the odor of alcoholic beverages), and then made a decision regarding the driver's state of impairment.

## Method

Both the officers and researchers staffing the checkpoints were blind to the driver's condition and to the number of drivers in each condition. The majority of the drivers (52%) passing through the checkpoints were sober. Approximately 79% of the drivers were either sober or had been drinking but had BACs below 0.10%. The target drivers, those with BACs at, or above 0.10%, constituted 21% of the drivers.

During testing, three checkpoints were situated along a public street that was closed to normal traffic. The street was illuminated by streetlights. The checkpoints were spaced about a quarter-mile apart. Each driver was stopped at each checkpoint. Using three checkpoints increased the amount of data that could be collected from each driver, with the risk that the driver's behavior might change as a result of each stop. The results revealed no detectable differences in the driver's behavior at the three checkpoints.

The drivers were 75 male volunteers, 20-30 years of age, who were paid to participate in the study. Testing was conducted over four nights, between 7:00 PM and 3:00 AM. Approximately 20 drivers each night were randomly assigned to one of three driver conditions. Five were given enough alcohol to produce a BAC of about 0.12%. Five were dosed to a lower BAC of about 0.07%, and the remaining drivers remained sober. The drivers were told whether they were drinking alcohol, but not what the target BAC levels were. They drove the test course in their own vehicles, with a researcher riding with them.

Each checkpoint consisted of a reflective warning sign ("STOP AHEAD POLICE SOBRIETY CHECKPOINT") placed 200 feet before the checkpoint, traffic cones, roadway flares, a clearly marked police vehicle with flashing lights, a traffic sign instructing the driver to stop to speak with the police officer ("STOP TO SPEAK WITH OFFICER"), a lighting truck to illuminate the checkpoint, and two uniformed police officers.

Police officers from three agencies participated in the study. Officers from the Massachusetts State Police (MASP), the Metropolitan District Commission Police of Massachusetts (MDC), and the Maryland State Police (MDSP) staffed the checkpoints. The officers from the MASP and MDC received three hours of training in administering the nystagmus test prior to their participation in the study. The officers from the MDSP had received 16 hours of instruction in the use of the nystagmus test and had used the test during their regular enforcement duties over the past year.

At the first two checkpoints, the officers used the test screening procedure (nystagmus test, divided attention task, and formal observations), while the typical screening procedure ("look and sniff") was used at the third checkpoint. A research assistant was stationed at each checkpoint to measure the stopping position of the cars, the length of time each car was stopped, and to monitor the officer's compliance with the research protocol. At the third checkpoint the research assistant also tested the passive alcohol sensor after the two officers were finished with the driver. The type of screening procedure used at a checkpoint was not rotated across the three checkpoints because it was not possible to properly balance this and other important variables without substantially increasing the number of subjects and officers employed in the study.

The two officers at each checkpoint both observed and interacted with each driver. One of the officers served the role of the lead officer and was responsible for stopping the driver and conducting the screening procedure. The second officer observed the driver's behavior and interaction with the first officer. Only the nystagmus test was administered to the driver a second time, by the second officer when the first officer was finished. The driver remained seated in his car while the screening procedure was conducted by the officers.

In order to control for differences between officers, at each checkpoint the roles of the lead officer and observing officer were alternated for every other driver in each session. In addition, the officers were rotated in prescribed order among the checkpoints from session to session. However, the officers did not rotate between the two screening procedures used.

Results

- The officers using the test screening procedure were able to accurately discriminate between impaired drivers (those with a breath alcohol level of 0.10% or higher) and those drivers who were not impaired (i.e., sober drivers). They correctly identified 95% of the impaired drivers, while misidentifying few of the sober drivers. These results are shown in Table 1.

- The Passive Alcohol Sensor (PAS) was accurate in detecting whether the driver had been drinking. The PAS correctly identified 94% of the impaired drivers as having been drinking, while misidentifying 10% of the sober drivers (shown in Table 1). Over all the BAC levels, the PAS was correct in indicating alcohol use approximately 88% of the time.

- The PAS or the officers using the test screening procedure were able to more accurately determine which drivers were impaired than those officers using the typical screening procedure. The more accurate performance of the officers using the test screening procedure appeared to be primarily due to the nystagmus test. (When the nystagmus test is used with a suspected drunk driver, a score of four or more points is taken (in the context of any other available information) as the basis for classifying the driver's BAC level as 0.10% or higher. Table 1 shows that same scoring procedure applied to the drivers in this study.)

Table 1

Percentage Of Drivers Judged Impaired At Each Driver BAC Level For Different Screening Procedures

| Screening Procedure | Driver BAC Level .00-.04% | .05-.09% | .10-.15% |
|---|---|---|---|
| Typical Procedure | 47% | 87% | 87% |
| Test Procedure | 16% | 61% | 95% |
| Nystagmus Test Score | 15% | 64% | 95% |
| Passive Sensor | 10% | 75% | 94% |

- The horizontal gaze nystagmus test was found to be easily and accurately administered to the drivers through the open car window in a brief period of time (about 40 seconds).

- The officers who had received 16 hours of training and were experienced in the use of the nystagmus test provided the most accurate judgements (as shown in Table 2).

Table 2

Percent Of Drivers Judged Impaired Using The Test Screening Procedure At Each Driver BAC Level By Officer Training

| Screening Procedure | Driver BAC Level .00-.04% | .05-.09% | .10-.15% |
|---|---|---|---|
| Briefly Trained Officers | 24% | 75% | 89% |
| Fully Trained Officers | 8% | 52% | 100% |

- The divided attention task as employed and scored in this study and the observations of driving behavior did not discriminate between most of the drivers with different BACs (i.e., between impaired and sober drivers).

- The observations by the officers using the test procedure of some of the personal appearance variables did correlate with driver BAC (a greater percentage of impaired than sober drivers exhibited these symptoms). Three of these variables, in particular, were observed in a relatively high percentage of impaired drivers but not in the unimpaired drivers, they were: Odor of Alcoholic Beverages, Face Flushed, and Eyes Dilated.

- The stopping distance measurements did not discriminate consistently between driver BAC levels.

These results suggest that the typical checkpoint screening procedure (where the officers simply observe the driver and form a subjective opinion) can be substantially improved. The use of screening procedures like the nystagmus test or a properly designed and used passive sensor would allow the officers to quickly detect almost all of the impaired drivers while unnecessarily detaining few, if any, of the unimpaired drivers.

Obviously, a word of caution is in order in interpreting these results, as the study did use simulated checkpoints (though conditions were designed, to the extent possible, to reflect the natural setting found at real checkpoints). The officers knew they were taking part in a study and that the decisions they made would not result in the arrest of the drivers they were screening.

The behavior of the drivers may also have differed from that found under real conditions. The drivers were not at risk of arrest and punishment as they would be if stopped on the road by the police. To motivate them not to exhibit any behaviors that would arouse police suspicion, they were offered a bonus payment if they convinced the officers they were sober. The drivers appeared to be quite motivated not to be detected by the police in our study (and anxious to earn the bonus payment for succeeding).

A second caution concerns the fact that our test screening procedure involved a number of tasks. There is a possibility that the effectiveness of any one part of the screening procedure may have been effected by the other tests the officer was also using. Though the officers were instructed to score the individual tests independently, it is possible their observations and judgments were affected by the other information available to them. For example, the extent to which an officer believed the nystagmus test was an empirically based, accurate indicator of BAC, the driver's nystagmus score may have influenced his decision to report other observations in cases where he was uncertain whether a cue or behavior occurred.

A third fact that should be remembered in comparing the results of the test screening procedure with the typical screening procedure was that different officers used the different screening procedures. Thus, it is possible some of the differences found between the screening procedures may have been due to differences in ability between officers. We were able to control only for the effects of police agency, training and experience of the officers.

# PILOT TEST OF SELECTED DWI DETECTION PROCEDURES FOR USE AT SOBRIETY CHECKPOINTS

Richard P. Compton

## INTRODUCTION

There has been a growing interest across the country in reducing the drunk driving problem by the adoption of general deterrence programs designed to raise the perceived risk of arrest and sanctioning by the vast majority of drunk drivers who are never arrested. One popular and promising component to this approach has been the use by the police of DWI (Driving While Intoxicated) sobriety checkpoints. Sobriety checkpoints involve a brief stop of all or a random selection of motorists by the police for screening to determine if they are impaired by alcohol. For example, the State Police in Delaware, Maryland, New York, Arizona, and local police in many counties and cities, have in the last year or two initiated checkpoint programs.

The use of sobriety checkpoints appears to increase the perception among drinking drivers that they will be detected and arrested if they drive while impaired (Williams and Lund, 1984). Checkpoints have been demonstrated to be highly effective in raising the visibility of DWI enforcement efforts (Maryland State Police, 1983).

The use of sobriety checkpoints for DWI enforcement raises a number of legal issues related to the stopped driver's constitutional rights which constrain the actions the police operating a checkpoint may take. These issues are reviewed in a Technical Note published by NHTSA (Compton and Engle, 1983). The Note also contains a list of program and operational procedures, based upon the relevant court decisions and NHTSA's review of existing programs, that should be useful to police administrators considering the use of sobriety checkpoints in their DWI enforcement programs. It is important that all sobriety checkpoints used for DWI enforcement be conducted in a way that protects the rights of individuals and are consistent with the guidelines expressed by the courts. At the same time, it is necessary that the specific procedures used are effective in detecting impaired drivers and maintaining the public perception of their effectiveness over time.

The police officers conducting sobriety checkpoints must be properly trained in effective DWI detection procedures so they can detect and arrest most of the alcohol-impaired drivers stopped at the checkpoint. Otherwise, drinking drivers will eventually learn that many drunk drivers get through the sobriety checkpoints and will as a result perceive them to be ineffective. Thus, the use of sobriety checkpoints that allow legally intoxicated drivers to pass through undetected will not, over the long run, achieve a general deterrent effect.

At a checkpoint, the police officer must determine, in a very brief period of time, whether the driver he has stopped is likely to be under the influence of alcohol. The only information he has available to him is the brief observation of the driver approaching and stopping at the checkpoint and any subsequent observations he can make during a brief interaction with the driver. He must make a quick decision without a lot of information. Should he decide to detain the driver for suspicion of DWI, he will then have the opportunity to ask the driver out of his car, to perform behavioral tests, and perhaps to take a preliminary breath test. This further investigation of the driver can take place out of the traffic lane without impeding the flow of traffic. However, the officer must have articulatable cause to detain the driver beyond the brief initial stop at the checkpoint.

The results of recent sobriety checkpoints (e.g., Maryland State Police, 1983, Delaware State Police, 1983), in which approximately 2% or less, of the drivers stopped were arrested, have raised the issue of whether the officers were really detecting the majority of the impaired drivers passing through the checkpoints. Studies conducted in the 1960's and 1970's have estimated that on weekend nights approximately 6% to 10% of the drivers on the road are driving while impaired (Jones and Joscelyn, 1978). Knowledge that the police can in fact identify most drunk drivers stopped at checkpoints would both help justify the use of this enforcement technique and maintain the heightened fear of arrest generated by the use of checkpoints.

Current police procedures at sobriety checkpoints encompass a variety of approaches to the detection of the alcohol-impaired driver. For example, officers at some checkpoints do no more that briefly observe the appearance of the driver, attempt to smell the presence of alcoholic beverages, and briefly converse with the driver (e.g., Maryland State Police). At other police checkpoints the driver is requested to produce his/her license and vehicle registration (e.g., Charlottesville, VA). One might presume that the longer the officer spends interacting with the driver the more likely he is to detect alcohol-impairment. However, no information is available regarding the effectiveness of different detection techniques used at sobriety checkpoints. An equally important consideration is the need to keep the initial stop of the drivers at a checkpoint to the briefest period possible (for legal and public relations reasons) as well as to expedite the flow of traffic.

## Test Procedure

Because there was little information currently available to assist the police officer in detecting the impaired driver stopped at a checkpoint, NHTSA developed a screening procedure designed to maximize the detection of the alcohol-impaired driver which was evaluated in this study. The screening procedure made use of several techniques known or expected to detect alcohol intoxication. It included four components, each of which might provide the officer with reason to believe the driver was under the influence of alcohol and hence, with cause to detain the driver after the initial stop.

The four components, are described briefly below:

- o Horizontal Gaze Nystagmus Test
- o Driver Behavior During Approach & Stopping
- o Driver Appearance
- o Divided Attention Task

Horizontal Gaze Nystagmus Test

Research by the NHTSA has led to the development of an effective behavioral test battery that could be used by police officers to help assess whether a suspected drunk driver was legally impaired (Anderson, Schweitz & Snyder, 1983). This test battery is used at the roadside (outside of the car) with a driver already identified as a suspected drunk driver. The most important component of the test battery is the horizontal gaze nystagmus test. This is a simple eye test that is scored on a six point scale. The gaze nystagmus test has been shown to be a reasonably accurate means of estimating whether a driver's BAC is equal to, or above 0.10% (Tharp, Burns & Moskowitz, 1981).

Horizontal gaze nystagmus refers to a jerking of the eyes that occurs as they gaze to the side. Many people will show some nystagmus (or jerking) of the eyes as they are turned as far as possible to the side. However, as people become intoxicated, the onset of the jerking will occur sooner, and the jerking at the extremes becomes more distinct. With practice, it is possible for officers to use this phenomenon to gauge impairment.

The gaze nystagmus test (as developed for NHTSA) uses three measures to gauge intoxication, namely:

- o Angle of Onset - the more intoxicated a person becomes, the sooner the jerking will occur as the eyes move to the side.
- o Maximum Deviation - the greater the alcohol impairment the more distinct the nystagmus is when the eyes are as far to the side as possible.
- o Smooth Pursuit - an intoxicated person often cannot follow a slowly moving object smoothly with his eyes.

One point is scored for each of these three factors (for each eye), for a total possible of six points. Four or more points are taken as indicating that the persons BAC is over 0.10%. Because of the accuracy and ease of administration of this test, it appeared promising for use as an initial screening device at sobriety checkpoints (to be administered through the open window to the driver seated in his vehicle).

## Driver Behavior During Approach & Stop

Most checkpoint operations will allow an officer to observe the driving behavior of a motorist while he approaches and stops at the checkpoint. This brief glimpse of driving behavior may provide the first indication of alcohol impairment. Previous research has shown that certain behaviors exhibited by drivers (at night) indicate a high likelihood that the driver has a BAC equal to or greater than 0.10% (Harris, et. al., 1980). Some of these behaviors might be observed at a checkpoint (e.g., weaving, improper speed, decelerating rapidly, braking erratically, failing to respond to traffic signs, stopping inappropriately, etc.).

During the vehicles approach to the checkpoint, it's speed and lane position may be a possible indicator that the driver has a high BAC (e.g., signs of drifting, straddling the lane marker, fast or slow speed). Finally, the driver's inability to decelerate smoothly and slowly (i.e., rapid, jerky stopping may be an indication of high BAC) and to stop where indicated (stopping short and/or inching forward or traveling beyond the designated stopping point) may be an indication of high BAC. A checklist of such behaviors is shown in Appendix A.

## Driver Appearance

Intoxicated drivers often appear to be drunk to an experienced officer. While no precise description of an intoxicated person can be provided, experience and judgement may allow an officer to notice certain signs that may be indicative of intoxication. During the officer's initial contact with the driver, the officer will typically evaluate a driver's physical appearance and condition while he is still seated in the vehicle. The sort of things an officer may notice include the odor of alcoholic beverages (keeping in mind that alcohol itself has no odor, though certain alcoholic beverages have rather pronounced and distinctive odors), a flushed appearance of the face, condition of the eyes (dilated pupils), disheveled hair or clothing, slurred speech, nervous or excited demeanor, poor dexterity, etc. The list of these items is also shown in Appendix A.

## Driver Behavior During Routine Investigation

One of the more pronounced and reliable effects of alcohol on behavior is to reduce a person's ability to attend to, and do, two different things at once. This phenomenon (known as a decrement in divided attention) can be exploited at the checkpoint situation by requesting the driver to produce his driver's license and vehicle registration while engaging him in conversation (questioning the driver in a way that he can not respond without thinking). An impaired driver may have more difficulty complying with a request for his license and registration while at the same time responding to questions put to him by the investigating officer. Impaired drivers may be more likely than a sober driver to pause in their search for their license/registration or to

forget entirely the request if they become involved in conversing with the officer. Similarly, they may not respond quickly to questions the officer asks if they are concentrating on finding their license or vehicle registration. The questions used by the officers in our study and the list of behaviors they looked for during this task are shown in Appendix A.

Study Objectives

The primary purpose of the study was to evaluate the ability of police officers to detect alcohol-impaired drivers using different screening procedures during the brief initial stop at a sobriety checkpoint. In the study, dosed and sober drivers drove their own cars down a closed street and were stopped by police officers at a sobriety checkpoint. The setting of the experiment and the procedures used were designed, to the extent possible, to simulate the natural settings found at real checkpoints. The officers staffing the checkpoints came from three police agencies (the Massachusetts State Police, the Metropolitan District Commission Police of Massachusetts, and the Maryland State Police). They knew only that sober and dosed drivers would be driving through the checkpoints. These officers were, for the most part, experienced in staffing sobriety checkpoints as part of their regular police duties. Their task, as participants in this study, was to briefly stop and screen the drivers passing through the checkpoint, using the assigned screening procedure. Once this procedure was completed, the driver was sent on his way. No further investigation took place in the study.

Two checkpoint screening procedures were used. One was a "typical" police procedure, involving a brief stop and quick observation of the driver by the officer. This was the procedure actually employed in the field by the officers participating in our study. In it the officer looked at the driver, engaged him in brief conversation (in order to smell the odor of alcoholic beverages), and then made a decision regarding the driver's state of impairment.

The second screening procedure, called the "test procedure", involved the use of the gaze nystagmus test, a divided attention task, and observations of the driving behavior and personal appearance of the driver (as described above). From a design point of view, it would have been preferable to have evaluated each of these components separately. However, due to cost and other constraints, it was not feasible to do so.

Though the nystagmus test has been shown to accurately indicate whether a driver's BAC is at, or above 0.10%, when administered at the roadside, it was not clear whether it could be used easily and accurately with a driver seated in his vehicle. An additional question addressed in this study concerned the effect of the extent of training and experience the officers had in the use of the nystagmus test on the accuracy with which they could score the test. A comparison was made between the performance of officers given just 3 hours of training in the use of the test and officers who had received 16 hours of training and were experienced in the use of the test.

Additional measurements were made on each driver stopped at the checkpoints in order to assess the extent to which these measurements related to the driver's BAC. One of these was stopping distance from a designated stop location (the driver was instructed by means of a sign to stop to speak with the police officer). A researcher, stationed at the checkpoint, measured the location of the driver from the position the officer was standing at when the vehicle came to a complete stop. We were interested in determining whether the impaired drivers had a greater tendency to stop before or beyond this location. Previous research on the effects of alcohol on driving performance have repeatedly reported detrimental effects on stopping performance (e.g., Damkot et. al., 1977).

Recent reports about a Passive Alcohol Sensor (PAS), a breath alcohol measurement device designed to detect whether a person has been drinking or not, have suggested that this device has promise as a screening tool for use at sobriety checkpoints (Voas, 1983a, 1983b). The PAS detects the presence of alcohol in the air passing over a sensor (e.g., in exhaled breath). It does not require a person to blow into the mouthpiece, rather, a person provides a sample by breathing and/or talking naturally through the nose or mouth while the unit is held about six inches from his/her face. A small fan pulls air into the unit where it is tested for the presence of alcohol. This device does not measure the amount of alcohol present in the person's breath (like a screening or evidential breath testing device), it can detect only the presence of alcohol in the air sample tested.

The major advantage of this type of device is that it does not require as much active cooperation of the person being tested as do traditional breath testers. Portable breath testing devices require the person to provide a sample of deep lung air by blowing into a tube. The PAS, may be usable through the open car window by an officer who is conversing with the driver. A prototype passive alcohol sensing device (known as the Honda PAS, originally manufactured by the Honda Motor Co., Ltd.) was used in the study by a researcher to determine the extent to which it was useful in screening drivers at a checkpoint.

In summary, this study was designed to evaluate a variety of potential screening procedures to determine the extent to which they discriminated between impaired and sober drivers during the brief initial stop at a sobriety checkpoint, by:

- Evaluating the effectiveness of the gaze nystagmus test when used as an initial screening procedure at a checkpoint;
- Assessing the effect of training and experience on the officer's ability to accurately apply the nystagmus test as a screening procedure (comparing fully trained and experienced officers with officers receiving less training and no experience);
- Evaluating the effectiveness of a divided attention task (questioning of the driver during a license and registration check) to identify impaired drivers;

- Evaluating the effectiveness of officer's observations of driving behavior during approach and stopping and of the driver's appearance to identify impaired drivers;

- Studying the extent to which the driver's ability to stop at a designated point on the road related to the driver's BAC;

- Evaluating the extent to which a prototype passive alcohol sensing device (PAS) would be useful and accurate in screening drivers at a checkpoint; and

- Comparing the police screening procedure currently used by a number of police agencies with the screening procedures described above that were designed to maximize the detection of alcohol-impaired drivers.

## METHOD

### Overview

The study was designed, to the extent possible, to simulate conditions found at a real checkpoint. Thus, dosed and sober subjects drove their own cars down a closed street, at night, and were stopped by police officers at sobriety checkpoints. Both the officers and researchers at the checkpoints were blind to the subject's condition and to the number of subjects in each condition. In order to make the detection of the impaired drivers reasonably similar to the natural environment, the majority of the drivers (52%) were sober. Approximately 79% of the drivers passing through the roadblock were either sober or had been drinking but had BACs below 0.10%. The target subjects, those with BACs at, or above 0.10%, constituted 21% of the drivers. This percentage was higher than one might expect to find on-the-road and represented a compromise between practical considerations and the desire to make conditions as real as possible.

During testing, three checkpoints were situated along a public street that was closed to normal traffic. The section of the roadway used was approximately a mile long, two lanes wide (without a center line), oneway, and illuminated by streetlights. The checkpoints were spaced about a quarter-mile apart. Each driver was stopped at each checkpoint. Using three checkpoints increased the amount of data that could be collected from each driver, while running the risk that the driver's behavior might change as a result of each stop. However, many of the measures used in the study could or should not be affected by experience (e.g., nystagmus test score); the other measures were examined for a practice effect.

The drivers were 75 male volunteer subjects (20-30 years of age) who were paid to participate in the study. Testing was conducted over four nights, during the months of October and November, 1983 between 7:00 PM and 3:00 AM. Approximately 20 subjects served as drivers each night and were randomly assigned to one of three driver conditions. Five subjects were given enough alcohol to produce a BAC of about 0.12%. Five were dosed to a lower BAC of about 0.07%, and the remaining subjects remained sober. The subjects were told whether they were drinking alcohol and whether they were in the high dose or low dose group (but not what the target BAC levels were).

The dosing took place at a rented hall adjacent to the test course. Subjects drove the test course at approximately ten minute intervals, in their own vehicles, with a researcher riding with them in the front seat of the car. For safety reasons, the vehicle's speed was limited to 25 miles per hour.

Each checkpoint consisted of a reflective warning sign ("STOP AHEAD POLICE SOBRIETY CHECKPOINT") placed 200 feet before the checkpoint, traffic cones, roadway flares, a clearly marked police vehicle with flashing lights, a traffic sign instructing the driver to stop to speak with the police officer ("STOP TO SPEAK WITH OFFICER"), a lighting truck to illuminate the checkpoint, and two uniformed police officers.

Police officers from three agencies participated in the study. On the first two nights, officers from the Massachusetts State Police (MASP) and the Metropolitan District Commission Police of Massachusetts (MDC) staffed the three checkpoints. During the last two nights of data collection, officers from the Maryland State Police (MDSP) worked at all three checkpoints. The officers from the MASP and MDC received three hours of training in administering the nystagmus test prior to their participation in the study. The officers from the MDSP had received 16 hours of instruction in the use of the nystagmus test and had used the test during their regular enforcement duties over the past year.

At the first two checkpoints, the officers used the test screening procedure (nystagmus test, divided attention task, and formal observations), while the typical screening procedure ("look and sniff") was used at the third checkpoint. A research assistant was stationed at each checkpoint to measure the stopping position of the cars, to time the length of the stop, and to monitor the officer's compliance with the research protocol. At the third checkpoint the research assistant also tested the passive alcohol sensor after the two officers were finished with the driver. The type of screening procedure used at a checkpoint was not counterbalanced for the three checkpoints because it was not possible to properly balance this and other important variables without substantially increasing the number of subjects and officers employed in the study.

The two officers at each checkpoint both observed and interracted with each driver. One of the officers served the role of the lead officer and was responsible for stopping the driver and conducting the screening procedure. The second officer observed the driver's behavior and interaction with the first officer. Only the nystagmus test was administered to the driver a second time, by the second officer when the first officer was finished. The driver remained seated in his car while the screening procedure was conducted by the officers.

In order to control for differences between officers, at each checkpoint the roles of the lead officer and observing officer were alternated for every other driver in each session. In addition, the officers were rotated in prescribed order among the checkpoints from session to session. However, the officers did not rotate between the two screening procedures used.

Subjects were dosed according to the Widmark formula. High dose subjects received four drinks containing alcohol over a period of two hours with a "soak in" period after each dose. Low dose subjects received two drinks over a period of one and one-half hours. The administration of the initial dose was staggered so that the subjects arrived at the predetermined target BAC levels at various times corresponding to their randomly assigned driving order and condition. The target BAC level for the high dose subjects was a falling BAC that was approximately 0.12% but not less than or equal to 0.10%. The target for the low dose subjects was a falling BAC level of approximately 0.07% but not less than or equal to 0.05%. Subjects' BAC levels were closely monitored by periodic testing with a Smith and Wesson Breathalyzer Model 2000, and a nurse monitored their pulse, heartbeat, and respiration.

Specific information about the study methodology is presented below.

Subjects

Seventy-five (75) male volunteers between the ages of 20-30 years old served as the drivers in the study. Twenty subjects were recruited for each of the four test sessions. One high dose subject was dropped from the study due to an adverse reaction to the alcohol and four subjects were no-shows.

Subjects were recruited through one page flyers that were circulated or posted in selected locations. The organizations that received flyers included hospitals, universities, child care facilities, state agencies, libraries, churches and civic groups. A sample flyer appears in Appendix C. Subjects were also recruited through two local unemployment offices, two university employment offices, and one university newsletter. The amount of information provided to the subjects concerning the nature of the study was limited and carefully controlled.

Interested candidates were screened in a ten to fifteen minute telephone interview to determine whether they met the following conditions:

- They had to have a valid driver license and have been driving for at least 3 years;
- They had to drink alcohol at least once a week, and have been doing so for at least one year;
- They had to be in good general health, and must not have had a history of alcoholism or any medical conditions which might be complicated by consuming alcohol;
- They could not be daily users of any medication or any other intoxicants (including such drugs as marihuana and cocaine);
- They had to be willing to drink enough alcohol to reach a BAC level that would make them legally impaired (i.e., 0.12%); and
- They had to have a car to use for the testing and be willing to allow a researcher to drive it to and from the test course.

The subjects were not advised of the condition they were assigned to until they arrived for the experiment (see Assignment To Conditions). They were instructed not to eat for at least one hour prior to their arrival, and to not take any drugs (including alcohol) or medication on the day of the study.

All applicable regulations pertaining to the protection of human subjects were complied with in the conduct of this study. The study procedures were reviewed and approved by an Institutional Review Board (the North Charles Mental Health Research and Training Foundation which holds a General Assurance for the protection of human subjects). Appendix C describes the steps taken to minimize the risks to the subjects and contains a copy of the implied consent form subjects were required to sign prior to participating in the study.

## Assignment To Conditions

Subjects were randomly assigned to conditions in blocks of five. Each block contained three sober subjects, one high dose subject and one low dose subject. The subjects within these blocks were randomly assigned to a driving order during the screening process. A purely random assignment of subjects to the BAC conditions and driving orders was not attempted to prevent abnormal orders from occurring. For example, random assignment could lead to situations such as having all of the high dosed subjects pass through the checkpoints early in the evening or having subject clusters occur that might interact with the officers fatigue level or expectations.

During testing, a few subjects were reassigned from a sober to a dosed condition when a subject originally assigned to a dosed condition did not appear as scheduled. Also, there were a few instances in which a subject's driving order was changed (though not his condition). This occurred when a dosed subject failed to reach his target BAC level at the time he was scheduled to drive. In this case, another subject (usually a sober one) would drive in his place.

## Subject Payment and Incentive Bonus

The subjects were paid on a sliding scale depending upon the condition they were in. The sober subjects were paid $50 and low and high dose subjects $80. The dosed subject received higher payment because they were required to remain at the test area after driving until their BAC level had dropped to a point where they could be released.

In real life, drivers who encounter a sobriety checkpoint would normally not deliberately exhibit any behaviors that would arouse police suspicion. In order to simulate this behavior in the subjects during the test drive they were offered a bonus payment. To qualify for the bonus payment, they were told that they had to convince a majority of the officers they encountered on the road that they were sober. In fact, all the subjects received a bonus ($10 for the sober subjects and $20 for the dosed subjects) regardless of their behavior or ability to fool the officers.

## Site Description

The roadway used for the test course was located in Medford, Massachusetts (a suburb of Boston). The test course was about a one mile section of the Mystic Valley Parkway, a one-way two lane wide street (without a center line). The road was illuminated by street lights and relatively free of obstacles for several feet to either side of the edge of the pavement. During testing, the road was closed to normal traffic by the MDC police by means of police barricades placed across the one access street and a roadblock at the point of entry. Access by pedestrians was limited by sections of chain link fence on both sides of the street for most of the test course.

The staging and dosing area was located adjacent to the street in a VFW Post. Separate sections of the building (with separate entrances) were used for the subjects and police officers so that no contact of any type occurred between the officers and researchers stationed at the checkpoints and the subjects prior to their driving up to the checkpoint.

Checkpoint Configuration

The three checkpoints were configured similarly, as illustrated in Figures 1 and 2. Each checkpoint consisted of a reflective warning sign saying "STOP AHEAD POLICE SOBRIETY CHECKPOINT" placed 200 feet before the checkpoint, a series of traffic cones and flares intermixed over the next 180 feet at approximately 18 foot intervals with the last the cone about 20 feet from the stop location, and with the last flare approximately 100 feet from the stop location. The position of the cones and flares as one approached the checkpoint were angled to move oncoming cars to the right side of the roadway. A marked police cruiser with flashing lights was parked at the left edge of the pavement with the front of the vehicle adjacent to the stop location. To the left of the cruiser, on the shoulder of the road, was a lighting truck. A second warning sign that said "STOP TO SPEAK WITH OFFICER" was located about 30 feet from the stop location on the first two nights of testing and 170 feet from the stop location on the last two nights of testing. The size and location of this sign was changed after many of the drivers on the first two nights said they did not see it. The sign used on the first two nights of testing was 2.5 feet by 2 feet in size, while the larger sign used on the last two nights of testing was 4 feet by 3 feet and had increased reflectivity.

The checkpoints were designed to represent a "normal" police checkpoint that might be established at that location, to the extent possible. However, there were some features which differed from most checkpoints. (1) There were fewer official police vehicles and uniformed officers present than one typically finds at a checkpoint. (2) The total distance from the initial sign to the stop location (200 feet) was shorter than normal because of the low speed at the test course. (3) Lighting trucks (that the MASP normally used when conducting a checkpoint) were placed parallel to the stop zone. (4) An additional warning sign which read "STOP TO SPEAK WITH OFFICER" was used as part of a test to determine the subjects' ability to stop at a designated location. (5) A stop line was placed across the road with tape, and as shown in Figure 2, hash marks were drawn on the roadway at six inch intervals for a distance of five feet before and after this line. These markers served to determine the position of the officer halting the car, and as guides to recording the distance from the officer that the driver stopped. Neither the stop line or hash marks were visible to the drivers. (6) The police vehicles were located on the left side of the roadway, whereas they are more often placed to the right side of the road. This was done for safety reasons (there were fewer obstacles off the roadway to the right in case the co-driver had to take control of the vehicle and steer it off the roadway) and to allow the auxiliary lighting to be placed behind the officers (so that it illuminated the drivers). (7) The roadway flares used were kept 100 feet away from the position of the officers so that the smoke and fumes would not interfere with the officers ability to smell alcoholic beverages.

FIGURE 1

CHECKPOINT CONFIGURATION

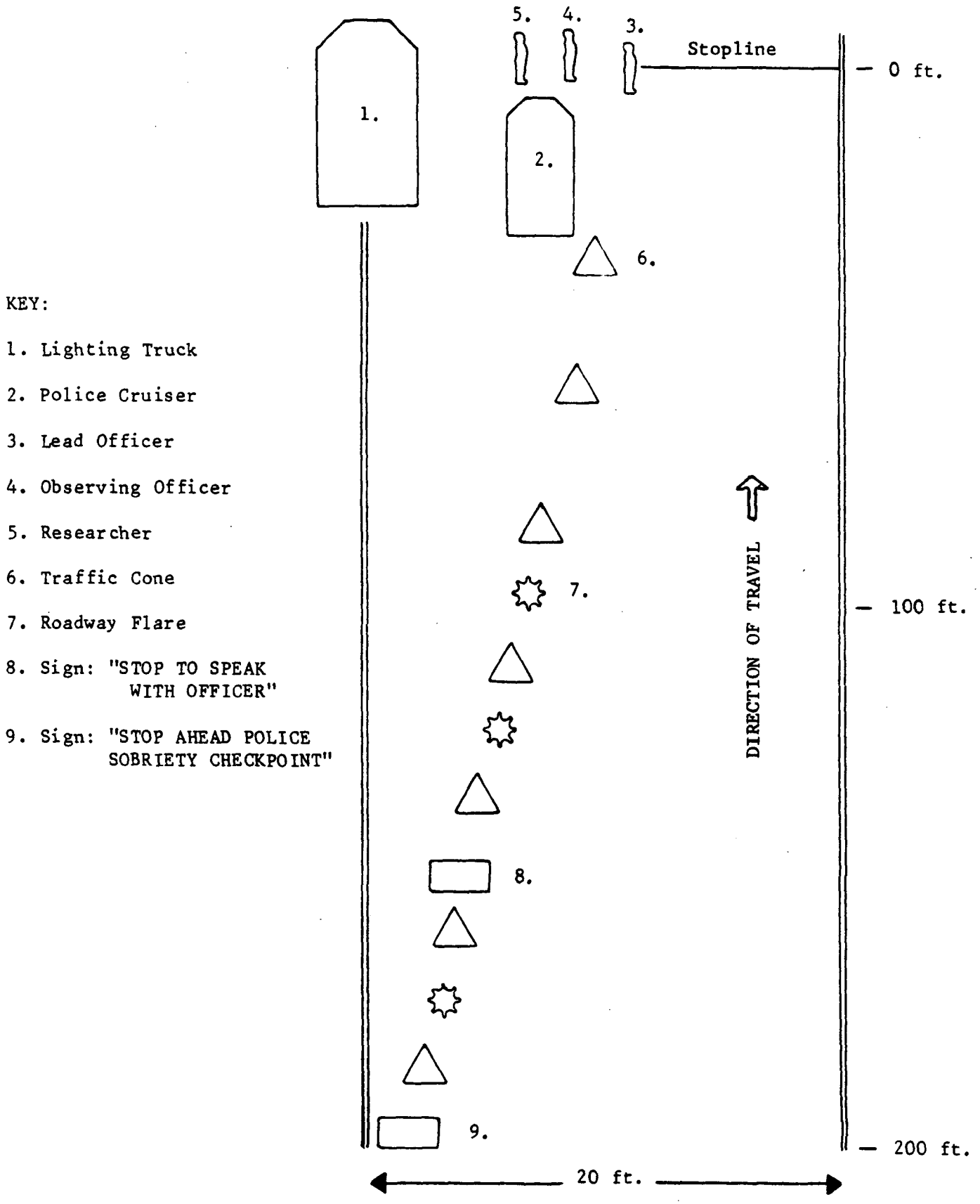
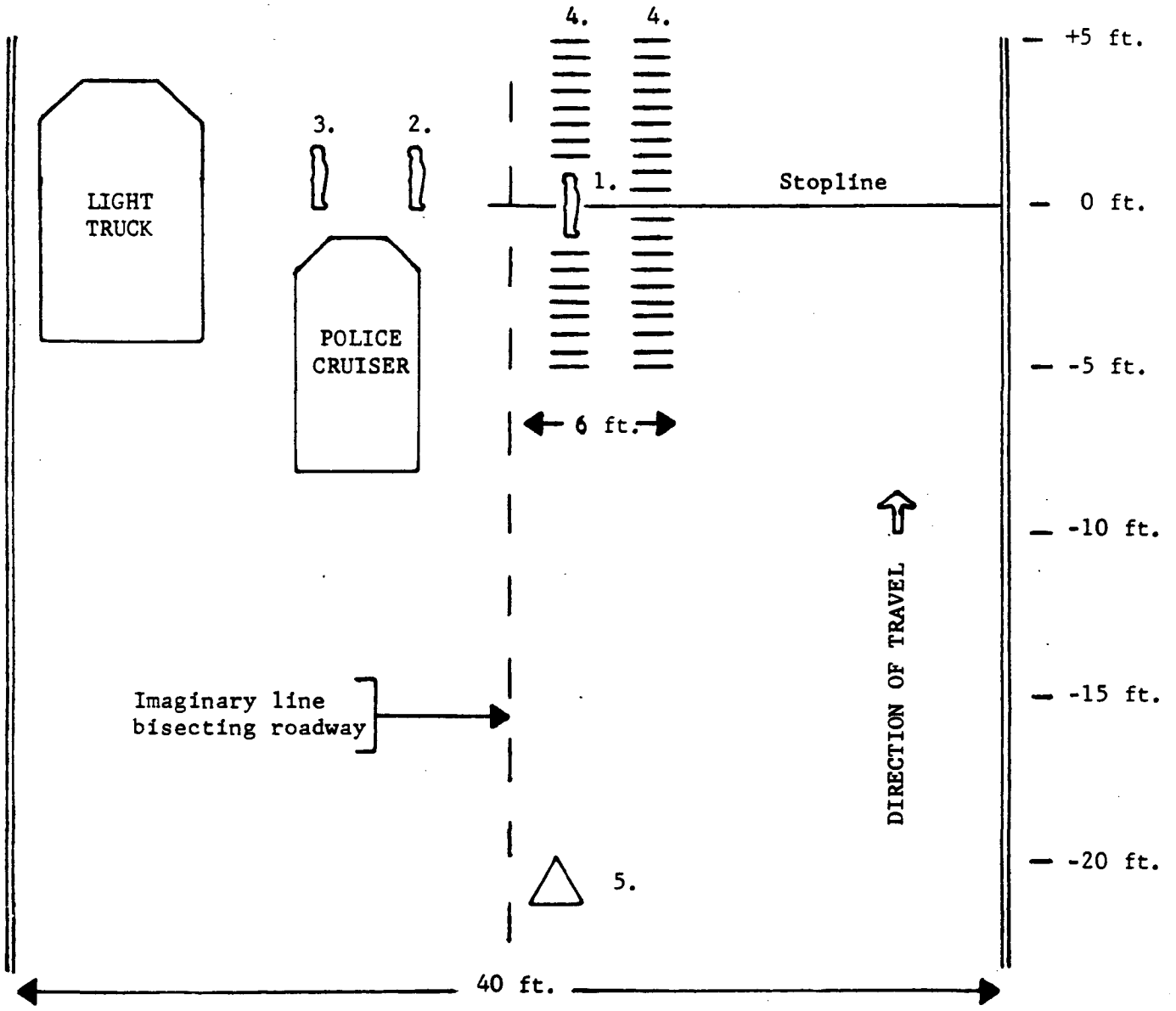


FIGURE 2

DETAIL OF STOP LOCATION




KEY:
1. Lead Officer
2. Observing Officer
3. Researcher
4. Columns of hash marks indicating 6 inch intervals from stopline
5. Last of 7 traffic cones

## Training of Police Officers

The Massachusetts police officers who conducted the checkpoints at which the gaze nystagmus and divided attention tests were used attended a three-hour training session two days before testing started. The officers were instructed in the use of the nystagmus test, how to conduct the divided attention test, the procedure to be used during testing and the proper use of the data collection forms. The officers who were running the checkpoint using the typical screening procedure were given general instructions about the testing procedures and use of the data collection forms. The Maryland State Police officers, had been previously trained in the administration of the gaze nystagmus test and had been using it during their normal enforcement activities for about a year (though not with drivers seated in their cars). They were trained in using the gaze nystagmus test with drivers seated in their cars and in the other experimental procedures one week prior to their participation in the study.

Each night prior to the start of the experimental session, the police and researchers attended a briefing session to review the procedures they were to follow. Also, trial runs were conducted each session before the first subject drove the course. The researchers stationed at each checkpoint (and in the cars with the subjects) noted on the data forms any deviations from the established protocol.

## Study Procedure

Upon arrival for the study, subjects were given a breathalyzer test to verify a zero BAC, their possession of a driving license was confirmed, and they read and signed an informed consent form (Appendix C). Breathalyzer tests were conducted by a Massachusetts State Police officer trained as a breathalyzer instructor using a Smith and Wesson Breathalyzer Model 2000. The breathalyzer was calibrated before each session. Subjects were not told about the result of any BAC test prior to their completing the study. Each subject provided information on their background (age, occupation, etc.) and frequency/quantity of alcohol use.

Subjects were told the condition (high or low dosed or sober) they were in, but not the target BACs. Dosed subjects were provided alcohol in mixed drinks, while sober subjects were provided non-alcoholic beverages. Low dose subjects spent approximately 100 minutes between the time they were given their first drink and the time they drove, while for high dose subjects about 140 minutes elapsed between beginning the first drink and driving. (See Appendix C for more information about the dosing procedure used).

Periodic breathalyzer tests were given to track the subjects BACs. Subjects received a final breathalyzer test prior to driving to confirm that they had a falling BAC within the target range. During the last three sessions, dosed subjects estimated their own BAC and ability to drive just prior to, and right after driving. A post drive BAC test was administered to verify the subject's BAC level.

Subjects were driven to the start of the course by a researcher. They then switched places and the subject was instructed to proceed down the course obeying all signs and instructions from officers and to not exceed 25 MPH. Apart from these instructions the researcher limited conversation to information already provided the subject. After the last checkpoint was completed, the subject was driven back to the dosing area. They were then escorted to a waiting area and kept apart from subjects who had not yet completed driving. Dosed subjects were not released from the study until their BAC fell to 0.01%, or until a research staff member was available to drive them home. Payment was made to the subjects upon their release.

Study Design

Table 3 shows the screening procedures by session for the three checkpoints. On all four testing nights the test procedure was used at the first two checkpoints while the typical procedure was always used at the third checkpoint. All three police agencies conducted both the test procedure and typical procedure. Officers staffing the first two checkpoints exchanged positions on different evenings. A particular officer always used the same type (test or typical) of screening procedure. The passive alcohol sensor was used only at the third checkpoint immediately after the two officers completed their procedure. Measurements of stopping distance from the designated location were made at each checkpoint. Timing measurements were also made at each checkpoint to determine the average length of time the screening procedure required.

Checkpoint Screening Procedures

One of the two officers at each of the checkpoints was designated the "lead" officer, and the other the "observer." The officers changed roles for every other driver passing through the checkpoint.

Test Procedure - The lead officer was responsible for standing astride the stop line to indicate to the driver where to stop. As the vehicle approached, the lead officer used a flashlight to motion the driver to proceed to his position. As the vehicle's bumper reached him he was to stop motioning. The officers were instructed not to point to the stop line or to hold up their hand to indicate where the driver was to stop. As the vehicle approached and stopped the officer observed and recorded (see Appendix A) such things as the vehicles speed, the driver's ability to control the vehicle's position, his ability to decelerate smoothly, and his ability to stop where indicated.

After the driver had stopped, the officer approached the driver and greeted him with:

> "GOOD EVENING. I AM OFFICER (name) WITH THE (name) POLICE. WE ARE STOPPING CARS TO LOOK FOR DRUNK DRIVERS. YOU WILL BE STOPPED FOR ONLY A MINUTE OR TWO. MAY I SEE YOUR DRIVER'S LICENSE AND VEHICLE REGISTRATION, PLEASE?"

Table 3

Study Design: Showing the Screening Procedure Used,
Police Agency & Officer Assignment At The Three Checkpoints

| | CHECKPOINT #1 (Test Procedure) | CHECKPOINT #2 (Test Procedure) | CHECKPOINT #3 (Typical Procedure) |
|---|---|---|---|
| Night 1 | MASP 1,2* | MDC 5,6 | MASP 3,4 |
| Night 2 | MDC 5,6 | MASP 1,2 | MDC 7,8 |
| Night 3 | MDSP 9,10 | MDSP 11,12 | MDSP 13,14 |
| Night 4 | MDSP 11,12 | MDSP 9,10 | MDSP 13,14 |

*Note: MASP = Massachusetts State Police
MDC = Metropolitan District Commission Police
MDSP = Maryland State Police
1,2 = numbers indicate unique officers

The officer continued questioning the driver while he searched for these documents. During this time the officer observed and recorded anything about the drivers personal appearance which suggested alcohol impairment such as the odor of alcoholic beverages, appearance of the driver's face and eyes, slurred speech, demeanor, and dexterity (Appendix A). Also, the officer was expected to judge the driver's performance of the divided attention task (i.e., the driver's ability to both locate his license and registration and respond to questions). The following questions were asked:

- "HOW WAS THE TRAFFIC TONIGHT ON THE WAY HERE?"
- (if the license had been presented) "DO YOU STILL LIVE AT THIS ADDRESS?"
- (if the license not yet presented) "DO YOU LIVE AROUND HERE? WHAT IS YOUR ADDRESS?"
- "HOW DO YOU GET THERE FROM HERE?"
- "DID YOU NOTICE ANYTHING OUT OF THE ORDINARY ON YOUR WAY HERE FROM THE HALL?"
- "HAVE YOU BEEN DRINKING THIS EVENING? WHAT WERE YOU DRINKING? COULD YOU TELL ME HOW MANY DRINKS YOU HAD?"

After the driver produced his license and registration, the officer examined them briefly, returned them to the driver and administered the gaze nystagmus test. After completing the nystagmus test, the officer said "THANK YOU -- ANOTHER OFFICER IS WAITING TO SPEAK WITH YOU", and stepped away from the vehicle. The lead officer then completed his checklist of observations (Appendix A), which included his judgement as to whether the driver appeared impaired and should be detained (at a real checkpoint) for further investigation. The officer also provided an estimate of the driver's BAC.

While the lead officer was interacting with the driver, the observing officer stood close enough to hear and observe the driver's behavior and appearance, and he filled out a similar checklist (Appendix A). The observer did not complete the checklist items on the nystagmus test at this time since it was not possible for him to clearly observe the driver's eyes.

When the lead officer stepped away from the vehicle, the observer approached, and said "HI. I WOULD LIKE TO CHECK YOUR EYES AGAIN..." and administered the nystagmus test. After completing the test the observer thanked the driver, instructed him to continue on his way, and completed the observer checklist independently of the lead officer.

The procedure described above was altered slightly for the last two nights of data collection so that the officers completed all of the other items on the checklist prior to administering the nystagmus test. This was done out of concern that the nystagmus test score might influence the officer's perceptions on the other items. Specifically, the lead officer stepped away from the vehicle after the divided attention task, the nystagmus test was given by the observer, and then the lead officer readministered the nystagmus test.

Typical Procedure - The two officers at Checkpoint #3 followed identical procedures in interacting with the driver. However, the second officer stood apart from the vehicle and did not observe the interaction between the lead officer and driver.

The lead officer stood at the stop line and motioned the vehicle to approach. When the vehicle came to a full stop, the officer approached the driver and greeted him:

> "GOOD EVENING. I AM OFFICER (name) WITH THE (name) POLICE. WE ARE STOPPING CARS TO LOOK FOR DRUNK DRIVERS. HOW ARE YOU THIS EVENING?"

After waiting for the driver's response, the officer handed him a flyer describing the states 'drunk driving' laws and stated:

> "THIS IS SOME INFORMATION ON THE NEW DRUNK DRIVING LAWS IN MASSACHUSETTS (all references to Massachusetts were changed to Maryland when Maryland State Police staffed the checkpoints). HAVE YOU HEARD ABOUT THEM (wait for response)? YOU MAY WANT TO READ THIS WHEN YOU GET HOME THIS EVENING. IF YOU WILL WAIT A MOMENT THERE IS ANOTHER OFFICER HERE WHO WOULD LIKE TO SPEAK WITH YOU."

The lead officer then stepped away from the vehicle and filled in a checklist about his observations of the driver and indicated whether he would have detained the driver for further investigation (at a real checkpoint). A copy of the checklist is shown in Appendix A.

The second officer then approached the driver and repeated this same procedure.

Research Staff Procedure - A single research staff member was stationed at each checkpoint. He waited behind the police cruiser until the vehicle came to a full stop and then stood behind the officers so that he could hear and observe the interaction between the officers and driver.

At the checkpoints using the test screening procedure the researcher was responsible for timing the administration of the nystagmus test and the divided attention test (license and registration check) by the lead officer. He also recorded the total time elapsed from the vehicle's stop until the lead officer stepped away from the driver's window.

In addition, the researcher recorded the stopping position of the vehicle with respect to the stop line (described under "Checkpoint Configuration", above). This measurement was made by determining which hash mark was closest to an imaginary vertical line running through the driver's head perpendicular to the road surface. When the drivers stopped outside the ten foot range of hash marks, the researcher dropped a marker on the roadway, and measured the distance to the stop line after the driver departed (see Appendix B for a sample data recording form).

The procedure followed by the researcher at the third checkpoint was similar with two exceptions. First, this researcher timed only the total elapsed time from when the vehicle stopped to when the lead officer stepped away from the vehicle. Second, the researcher approached the driver and administered a test of the passive alcohol sensor (PAS) after the second officer had finished with the driver.

With the PAS, the presence of alcohol in the air sample pulled over the sensor is indicated by a red light. After the second officer stepped away from the driver, the researcher approached and stated:

> "GOOD EVENING. I AM A RESEARCHER AND I WOULD LIKE TO TEST A PIECE OF EQUIPMENT. THIS WILL TAKE ONLY A FEW SECONDS. PLEASE COUNT FROM ONE TO TEN, SLOWLY."

The researcher then placed the end of the PAS (which is shaped like a long flashlight) approximately six inches from the subject's mouth. If the red light did not appear, the researcher thanked the driver and told him to proceed. If the red light came on, the researcher moved the PAS away from the driver's face and observed whether the red light went off or remained on. This step was intended to test whether the light was lit as a result of the driver's breath or as the result of contaminates in the immediate vicinity of the car. If the red light remained on, the driver was dismissed. If the light extinguished, the researcher repeated the initial test, except that this time he held the device approximately one foot from the driver's mouth, stating: "I WANT TO TRY THIS AGAIN, PLEASE COUNT FROM ONE TO TEN." At this point the procedure was completed regardless of the result.

## RESULTS

In this section the ability of the officers to detect alcohol-impaired drivers during their brief stop at the checkpoint is described. The performance of the officers using the typical and test screening procedures is then compared. Following this the effectiveness of the various components of the test procedure (i.e., horizontal gaze nystagmus test, effect of differential training and experience, the divided attention task, observations of driving behavior and the driver's appearance) are analyzed. Finally, the ability of the stopping distance measurements and the passive alcohol sensor to discriminate the driver's BAC is presented.

The results from this study were analyzed statistically using the Chi Square test, except for the stopping distance measurements, which were analyzed using analysis of variance. All of the results presented below were statistically significant at a probability level of less than .01, unless otherwise noted.

### Ability of Officers to Detect Alcohol-Impaired Drivers

The officers indicated, for each driver stopped, whether they judged the driver should be detained for further investigation (though the drivers were not actually detained as part of the study). The officers were not trying to decide whether the driver should be arrested, only whether they thought they had reasonable grounds to believe that the driver had been drinking and might be impaired. Typically a decision about whether the driver was actually impaired and should be arrested would only be made after further investigation (of the driver outside of his vehicle). This study focused only on the officer's initial judgement of whether to pass the driver immediately through the checkpoint or to detain him for further investigation. A judgement that the driver should be detained did not necessarily mean the officer believed the driver's BAC was over 0.10%, only that he thought the driver might be impaired by alcohol.

The results (Table 4) showed that the officers, regardless of which screening procedure they used, were quite successful at detecting impaired drivers (those with a breath alcohol level of 0.10% or higher). Overall, the officers in this study correctly identified over 90% of the impaired drivers (the detection rate varied from 67% to 100% depending upon the screening procedure used and the amount of training the officers had received). About 70% of the drivers whose BAC was at or above 0.05%, but below 0.10%, were identified for further investigation.

The officers were somewhat less able to determine that sober drivers (with a 0.00% BAC) had not been drinking, with the overall accuracy being approximately 74% (with a range of 42% to 92% depending upon the procedure used). An accurate judgment in this case would be an indication not to detain the motorist.

Certainly a 26% false positive rate is a lot higher than one would like to see; however, the accuracy of the officers judgments depended a great deal on the screening procedure they used. A detailed discussion of these results will be presented later in this paper.

Table 4

Officers' Judgments Whether
Driver Should Be Detained
(Across All Screening Procedures)

| Driver's BAC (%) | Percent of Drivers Who Would Have Been Detained |
|---|---|
| .00 | 26% |
| .05 - .09 | 70% |
| .10 - .15 | 93% |

The results shown in Table 4 are presented in terms of the percentage of judgments made by the officers. Because there were two officers at each of three checkpoints, the number of judgments made was equal to six times the number of drivers. There were thirty-nine drivers in the sober condition (producing 234 judgments), twenty drivers with a BAC level at or above 0.05%, but below 0.10% (or 120 judgments), and sixteen drivers whose BAC level was between 0.10% and 0.15% (or 96 judgments). Thus, a total of 450 separate judgments were made on the 75 drivers.

An analysis of the effects of officer position (lead or observing) revealed no effect on the observations and judgments made by the officers. The interrater reliability (percent of agreement) for each pair of officers at a checkpoint showed an overall 82% rate of agreement. There were no differences found between checkpoints 1 & 2 (which used the identical procedures). Thus, the remaining analyses collapse across these variables.

A comparison between the three police agencies participating in the study is shown in Table 5. The officers from two of the police agencies judged the drivers in a comparable fashion. The officers from the third agency had a tendency not to recognize the sober drivers with 52% of these drivers being identified for further investigation, compared to 18% for the officers from the two other police agencies. There is no obvious reason for this difference between the performance of the officers from the different agencies.

Table 5

Percent of Drivers The Officers Judged Should Have Been Detained by Police Agency

| Driver's BAC (%) | Police Agency #1 | #2 | #3 |
|---|---|---|---|
| .00 | 18% | 52% | 18% |
| .05 - .09 | 77% | 77% | 63% |
| .10 - .15 | 91% | 85% | 96% |
| Totals | 48% | 64% | 48% |

Table 6 shows the officer's estimates of the driver's BAC level. The drivers are shown grouped into three BAC groups: .00-.04%, .05-.09%, and .10-.15% BAC. There was a tendency for the officers to overestimate the driver's BAC level for those drivers with low BACs. Over 30% of the drivers whose actual BAC was below 0.05% were estimated by the officers to have BACs at or over 0.05%. The officers had the greatest difficulty estimating the BAC of the drivers whose actual BACs were in the .05-.09% range (with 63% of the estimates being below or above this range). Overall, the officers' estimates were fairly accurate, with their estimates of the driver's BAC falling in the correct range approximately 62% of the time. They were even more accurate in correctly estimating the BAC of the sober (69%) and legally impaired drivers (79%). The correlation of the officers' estimate with the drivers' actual BAC level was r = 0.637.

Table 6

Officers' Estimate of Drivers' BAC Level By Drivers' Actual BAC Level

| Drivers' Actual BAC Level | (N) | Officers' Estimate of Drivers' BAC .00-.04 | .05-.09 | .10-.22 | Total % |
|---|---|---|---|---|---|
| .00-.04% | (234)* | 69% | 19% | 12% | 100% |
| .05-.09% | (120) | 20% | 37% | 43% | 100% |
| .10-.15% | (96) | 5% | 16% | 79% | 100% |
| Total | (450) | 42% | 23% | 35% | |

* - This is the number of judgments made on drivers at this BAC level.

## Comparison of the Test and Typical Screening Procedures

In comparing the test screening procedure with the typical procedure, it is clear that the officers using the test procedure were able to more accurately judge the extent of alcohol use by the drivers. Table 7 shows for the two screening procedures the percentage of drivers at the different BAC levels the officers felt should be detained.

Table 7

Percentage of Drivers The Officers Judged Should Have Been Detained For Each Screening Procedure

| Drivers' BAC (%) | Typical Procedure | (N) | Test Procedure | (N) |
|---|---|---|---|---|
| .00 - .04 | 47% | (78) | 16% | (156) |
| .05 - .09 | 87% | (40) | 61% | (80) |
| .10 - .15 | 87% | (32) | 95% | (64) |
| Totals | | (150) | | (300) |

Note: Two checkpoints used the test procedure (compared to one using the typical procedure) resulting in twice as many judgments.

Both procedures enabled the officers to detect a fairly high percentage (87% and 95%) of those drivers whose BAC was at, or above, 0.10%. The test procedure resulted in substantially fewer of the drivers whose BAC was between 0.05 and 0.09% being identified for further investigation (61% for the test procedure versus 87% for the typical procedure). The biggest difference occurred for the sober drivers, where the typical procedure resulted in the officers identifying three times as many drivers for further investigation than the officers using the test procedure.

The false positive rate (for the sober drivers) was higher than one would like to have found. However, it should be kept in mind that the officers were only asked to indicate which drivers they felt should be detained for further investigation. This was not an indication that the officers felt these drivers should be arrested. At the initial checkpoint stop, the officer's task is to quickly screen the drivers to determine which to detain (based on some articulatable suspicion the driver might be impaired). The probable cause for an arrest would be developed during the subsequent investigation of the detained driver. Thus, the consequence for these drivers would probably only be a few minutes of their time while the police determined that they were not impaired (by administering additional behavioral tests, or a pre-arrest breath test).

It is appropriate that many of the drivers with BAC's above 0.05% but below 0.10% would not have passed immediately through the checkpoint based on the initial screening. These drivers had been drinking to the point of being under the influence of alcohol (many had BAC's in the 0.07% to 0.09% range). In some States they would be legally impaired at those BAC levels. Thus, it is not unreasonable that they be detained a few minutes in order for the officers to make a more precise determination of their impairment.

Also, there is reason to suspect that the officers participating in the study were expecting more of the drivers to be impaired than one would typically find at a checkpoint. Because of this expectation and some natural competitive pressure that came from using officers from several different police agencies, the officers may have tended to rate the drivers higher (more likely to be impaired) especially when he was uncertain whether he observed behavior indicative of alcohol impairment, rather than take a chance of missing an impaired driver. At a real checkpoint, the tendency might be just the reverse, to give the benefit of any doubt to the driver in order not to detain any unimpaired drivers.

Table 8 shows the performance of the officers from the three participating agencies in terms of the two screening techniques. In each case, the officer's performance was substantially improved when they were using the test screening procedure in comparison to the typical procedure. The largest effect was on the percentage of sober drivers correctly recognized as unimpaired by alcohol. The percentage increase in correct judgments ranged from 29% to 35%. Also, though more difficult to interpret, there was an average drop of 24% in the number of drivers whose BAC was in the 0.05% to 0.09% range who were identified for further investigation. This may reflect the officer's greater confidence in their ability to discriminate between drinking drivers and impaired drinking drivers. The detection rate for the drivers whose BAC was 0.10% and above increased an average of 12% when the officers used the test procedure.

Table 8

Comparison by Police Agency:
Percentage of Drivers The Officers Judged Should Have Been Detained For Each Screening Procedure

| | Agency #1 | | Agency #2 | | Agency #3 | |
|---|---|---|---|---|---|---|
| | Procedure | | Procedure | | Procedure | |
| Driver's BAC (%) | Typical | Test | Typical | Test | Typical | Test |
| .00 - .04 | 40% | 8% | 75% | 40% | 37% | 8% |
| .05 - .09 | 100% | 65% | 80% | 75% | 85% | 52% |
| .10 - .15 | 100% | 86% | 67% | 93% | 89% | 100% |

As might be expected, the officer's ability to estimate the driver's BAC was also improved when they were using the test screening procedure. Table 9, below, shows the percentage of time the officer's estimate of the driver's BAC was in the correct range (i.e., below 0.05%, 0.05-0.09%, or 0.10% and above). The greatest improvement occurred with the sober and impaired drivers. The officer's estimates for these two groups were correct about 20% more often when the officers were using the test procedure (as shown in the last line in Table 9).

Table 9

Percent Correct Officers' Estimates of the Drivers' BAC Category By Screening Procedure

| Drivers' BAC (%) | Percent Correct Typical Procedure | Test Procedure |
|---|---|---|
| .00 - .04 | 59% | 74% |
| .05 - .09 | 45% | 33% |
| .10 - .15 | 63% | 88% |
| All Drivers | 56% | 66% |
| Sober & Impaired Drivers | 60% | 78% |

The average time it took to conduct the typical screening procedure was 30 seconds and for the test screening procedure 90 seconds. The most time consuming component of the test screening procedure (the divided attention task) did not contribute substantially to the detection rate (as will be seen in a later section). The divided attention task took an average of 41 seconds to complete. Without this component, the average time for a stop using the test screening procedure could be reduced by almost 50% without substantially lowering the detection rate.

## Effectiveness of the Horizontal Gaze Nystagmus Test

The horizontal gaze nystagmus test (HGN) was one component of the test screening procedure. This test, when used with suspected drunk drivers, has been shown to reliably indicate alcohol intoxication. The results of the current study indicate that it is relatively easy to use in the checkpoint situation, administered through the open car window to the driver seated in his vehicle. The average time to administer the test was 41 seconds.

The test is scored on a six point scale, with up to three points being scored for each eye. When used with a suspected drunk driver, a score of four or more points is taken (in the context of any other information available) as the basis for classifying the driver's BAC level as 0.10% or higher. In a previous study (Anderson, et. al., 1983), that scoring procedure has been shown to correctly classify the driver's BAC 77% of the time. Table 10 applies the same scoring procedure to the nystagmus test scores from the driver's in this study. Overall, this scoring procedure correctly classified the driver's BAC level (as above or below 0.10%) 74% of the time. This is practically the same accuracy that was found when the nystagmus test is administered to drivers under more favorable conditions.

Table 10

Percent of Drivers At Each BAC Level Receiving A Nystagmus Test Score of Four or More Points

| Drivers' BAC (%) | Percent of Drivers |
|---|---|
| .00 - .04 | 15% |
| .05 - .09 | 64% |
| .10 - .15 | 95% |

As mentioned previously, the officers may have expected more of the drivers in the study to be impaired than one would typically find at a checkpoint. They also may have felt some competitive pressure not to miss any impaired drivers. These unintended factors may have had the subtle effect of raising the nystagmus score in those cases in which the officer was uncertain whether he observed a response. As a result, it is possible that the percentage of drivers classified as impaired on the basis of the nystagmus test score was a little higher than one would expect to find at a real checkpoint. Under normal conditions, a smaller percentage of both impaired and unimpaired drivers might be classified as impaired by the test. There is no reason to expect that this potential reduction in the percentage of drivers classified as impaired would not be the same across all BAC levels.

It is interesting to compare the percentage of drivers at each BAC level that received a score of four or more points on the nystagmus test with the percentage of drivers the officers felt should be detained for further investigation (shown in Table 7). If the nystagmus score had been used as the sole criterion for this decision the results would not have differed from the judgments of the officers using the test screening procedure. One possible implication of this is that the other components of the test screening procedure (i.e., the observations of driving and stopping behavior, driver's personal appearance, and divided attention task) did not improve the accuracy of the officer's judgment.

Table 11 shows the breakdown by police agency of the percentage of drivers at each BAC level who were given a score of four or more points on the nystagmus test. There was some variation between the agencies with the largest amount of variation occurring with the sober drivers (where the range was between 10% and 25%).

Table 11

Percentage of Drivers At Each BAC Level Receiving Four of More Points On The Nystagmus Test By Police Agency

| Drivers' BAC (%) | Police Agency #1 | #2 | #3 |
|---|---|---|---|
| .00 - .04 | 10% | 25% | 13% |
| .05 - .09 | 70% | 65% | 60% |
| .10 - .15 | 93% | 86% | 100% |
| Overall Correct | 74% | 66% | 78% |

Effect Of Training & Experience

A comparison was made between the performance of officers given just three hours of training in the use of the nystagmus test and officers who had received 16 hours of training and were experienced in the use of the test. The nystagmus scores from the fully trained and experienced officers correctly classified 100% of the drivers with a BAC of .10% or greater, compared to 89% for the officers with less training. For the sober drivers, 87% were given a score of less than four points by the fully trained officers while 82% were scored less than four points by the less trained officers. Table 12 shows that for each BAC level the officers with less training and no experience in the use of the gaze nystagmus test did not do as well as the better trained and more experienced officers (police agency #3).

The fully trained officer's nystagmus scores correctly classified 78% of the driver's BACs compared to only 70% correct for the less trained officers. The performance of the fully trained and experienced officers in using the nystagmus test with drivers seated in their cars was comparable to that found in previous field research evaluating the nystagmus test in which officers correctly classified 81% of a group of drivers (Anderson, et. al., 1983).

Table 12

Percentage of Drivers At Each BAC Level Receiving
Four or More Points On The Nystagmus Test
By Officer Training & Experience With
The Nystagmus Test

| Drivers' BAC (%) | Fully Trained & Experienced Officers | Briefly Trained & Inexperienced Officers |
|---|---|---|
| .00 - .04 | 13% | 18% |
| .05 - .09 | 60% | 68% |
| .10 - .15 | 100% | 89% |

Effectiveness of the Divided Attention Task

The divided attention task was an attempt to measure the driver's ability to attend to, and do, two different things at one time. This was accomplished by asking the driver to produce his license and vehicle registration while the officer attempted to simultaneously question the driver. The officer looked for certain behaviors that would indicate the driver was having difficulty doing both things at the same time. Table 13 shows the frequency with which the officers observed the occurrence of these driver behaviors for drivers at each BAC level at the first checkpoint. While this task was also performed at the second checkpoint, it is logical to assume that the second time a driver is asked to perform this identical task within a few minutes his behavior will be altered. Thus, the data from the second checkpoint are not presented here (an analysis of the data from the second checkpoint showed no significant differences).

The only behavior which showed a significant difference for the different BAC levels was the last one, "gives inappropriate answer to question." In this case only one of the sober drivers and none of the low BAC level drivers exhibited this behavior while 12% of the impaired drivers were observed to do so. Table 14 shows the percentage of drivers at each BAC level who were observed exhibiting none, one, or two or more of these behaviors. While more than half of the drivers whose BAC was below 0.10% did not show any of these behaviors and more than half of the impaired drivers did show at least one of these behaviors, the differences are small. Only when two or more behaviors were exhibited did any substantial difference occur.

These data were disappointing in that most of the behaviors did not appear to reliably discriminate between the different driver BAC levels. That the occurrence of two or more of these behaviors did seem to indicate a BAC above .10% suggests that a better constructed divided attention task might prove a more reliable discriminator. However, the divided attention task as employed and scored in this study did not identify a very large percentage of the drivers with a BAC at, or over, 0.10%.

Table 13

Percentage of Drivers At Each BAC Level Observed Exhibiting Various Behaviors During The Divided Attention Task At Checkpoint 1

| Driver Behavior | Driver BAC Level .00-.04 | .05-.09 | .10-.15 | |
|---|---|---|---|---|
| Stops Looking For Lic./Reg., Then Continues | 17% | 12% | 34% | NS* |
| Stops Looking For Lic./Reg. Completely (over 10 sec.) | 5% | 10% | 6% | NS* |
| Hesitates In Answering Questions (less than 10 seconds) | 12% | 18% | 28% | NS* |
| Forgets to Answer Question | 0% | 0% | 0% | NS* |
| Gives Inappropriate Answer To Question | 1% | 0% | 12% | |

* - Note: This difference was not statistically significant at the $p \leq .01$ level.

Table 14

Percentage of Drivers At Each BAC Level Observed Exhibiting None, One, or Two or More Divided Attention Task Behaviors

| Driver's BAC (%) | None | One | Two or More |
|---|---|---|---|
| .00 - .04 | 73% | 24% | 3% |
| .05 - .09 | 59% | 37% | 4% |
| .10 - .15 | 47% | 37% | 16% |

## Effectiveness of Observations of Driving Behavior

As each driver approached and stopped at the checkpoint, the two officers observed their driving and stopping behavior. The number of items observed were tabulated and are shown as the percentage of drivers exhibiting these behaviors in Table 15. Only for three of these variables (i.e., Swerving, Stopping Smoothly, and Stopping Jerky) were the differences between drivers at the different BAC levels significant. In each of these cases less than half of the impaired drivers were observed exhibiting the behavior.

As each officer observed and interacted with each driver he noted on the checklist any of a number of personal appearance variables exhibited by the drivers. The percentage of drivers showing these behaviors at each BAC level is displayed in Table 16. All but two of these variables were found to be significantly correlated with driver BAC. Three of these variables, in particular were observed in a relatively high percentage (over 50%) of impaired drivers but not by the unimpaired drivers. These three variables were the Odor of Alcoholic Beverages, Face Flushed, and Eyes Dilated.

Several other of these variables, were observed in virtually none of the sober drivers, though in a relatively smaller percentage of the impaired drivers (e.g., Speech Slurred, Demeanor, Hair Disheveled, Poor Dexterity, and Clothes DIsheveled). Variables like these might prove to be useful for screening drivers even if they aren't shown by the majority of impaired drivers. An officer observing one or more of these variables can be reasonably sure he has not stopped a sober driver.

There was considerable variation between the officers from the different police agencies in the frequency with which they observed these variables. Table 14 shows the minimum and maximum average percentage of drivers observed exhibiting these behaviors for the different police agencies. For example, on the average, 61% of the impaired drivers were observed to exhibit the odor of alcoholic beverages. However, the officers from one police agency only observed 8% of the impaired drivers exhibiting this behavior, while the officers from another agency detected the odor of alcoholic beverages with 100% of the impaired drivers. It is not possible to explain the reason for this variation, it could be due to differences in training, experience, the importance of evidence of this type in courtroom testimony in their respective jurisdictions, or understanding the test procedure instructions, etc. Because of this variation, these results should be interpreted cautiously.

Table 15

Percent of Drivers At Each BAC Level Exhibiting Various Driving Approach & Stopping Behaviors

| Driver Behavior | Driver BAC Level .00-.04 | .05-.09 | .10-.15 | |
|---|---|---|---|---|
| Speed Above the Limit | 18% | 14% | 31% | NS* |
| Speed Below the Limit | 7% | 13% | 9% | NS* |
| Weaving | 8% | 15% | 16% | NS* |
| Drifting | 4% | 9% | 5% | NS* |
| Swerving | 2% | 5% | 14% | |
| Driving Off Roadway | 1% | 0% | 0% | NS* |
| Almost Striking Object | 0% | 0% | 2% | NS* |
| Turning Too Wide | 1% | 0% | 2% | NS* |
| Headlights Off | 2% | 0% | 0% | NS* |
| Stopping Smoothly | 60% | 45% | 34% | |
| Stopping Jerky | 11% | 23% | 37% | |
| Stopping Slowly | 26% | 31% | 19% | NS* |
| Stopping Fast | 28% | 25% | 37% | NS* |
| Stopping Where Indicated | 40% | 34% | 41% | NS* |
| Stopping Other Location | 35% | 46% | 44% | NS* |

* - Note: This difference was not statistically significant at the $p \leq .01$ level.

Table 16

Percent of Drivers At Each BAC Level Observed
Exhibiting Various Personal Appearance Variables

| Driver Behavior | Driver BAC Level .00-.04 | .05-.09 | .10-.15 | |
|---|---|---|---|---|
| Odor of Alcohol | 7% (0-14%)* | 39% (5-68%) | 61% (8-100%) | |
| Face Flushed | 7% (0-11%) | 29% (5-45%) | 53% (14-72%) | |
| Speech Slurred | 3% (2-3%) | 14% (7-25%) | 20% (0-29%) | |
| Eyes Dilated | 15% (7-22%) | 41% (20-50%) | 56% (36-64%) | |
| Demeanor | 4% (2-5%) | 14% (1-15%) | 20% (7-25%) | |
| Hair Disheveled | 3% (2-5%) | 5% (0-10%) | 9% (7-14%) | NS** |
| Poor Dexterity | 1% (0-2%) | 2% (0-5%) | 12% (0-17%) | |
| Clothes Disheveled | 3% (0-7%) | 2% (0-5%) | 14% (0-22%) | |
| Other Observations | 17% (5-25%) | 26% (0-38%) | 34% (0-100%) | NS** |

* - Note: These figures are the minimum and maximum average percent of drivers observed by the different police agencies.

** - Note: This difference was not statistically significant at the $p \leq .01$ level.

## Stopping Distance

The drivers, as they approached the checkpoint passed a sign that said, "STOP AHEAD - SOBRIETY CHECKPOINT." A second sign followed that said "STOP TO SPEAK WITH OFFICER." The lead officer stood at a marked location along the roadway and motioned to the oncoming vehicle to approach his position. The officer did not point or indicate in any way where the driver was to stop. The officer stopped motioning the driver to move forward when the vehicle's front bumper reached his position or when the car stopped, which ever came first. While the officer interacted with the driver the researcher stationed at the checkpoint measured the location of the driver with respect to the point where the officer had stood. Hash marks (not visible to the driver) had been placed on the roadway for this purpose.

The mean distance from the stopping point for the drivers at the different BAC levels did not differ significantly. The average distance in feet for the sober drivers, the drivers with a BAC between 0.05 and 0.09%, and the impaired drivers was 3.0, 5.6, and 3.8 feet respectively. Most of the drivers, approximately 87%, stopped before the stopping point (within approximately three feet), regardless of their BAC level. The percentage of drivers stopping before and beyond the stopping point did not differ significantly by the driver's BAC level.

There was no difference in the stopping behavior of the drivers at the three different checkpoints. The only significant difference that was found was apparently due to the change in the size of the warning sign made half way through the testing. There were different officers staffing the checkpoints when the different sized signs were used which, though unlikely, could also have accounted for this difference. Table 17 shows the mean distance from the stopping point for the drivers at the different BAC levels for the small and larger sign. The mean increase for the drivers with a BAC between 0.05 and 0.09% in the large sign condition was primarily due to a few extreme values (drivers who failed to stop at the checkpoint), and thus should be interpreted cautiously.

Table 17

Mean Distance (Feet) From Stopping Point
By Sign Size And Driver BAC Level

| Driver's BAC (%) | Small Sign | Large Sign |
|---|---|---|
| .00 - .04 | 3.3 | 2.6 |
| .05 - .09 | 3.8 | 7.5 |
| .10 - .15 | 2.8 | 4.5 |

Thus, as measured in this study, stopping distance did not reveal a reliable effect due to the driver's BAC level. However, observations of the driver's behavior suggests that there may have been differences in stopping behavior related to BAC level that were not detected by the particular measurement procdeures used in this study.

Effectiveness of the Passive Alcohol Sensor (PAS)

Each driver stopped at the third checkpoint was tested with the passive alcohol sensor. The device turns a light on when the air passing over the sensor contains a detectable amount of alcohol. The initial test conducted on each driver involved holding the device approximately six (6) inches from the driver's face. When the initial test result was positive, a second test was made with the device held away from the driver in an attempt to determine whether it was responding to alcohol in the driver's breath or to some environmental contaminant. If the second test was negative (indicating the sensor was not responding to environmental substances), a third test was then performed with the PAS held approximately twelve (12) inches from the driver's face.

As can be seen in Table 18, the PAS was fairly accurate in detecting whether the driver had been drinking. Overall the PAS correctly identified whether the driver had been drinking approximately 88% of the time. It correctly indicated a sober driver had not been drinking 90% of the time and correctly indicated that a dosed driver had been drinking 86% of the time.

Table 18

Percentage of Drivers At Each BAC Level For Which A Positive Response Occurred On The Initial Passive Alcohol Sensor Test

| Drivers' BAC (N) | Percentage Positive Responses (N) |
|---|---|
| .00 - .04 (39) | 10% (4) |
| .05 - .09 (19) | 75% (15) |
| .01 - .15 (16) | 94% (15) |

A second test was given only to the drivers whose first test reading was positive (indicating the presence of alcohol in the air sample tested). The second test, with the device held away from the driver's face, was designed to reveal whether the positive first reading was due to alcohol in the driver's breath or to some environmental contaminant. For example, when a positive result occurred with a sober driver (who had no alcohol in their exhaled breath), the device should have been responding to something in the environment that would presumably also produce a positive reading on the second test. However, this did not occur as none of the four sober drivers who produced a positive first test produced a positive second test. The test results are shown in Table 19. The situation with the drinking drivers should be just the reverse. They produced a positive result on the first test due to the alcohol on their breath. Thus, they should have tested negatively on the second test. Only 83% of the tests for the dosed drivers were negative.

The third (12") test was supposed to help discriminate between drivers with low BACs (who should produce no response on the third test at the greater distance) from those with high BACs (who should produce a response of the third test). However, the results showed the third test did not discriminate between low and high dosed drivers.

Table 19
Percentage of Drivers At Each BAC Level For Which A Positive Response Occurred On The Second And Third Passive Alcohol Sensor Tests

| Drivers' BAC (%) | Test 2 (Away) | Test 3 (12") |
|---|---|---|
| .00 - .04 | 0% | 75% |
| .05 - .09 | 13% | 60% |
| .10 - .15 | 20% | 73% |

## CONCLUSIONS

In the introduction, mention was made of the fact that at recent sobriety checkpoints approximately 2% or less of the drivers stopped were arrested. Available research has suggested that upwards of 6%-10% of the drivers on the road (on weekend nights) are driving while impaired. This fact has been used by some persons to argue that the officers at the checkpoints were not detecting the majority of impaired drivers passing through.

While this study can not address that issue directly, the results do show that trained and experienced officers were quite accurate in detecting alcohol-impaired drivers (those with a breath alcohol level of 0.10% or higher). They were able to do this within a relatively short period of time (from 30-90 seconds, depending on the screening procedure used). Their judgments were made at night under conditions (roadway, checkpoint set up, lighting, etc.) similar to those found at real checkpoints. They screened drivers they had never seen before, using information they obtained on the scene, that should be available to any officer at any checkpoint who has been properly trained in the screening procedure.

A word of caution is in order in interpreting some of the results of this study. Simulated checkpoints were used (though conditions were designed, to the extent possible, to reflect the natural setting found at real checkpoints). The officers knew they were taking part in a study and that the decisions they made would not result in the arrest of the drivers they were screening. In addition, post-study debriefing of the officers revealed that they had expected a higher percentage of the drivers to be legally impaired than actually were dosed above 0.10% BAC. This may have had the effect of increasing the detection of the impaired drivers and also increasing the false positive rate (judging unimpaired drivers as impaired). There is no way of estimating what magnitude this effect had, if any.

The behavior of the drivers may also have differed from that found under real conditions. The drivers were not at risk of arrest and punishment as they would be if stopped on the road by the police. To what extent our incentive bonus provided motivation similar to that occurring when drivers naturally encounter a sobriety checkpoint is not known. The drivers appeared to be quite motivated not to be detected by the police in our study (and anxious to earn the bonus payment for succeeding).

A second caution concerns the fact that our test screening procedure involved a number of tasks. There is a possibility that the effectiveness of any one part of the screening procedure may have been effected by the other tests the officer was also using. Though the officers were instructed to score the individual tests independently, it is possible their observations and judgments were affected by the other information available to them.

For example, the extent to which an officer believed the nystagmus test was an empirically based, accurate indicator of BAC, the driver's nystagmus score may have influenced his decision to report other observations in cases where he was uncertain whether a cue or behavior occurred. While the order in which the officer was supposed to record his observations and judgements was determined by the procedure, there was opportunity for the officers to review the checklist immediately after the driver departed the checkpoint (and make corrections). The study procedure could only insure that the officers did not speak to each other until their data sheets had been turned in.

Another example of the possible influence of one part of the test screening procedure on the others can be found in the divided attention task. While this task did not seem to discriminate between drivers of different BACs, it did provide the officers additional time to observe the driver's behavior. Observations made during this task may have been useful to the officer in reaching his judgment about the subject even if the specific behaviors the officers were instructed to look for in the divided attention task did not correlate with BAC. To what extent the correlations we found for some of the observational variables would have occurred, even if this task had not have been conducted, is not known. It is reasonable to assume there is some minimal amount of time the officer needs to spend with a driver to judge him accurately, any additional time may represent a diminishing return in terms of increasing accuracy of the officer's judgment.

A third fact that should be remembered in comparing the results of the test screening procedure with the typical screening procedure was that different officers used different screening procedures. Thus, it is possible some of the differences found between the screening procedures may have been due to differences in ability between officers. We were able to control only for the effects of police agency, training and experience of the officers.

The major results of this study are listed below:

- The officers using the test screening procedure were able to accurately discriminate between impaired drivers (those with a breath alcohol level of 0.10% or higher) and those drivers who were not impaired (i.e., sober drivers). They correctly identified 95% of the impaired drivers, while misidentifying few of the sober drivers.

- The Passive Alcohol Sensor (PAS) was accurate in detecting whether the driver had been drinking. The PAS correctly identified 94% of the impaired drivers as having been drinking, while misidentifying 10% of the sober drivers. Over all the BAC levels, the PAS was correct in indicating alcohol use approximately 88% of the time.

- The PAS or the officers using the test screening procedure were able to more accurately determine which drivers were impaired than those officers using the typical screening procedure. The PAS or the officers using the test screening procedure resulted in a higher percentage of the impaired drivers (BAC of 0.10% or higher) being detected (94% for the PAS, 95% for the test screening procedure versus 87% for the typical screening procedure).

Also, fewer of the sober drivers were identified for further investigation with these better screening procedures (10% for the PAS, 16% for the test screening procedure versus 47% for the typical screening procedure). The PAS and test screening procedure also resulted in fewer of the drivers whose BAC was between 0.05 and 0.09% being identified for further investigation (75%, 61% and 87%, respectively).

- o The horizontal gaze nystagmus test was found to be easily and accurately administered to the drivers through the open car window in a brief period of time (about 40 seconds). The nystagmus test scores were accurate in detecting impaired drivers (BAC of 0.10% or higher) identifying 95% of these drivers, with only 15% of the sober drivers being identified for further investigation.

- o The officers with more experience using the nystagmus test provided the most accurate judgments.

- o The divided attention task as employed and scored in this study and the observations of driving behavior did not discriminate between most of the drivers with different BACs (i.e., between impaired and sober drivers).

- o The observations of some of the personal appearance variables did correlate with driver BAC (a greater percentage of impaired than sober drivers exhibited these symptoms). Three of these variables, in particular, were observed in a relatively high percentage of impaired drivers but not in the unimpaired drivers, they were: Odor of Alcoholic Beverages, Face Flushed, and Eyes Dilated.

- o The stopping distance measurements did not discriminate consistantly between driver BAC levels.

These results suggest that the typical checkpoint screening procedure (where the officers simply observe the driver and form a subjective opinion) can be substantially improved. The use of screening procedures like the nystagmus test or a properly designed and used passive sensor would allow the officers to quickly detect almost all of the impaired drivers while unnecessarily detaining few, if any, of the unimpaired drivers.

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## APPENDIX A


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|---|---|
| Instructions and Checklist for Test Procedure Lead Officer | A-1 |
| Instructions and Checklist for Test Procedure Observing Officer | A-4 |
| Instructions and Checklist for Typical Procedure Lead Officer | A-7 |
| Instructions and Checklist for Typical Procedure Second Officer | A-9 |

4. After requesting driver's license and vehicle registration continue to question the driver during his search. ASK THESE QUESTIONS:

   - o "HOW WAS THE TRAFFIC TONIGHT ON THE WAY HERE?"
   - o (If license has been presented) "DO YOU STILL LIVE AT THIS ADDRESS?"
   - o (If license not yet presented) "DO YOU LIVE AROUND HERE?" "WHAT IS YOUR ADDRESS?"
   - o "HOW DO YOU GET THERE FROM HERE?"
   - o "DID YOU NOTICE ANYTHING OUT OF THE ORDINARY ON YOUR WAY HERE FROM THE HALL?"
   - o "HAVE YOU BEEN DRINKING THIS EVENING? WHAT WERE YOU DRINKING? COULD YOU TELL ME HOW MANY DRINKS YOU HAVE HAD?"

   Observe the driver's ability to answer questions and search for his license and registration simultaneously (CHECK AS MANY AS YOU OBSERVE):

   _____ driver stops looking for license/registration while answering questions, then continues looking

   _____ driver stops looking for license/registration after answering questions and does not continue without a reminder (stops looking for 10 seconds)

   _____ driver hesitates in answering questions while looking for license/registration

   _____ driver forgets to answer questions (within 10 seconds)

   _____ driver gives inappropriate answer for the question asked

5. While the driver is producing his license and registration you should OBSERVE THE DRIVERS APPEARANCE for anything suggesting alcohol impairment (CHECK AS MANY AS YOU OBSERVE:

   _____ odor of alcoholic beverage on driver's breath
   _____ face flushed
   _____ eyes dilated
   _____ hair disheveled
   _____ closthing in disarray
   _____ slurred speech

   _____ demeanor (explain): _____

   _____ lack of dexterity (give example) _____

Other (describe): _____

Driver # _____
Checkpoint # _____
Officer Initials _____

## INSTRUCTIONS & CHECKLIST FOR TEST PROCEDURE
## LEAD OFFICER

1. Stand on stop line and motion approaching vehicle with your flashlight to proceed to your position.

2. Observe DRIVER'S BEHAVIOR during approach and stopping (CHECK ALL THE BEHAVIORS LISTED BELOW YOU OBSERVE):

APPROACH

| | | | |
|---|---|---|---|
| _____ | Sppeding Above Limit | _____ | Speeding Below Limit |
| _____ | Weaving | _____ | Drifting |
| _____ | Swerving | _____ | Headlights Off |
| _____ | Turning Abruptly | _____ | Driving Off Roadway |
| _____ | Almost Striking Object (cones, markers) | | |

STOPPING (CHECK ONE OF EACH PAIR):

| Deceleration: | | | | Location: | |
|---|---|---|---|---|---|
| Smooth | _____ | Slow | _____ | Where Indicated | _____ |
| Jerky | _____ | Fast | _____ | Other | _____ |

3. Approach driver's window and politely greet the driver:

GOOD EVENING. I AM OFFICER JONES WITH THE XYZ POLICE. WE ARE STOPPING CARS TO LOOK FOR DRUNK DRIVERS. YOU WILL BE STOPPED FOR ONLY A MINUTE OR TWO. MAY I SEE YOUR DRIVER'S LICENSE AND VEHICLE REGISTATION, PLEASE?

6. Now tell the driver that the other officer would like to speak with him and then step away from the window and mark your observations on the checklist.

7. After the second officer has completed the GAZE NYSTAGMUS TEST you will step up to the window again and repeat the test:

HI. I AM GOING TO CHECK YOUR EYES AGAIN. PLEASE TURN YOUR HEAD TO FACE ME.

(PLEASE REMOVE YOUR GLASSES.)

ARE YOU WEARING HARD CONTACT LENSES?

PLEASE LOOK AT THIS (penlight).

NOW, KEEP YOUR HEAD STILL AND FOLLOW THE PENLIGHT WHEN I MOVE IT. AGAIN, ONLY MOVE YOUR EYES, NOT YOUR HEAD.

(Demonstrate)

(CHECK AS MANY AS YOU OBSERVE):

_____ Nystagmus in the right eye is moderate or distinct when the eye is moved as far as possible to the right.
_____ Right eye cannot follow a moving object smoothly.
_____ Onset of gaze nystagmus in right eye occurs before 45 degrees (some white is visible).
_____ Nystagmus in left eye is moderate or distinct when the eye is moved as far as possible to the left.
_____ Left eye cannot follow a moving object smoothly.
_____ Onset of gaze nystagmus in left eye occurs before 45 degrees (some white is visible).

8. Thank the driver and instruct him to continue down the street, step away from the other officer and then complete this form.

9. YOUR JUDGMENT WHETHER THE DRIVER WAS IMPAIRED AND SHOULD BE DETAINED

_____ Yes
_____ No

Basis for judgement: (factors that contributed to your judgment rank ordered below, with 1 being most important, 2 being second most important, etc.):

Driver Behavior _____
Driver Appearance _____
Divided Attention _____
Nystagmus Test _____
Other _____
(Specify) _____
_____

10. YOUR ESTIMATE OF THE DRIVER'S BAC: _____%

Driver # _____
Checkpoint # _____
Officer Initials _____

## INSTRUCTIONS & CHECKLIST FOR TEST PROCEDURE
## OBSERVING OFFICER

1. Stand behind the lead officer approximately 3-4 feet.

2. Observe DRIVER'S BEHAVIOR during approach and stopping (CHECK ALL THE BEHAVIORS LISTED BELOW YOU OBSERVE):

APPROACH

| | | | |
|---|---|---|---|
| _____ | Sppeding Above Limit | _____ | Speeding Below Limit |
| _____ | Weaving | _____ | Drifting |
| _____ | Swerving | _____ | Headlights Off |
| _____ | Turning Abruptly | _____ | Driving Off Roadway |
| _____ | Almost Striking Object (cones, markers) | | |

STOPPING (CHECK ONE OF EACH PAIR):

| Deceleration: | | | | Location: | |
|---|---|---|---|---|---|
| Smooth | _____ | Slow | _____ | Where Indicated | _____ |
| Jerky | _____ | Fast | _____ | Other | _____ |

3. When the lead officer approaches the driver's-side window, you will also approach the vehicle, placing yourself to the left of the lead officer in a position so that you can observe the driver.

4. Observe the driver's ability to answer questions and search for his license and registration simultaneously (CHECK AS MANY AS YOU OBSERVE):

_____ driver stops looking for license/registration while answering questions, then continues looking

_____ driver stops looking for license/registration after answering questions and does not continue without a reminder (stops looking for 10 seconds)

_____ driver hesitates in answering questions while looking for license/registration

_____ driver forgets to answer questions (within 10 seconds)

_____ driver gives inappropriate answer for the question asked

5. While the driver is producing his license and registration you should OBSERVE THE DRIVER'S APPEARANCE for anything suggesting alcohol impairment (CHECK AS MANY AS YOU OBSERVE:

_____ odor of alcoholic beverage on driver's breath
_____ face flushed
_____ eyes dilated
_____ hair disheveled
_____ closthing in disarray
_____ slurred speech

_____ demeanor (explain): _____
_____

_____ lack of dexterity (give example) _____
_____

Other (describe): _____
_____
_____

6. After the lead officer has completed the license and registration check and stepped away from the driver's window, you will step up to the window and administer the GAZE NYSTAGMUS TEST:

HI. I AM GOING TO CHECK YOUR EYES. PLEASE TURN YOUR HEAD TO FACE ME.

(PLEASE REMOVE YOUR GLASSES.)

ARE YOU WEARING HARD CONTACT LENSES?

PLEASE LOOK AT THIS (penlight).

NOW, KEEP YOUR HEAD STILL AND FOLLOW THE PENLIGHT WHEN I MOVE IT.
AGAIN, ONLY MOVE YOUR EYES, NOT YOUR HEAD.

(Demonstrate)

(CHECK AS MANY AS YOU OBSERVE):

_____ Nystagmus in the right eye is moderate or distinct when the eye is moved as far as possible to the right.
_____ Right eye cannot follow a moving object smoothly.
_____ Onset of gaze nystagmus in right eye occurs before 45 degrees (some white is visible).
_____ Nystagmus in left eye is moderate or distinct when the eye is moved as far as possible to the left.
_____ Left eye cannot follow a moving object smoothly.
_____ Onset of gaze nystagmus in left eye occurs before 45 degrees (some white is visible).

7. Thank the driver and instruct him to continue down the street, step away from the other officer and then complete this form.

8. YOUR JUDGMENT WHETHER THE DRIVER WAS IMPAIRED AND SHOULD BE DETAINED

_____ Yes
_____ No

Basis for judgement: (factors that contributed to your judgment rank ordered below, with 1 being most important, 2 being second most important, etc.):

Driver Behavior _____
Driver Appearance _____
Divided Attention _____
Nystagmus Test _____
Other _____
(Specify) _____
_____

9. YOUR ESTIMATE OF THE DRIVER'S BAC: _____%

Driver # _____
Officer (L/O) _____
Checkpoint # _____
Officer Initials _____

## INSTRUCTIONS AND CHECKLIST FOR TYPICAL PROCEDURE
## LEAD OFFICER

1. Stand on the stop line and motion the approaching vehicle with your flashlight to proceed to your position.

2. When the car comes to a full stop approach the driver's window and politely greet the driver:

   GOOD EVENING. I AM OFFICER JONES WITH THE XYZ POLICE. WE ARE STOPING CARS TO LOOK FOR DRUNK DRIVERS. HOW ARE YOU THIS EVENING? (Wait for response)

3. Hand the driver the flyer on new Massachusetts Drunk Driving Laws and say:

   THIS IS SOME INFORMATION ON THE NEW DRUNK DRIVING LAWS IN MASSACHUSETTS. HAVE YOU HEARD ABOUT THEM? (wait for response)

   YOU MAY WANT TO READ THEM WHEN YOU GET HOME THIS EVENING.

   IF YOU WILL WAIT A MOMENT THERE IS ANOTHER OFFICER HERE WHO WOULD LIKE TO SPEAK WITH YOU.

4. Step away from the window and take a position in front of the cruiser. Fill out the items on the next page.

5. IN YOUR JUDGMENT, WOULD YOU HAVE DETAINED THIS DRIVER TO CHECK FURTHER ON HIS LEVEL OF INTOXICATION?

_____ Yes
_____ No

6. WHAT FACTORS CONTRIBUTED TO YOUR DECISION? (Rank order the factors which influenced you by writing a 1 next to the most important and 2 next to the second most important and so on.)

_____ Driver's approach to the roadblock was erratic (speeding, drifting, driving off road, weaving, etc.)

_____ Driver's stopping behavior (jerky, too slow or fast, etc.)

_____ Driver did not stop where indicated

_____ Driver's appearance (clothing in disarray, face flushed, eyes, etc.)

_____ Driver's speech (slurred, slow, etc.)

_____ Odor of alcohol on driver's breath

_____ Other

If you selected "other" please explain in brief:

_____

_____

_____

7. Your estimate of the Driver's BAC _____%.

Driver # _____
Officer (L/O) _____
Checkpoint # _____
Officer Initials _____

## INSTRUCTIONS AND CHECKLIST FOR TYPICAL PROCEDURE
## SECOND OFFICER

1. Stand to the front of the cruiser while the lead officer flags down the driver.

2. When the lead officer steps away from the driver's window approach the window and politely greet the driver.

   GOOD EVENING. I AM OFFICER JONES WITH THE XYZ POLICE. WE ARE STOPPING CARS TO LOOK FOR DRUNK DRIVERS. HOW ARE YOU THIS EVENING? (wait for response)

3. Continue with the following statements:

   DID THE FIRST OFFICER GIVE YOU A FLYER ABOUT THE NEW DRUNK DRIVING LAWS IN MASSACHUSETTS? (wait for response)

   GOOD, YOU MAY WANT TO READ THEM WHEN YOU GET HOME THIS EVENING.

   PLEASE WAIT A MOMENT. THERE IS ANOTHER PERSON HERE WHO WOULD LIKE TO SPEAK WITH YOU.

4. Step away from the window and take a position to the rear of the vehicle. Fill out the items on the next page.

5. IN YOUR JUDGMENT, WOULD YOU HAVE DETAINED THIS DRIVER TO CHECK FURTHER ON HIS LEVEL OF INTOXICATION?

_____ Yes
_____ No

6. WHAT FACTORS CONTRIBUTED TO YOUR DECISION? (Rank order the factors which influenced you by writing a 1 next to the most important and 2 next to the second most important and so on.)

_____ Driver's approach to the roadblock was erratic (speeding, drifting, driving off road, weaving, etc.)

_____ Driver's stopping behavior (jerky, too slow or fast, etc.)

_____ Driver did not stop where indicated

_____ Driver's appearance (clothing in disarray, face flushed, eyes, etc.)

_____ Driver's speech (slurred, slow, etc.)

_____ Odor of alcohol on driver's breath

_____ Other

If you selected "other" please explain in brief:

_____
_____
_____

7. YOUR ESTIMATE OF THE DRIVER'S BAC: _____%.

## APPENDIX B


| | Page |
|---|---|
| Instructions and Checklist For Researchers at Checkpoints #1 and #2 | B-1 |
| Instructions and Checklist For Researchers at Checkpoint #3 | B-3 |

Driver # _____
Researcher's Initials ____
Checkpoint # _____

## INSTRUCTIONS AND CHECKLIST FOR RESEARCHERS AT CHECKPOINTS #1 and #2

Be sure both your stopwatches are wound and reset.

Be sure that the lead officer and second officer roles have been switched since the last driver passed through the roadblock.

Be sure hash marks are readable.

Determine whether you will be timing the gaze nystagmus procedure or the search for registration and license by the number of subjects who have passed through the roadblock.

Remember you are timing the activities of the lead officer only.

TIMING OF GAZE NYSTAGMUS (From "Now I would like to test your eyes" until lead officer steps away. _____ Min _____ Sec

Note: time for drivers #1 - #5 and #11 - #15 only, excluding any practice runs.

TIMING OF LICENSE AND REGISTRATION CHECK (From Lead Officer's request for license or registration until officer returns them. _____ Min _____ Sec

Check here and enter no time if the driver stated he could not find either document _____

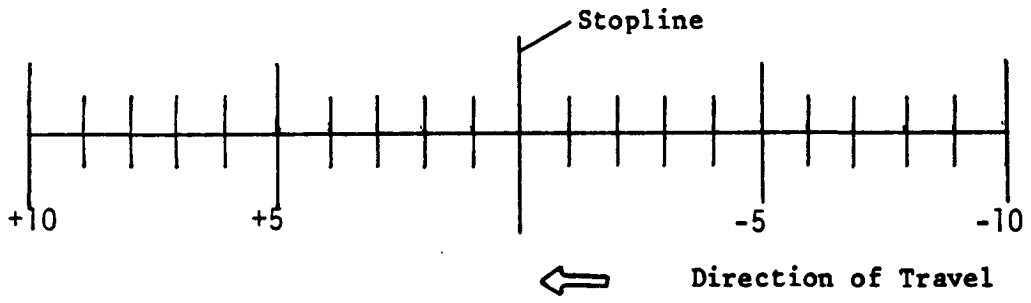
Check here and enter no time if and only if the co-driver shouts "time is up" _____

Note: time for drivers #6 - #10 and #16 - #20 only.

TOTAL TIME FOR LEAD OFFICER (From time vehicle comes to a full stop until the lead officer steps away from the vehicle.) _____ Min _____ Sec

POSITION OF VEHICLE ON HASH MARKS:

Circle the hash mark which best coincides with the position of the driver's head when the vehicle came to a full stop.




Comments:

Driver # _____
Researcher's Initials ____
Checkpoint # _____

## INSTRUCTIONS AND CHECKLIST FOR RESEARCHERS AT CHECKPOINT #3

Be sure both your stopwatches are wound and reset.

Be sure that the lead officer and second officer roles have been switched since the last driver passed through the roadblock.

Be sure hash marks are readable.

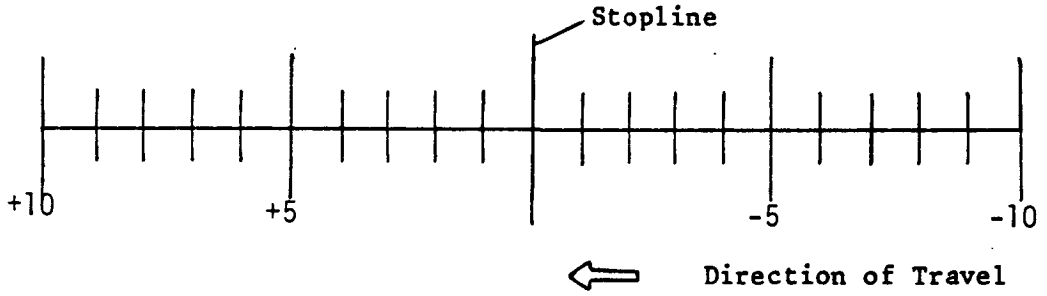
Be sure the sniffer has been calibrated within the past hour and that the batteries are fresh.

Remember you are timing the activities of the lead officer only.

TIMING OF LEAD OFFICER'S PROCEDURE (From time vehicle comes to a full stop until lead officer steps away.) _____ Min _____ Sec

POSITION OF VEHICLE ON HASH MARKS:

Circle the hash mark which best coincides with the position of the driver's head when the vehicle came to a full stop.




SNIFFER DATA (yes = light on, no = light off):

| | | |
|---|---|---|
| First Inside Test | Yes _____ | No _____ |
| Outside Test | Yes _____ | No _____ |
| Second Inside Test | Yes _____ | No _____ |

Comments:

# APPENDIX C


| | Page |
|---|---|
| Protection of Human Subjects (p. 31) | C-1 |
| Sample Flyer | C-3 |
| Screening Form | C-4 |
| Implied Consent Form | C-14 |
| Dosing Procedure | C-15 |

## PROTECTION OF HUMAN SUBJECTS

The North Charles Mental Health Research and Training Foundation holds a General Assurance for the protection of human subjects, and its Institutional Review Board approved this experiment.

Steps taken to minimize the risks to subjects in the proposed study included the following:

- Reports written about the study have not identified particular subjects.

- The possibility of nausea and other unpleasant effects were minimized by the use of split doses. Also, subjects were told that they could stop drinking if they experienced unpleasant effects. It should be noted that the likelihood of these effects occuring was quite small because the subjects were experienced drinkers.

- Because alcohol may produce dangerous side effects when taken in combination with other drugs, and may also inhibit the therapeutic action of other drugs, daily users of any other drugs (including recreational intoxicants) were excluded from this study.

- Use of alcohol is contraindicated for a variety of medical conditions including a history of treatment for alcoholism, hepatic and severe renal disease, ulceration of the gastrointestinal tract, epilepsy, and infections of the urinary tract. Accordingly, candidates with these conditions were excluded from the study.

- All subjects were given a breathalyzer test prior to consuming alcohol in the experiment, and would have been excluded if this showed evidence of alcohol in the bloodstream. Also, a nurse monitored the subjects' vital signs before, and at several points after each dose of alcohol. Any radical fluctuations in these data would have resulted in termination of the experiment for the subject(s) in question.

- The risk of falls and similar mishaps was minimized by close monitoring of the subjects. For example, dosed subjects were accompanied to the bathroom and assisted in and out of their vehicles.

- Risks involved in driving while intoxicated were minimized in several ways. (1) A researcher familiar with the course accompanied the subject. (2) Maximum speed was 25 mph. (3) Driving was not undertaken or was aborted if, in the judgment of the researcher, the subject could not maintain control of the vehicle. (4) No subject was released from the study until his BAC level dropped to .01 or researchers were available to transport the subject home. (5) Subjects surrendered theircar keys to the research team befor the drinking, and were not to be allowed to retain them until they were released from the study.

Written informed consent was obtained from each subject.

Problems encountered concerning human subjects were rare and minor. One high dose subject became ill after consuming his second dose. Further dosing was terminated, the nurse monitored his condition, he laid down on an air mattress and slept for two hours, and at his insistance drove later in the evening as a low doze subject. This same subject was not allowed to complete the course when he failed to stop at the second roadblock. One other subject failed to stop at a roadblock claiming he did not understand the officer's gestures.

WANTED:

MALES 20 TO 30 YEAR OLD

FOR RESEARCH ON DRUNK DRIVING

---

Earn $50 to $100 for a few hours of drinking, driving and trying to fool the police.

The United States Department of Transportation has developed new methods to identify drunk drivers at police roadblocks. You may qualify to participate as a subject in a research study to test these methods.

Some subjects will drink enough alcohol to become legally intoxicated. Some will drink less alcohol, and some will remain sober. All subjects will then drive their own cars on a special course through simulated police roadblocks. Police will try to determine how intoxicated each driver is. You can earn up to a $20 bonus by convincing the police that you are not over the legal limit of intoxication.

The study will be conducted in Medford on the evenings of Thursday October 20th, Friday October 21st, Thursday November 17th, and Friday November 18th. To learn if you are eligible to be a subject on one of these nights call Social and Behavioral Research, Inc. at 492-2503 between 10:00 AM and 4:00 PM.

# TELEPHONE SCREENING FORM FOR DOT ROADBLOCK STUDY

## INSTRUCTIONS

Fill in the blanks where appropriate. If a caller "fails" to pass a screening item or group of items write in "fail" and if necessary the reason(s). Grounds for disqualification and special instructions are noted in parentheses throughout.

If a subject is disqualified by an early response (except age) ask several more questions before stating "I think we can stop now. I am sorry but several things you have told me really do not fit the kind of subject we need for the study." Decline to be specific: "I cannot tell you exactly why you do not qualify. I am sure you will understand that we do not want to give out that information because other people might hear about what we are looking for and try to get into the study even though they are not eligible. The study involves some risks and so we must be very strict about this." Thank disqualified subjects for calling and state "If you know anyone else who might be interested please tell them to give us a call."

PROTOCOL

Date of call: _____

Screener's Name: _____

May I have your name? _____

My name is xxxx and I am one of the researchers involved in the study. How did you hear about the study? (may need to pay bonus)

_____

_____

What do you know about the study so far? (Use to disqualify subjects who know details concerning dosing, roadblock procedures, etc. Guidelines for limits of information is informed consent form on next page.)

Your Comment if any _____

_____

_____

Let me tell you briefly what the study is about and what would you would have to do. OK? (Go to next page and review material on consent form)

Does this sound like a project you would like to participate in? Fine, I need to check on some information to determine whether you are eligible to participate.

How old are you? (must be 20 through 30) _____

I want to be sure you could participate on at least one of the evenings we are conducting the study. Would you be able to come in on either Thursday October 21st, Friday October 22nd, Thursday November 17th or Friday November 18th? (precise times to be determined below) Yes ____ No ____

Do you currently hold a valid driver's license? (No disqualifies)

Yes ____ No ____

How long have you been driving? (3 year minimum) _____

Do you have any restrictions on your license? (daylight operation only, motorcycle only disqualify)

No restrictions _____

Restricted (specify) _____

Do you own a car that you can drive for this study?

Yes ____

(If no ask: Do you have access to a car you could drive and are you certain there would be no problems with your using it for this study? A no at this point disqualifies)

Yes _____ No _____

Is the car in good working order? (judgment) Yes _____ No _____

Comment on equivocal responses _____

_____

Is the car equipped with working seatbelts? (No disqualifies)

Yes _____ No _____

Would you be willing to have a researcher drive the car a short distance to and from the test course we will be using for the experiment? The distance is about half a mile and you will be in the car at the time. (No disqualifies)

Yes _____ No _____

If you are assigned to do some drinking it may be necessary to have a researcher drive you home in your car. We would have another researcher follow the two of you and give the researcher who drives your car home a ride back. If we do not drive you home you would have to remain at the research site until you are sober again which might take several hours. Would you be willing to have a researcher drive you home in your car? (No disqualifies)

Yes _____ No _____

Now I want to ask you a few quick questions about your general health. To begin I will read a short list of medical conditions and when I finish you can tell me whether you have any of these.

Any stomach or intestinal disorders such as ulcers; any infections of any kind?; any muscular or nervous disorders such as epilepsy; emphysema or any other respiratory disorder; any serious problems with your eyesight; high blood pressure or any problems with your kidneys or liver? (yes disqualifies)

Yes _____ No _____

Are you currently under medical treatment for any reason?

(judgment) Yes (specify) _____

No _____

Are you currently taking any medications (yes disqualifies)

Yes _____ No _____

Are you currently taking any non-prescription medication? Any anti-histamines like Contact? Any stomach preparations like Maalox? (yes disqualifies unless use is less than daily)

Yes (specify frequency) _____

No _____

Are you using any intoxicants other than alcohol such as marihuana, cocaine, barbituates, psychedelics, heroin? (yes disqualifies unless intoxicant use is less than daily)

Yes (specify frequency) _____

No _____

Now I want to ask about your use of alcohol. On the average how often do you use alcohol (once per week is minimum alcoholics are ruled out below

Specify frequency _____

How much alcohol do you usually drink on any one occasion? (minimum are 2 mixed drinks, 2 beers, 2 glasses of wine)

Specify frequency _____

(If minimum of 2 drinks not met ask: Do you sometimes drink 2 or more drinks of alcohol? A no at this point disqualifies

Yes _____ No _____

About how long have you been drinking the way you do now? (must meet two minimums above for at least one year)

Specify period _____

Would you be willing to drink as many as 4 strong mixed drinks over a period of a couple of hours for this study (no disqualifies)

Yes _____ No _____

Have you every been in a hospital because of your drinking (yes disqualifies)

Yes _____ No _____

Have you ever attended a meeting of Alcoholics Anonymous or seen a doctor, social worker or a clergyman about problems you have had with your drinking? (yes disqualifies)

Yes _____

(If no ask: Has anyone ever recommended that you attend Alcoholics Anonymous or seek some professional help for problems you have had with your drinking? (A yes at this point disqualifies) Yes _____ No _____

Have you ever been told you have alcohol-related liver trouble, or cirrhosis? (yes disqualifies) Yes _____ No _____

Have you ever been arrested for "drunk driving", "driving while intoxicated", or "driving while under the influence of alcohol'? (a yes disqualifies)

Yes _____ No _____

*******

You have met all the requirements for the study! I want to tell you about a few things you will be asked to do for the study. I emntioned some of them earlier, but I want to be sure you know what to expect:

1. You will have to come by car and will have to come alone.

2. You will have to refrain from eating any meals for at least one hour before you arrive.

3. You cannot take any medication, any alcohol or any other intoxicants on the day of the study.

4. You will be asked to let a researcher keep your car keys until you are released from the study.

5. You may be assigned to drink or assigned not to drink during the study. If you do not drink you will be paid $50 and you might earn a $10 bonus if you convince the police that you are sober. If you do not drink you will be spending about 2 hours with us. If you drink you will be paid $80 and could earn a $10 or $20 bonus depending on how much you are given to drink. Drinkers get paid more because they have to spend more hours with us. Depending on the time of night they start, a subject who drinks might have to stay with us until quite late -- perhaps 2:00 AM.

6. All the subjects will be given some forms to fill out and will be periodically tested with a breathalyzer to determine their alcohol levels. Even sober subjects will be given at least one breathalyzer test to be certain that they arrive without any alcohol "on board". Also a nurse will be monitoring everyone's blood pressure, heartbeat, and respiration.

7. As I mentioned, a researcher will drive your car the short distance to the start of the driving course, ride with you while you drive the course, and drive the car back to the building where the subjects will be. If you are chosen to drink, a researcher may also have to drive you home in your car.

8. One last thing, subjects who drink must be willing to allow us to install a temporary ignition kill switch in their car. This is a simple set of wires which clips onto the coil and won't damage the car in any way. The kill switch will be used by the researcher who will ride with you to help stop the car if he feels that you are in any danger while you are on the driving course.

(Go to scheduling sheet next page).

SCHEDULING SHEET

Subject's Name: (check spelling) _____

Home Address: _____
_____
_____

Home Phone: _____

Times Usually available at home (AM & PM) _____

Alternative phone (e.g., business) _____

Times usually available at alternative phone (AM & PM) _____

What kind of hard liquor such as vodka, gin, and whiskey do you prefer to drink?

First choice _____
Second choice _____

Scheduled Arrival (preference to assign subjects who live nearby to drinking conditions):

Date _____
Time _____

Closing Issues:

1. Its very important that you be on time.
2. We will be sending you a map and a letter which will review some of the things we talked about today.
3. Please do not hesitate to call us if you have any questions or concerns.
4. We are looking for more subjects, if you know someone who may be interested tell them to give us a call as soon as possible. (optional discussion of a $5 bounty for referrals who we accept as subjects, payable by mail after the referred subject appears)
5. The study will be conducted rain or shine.
6. We will probably be calling you just before the (date), if not I will see you at the study.

CONSENT FORM

FIELD TEST OF BEHAVIORAL MEASURES TO IDENTIFY INTOXICATED DRIVERS

The purpose of this study is to evaluate an observational technique which law enforcement agencies could use to identify intoxicated drivers under field conditions.

This study is supported by a contract awarded by the United States Department of Transportation to the North Charles Mental Health Research and Training Foundation, Inc., Box 590, Cambridge, MA 02139.

The study will take place between 4:00 PM and 2:00 AM on four nights. You may or may not be asked to drink enough of an alcoholic beverage to become intoxicated above the legal limit of a Blood Alcohol Concentration (BAC) of .10. If you receive alcoholic beverages, you will be so notified. Your BAC will be monitored by breathalyzer. A nurse will be present throughout the experiment and will monitor your pulse, heartbeat and respiration.

You will be asked to drive your own vehicle on a closed road course. You will be accompanied in your vehicle by a research staff member who will direct your activities. You will not driver over 25 miles per hour, and will only drive under supervision of the staff and will be required to follow their instructions. A "kill switch" will be attached to your vehicle. This will allow the research staff member to stop the vehicle in an emergency.

After driving the course, you will be given an alcohol breath test and checked by the nurse. You will be required to remain at the site until your BAC is .01 or lower, or until you can be transported by a sober driver.

You will be paid $50.00 upon completion of the session. If you drink alcoholic beverages as part of the experiment you will be paid $80.00, since you will be on site for more hours. In addition, you can earn up to an additional $20.00 for "passing" the roadblock check for intoxication.

You may experience detrimental effects from the consumption of alcohol as part of this experiment. These may include disorientation, impaired judgment, or serious medical complications if you have a pre-existing medical condition or use drugs of any kind. You are required to complete a medical checklist before you participate in the study. Precautions will be taken to minimize risks. However, your participation in any activity involved in this study is trictly voluntary and you may refuse to participate in any activity at any time.

You may ask the staff any questions you wish before you sign this form. You may ask the staff any questions you wish before participating in any activity involved in the study. After you have read and fully understand this statement, please sign it if you agree to participate in this study as a volunteer.

I, _____ have read and fully understand this form,
(name)
and consent to voluntarily participate in the Field Test of Behavioral Measures to Identify Intoxicated Drivers.

Signature: _____ Date: _____
Witness: _____ Date: _____

## DOSING PROCEDURE

Doses were calculated using the Widmark formula adjusted for split doses administered over time. The drivers were allowed to choose one of three types of spirits: 100 proof vodka, 100 proof bourbon, or 96.4 proof gin (dosage for the latter was adjusted accordingly). Mixed iced drinks were prepared in a palatable 3:1 mixer to spirits ratio using either water, tonic water, soda water, collins mixer or ginger ale with a slice of lemon or lime added to taste.

Low dose drivers were administered two drinks of an alcoholic beverage. The first was consumed within 10 minutes. Drivers were instructed to drink steadily so they would be half finished in five minutes, and not to consume all of the drink early on or to wait until the last few minutes to consume most of their drink. Consumption was followed by a 19 minute absorption period, and then a breathalyzer test. Results of the breathalyzer test were used to determine if the subject had reached his projected BAC level for the split dose. The second dose was adjusted as needed. The second drink was consumed within 10 minutes, and after a 34 minute absorption period another breathalyzer test was administered.

At this point the driver was projected to be at his peak BAC level of 0.07%. Fourteen minutes later, the driver received a final breathalyzer test to confirm that his BAC was falling, but still above the minimum of 0.05%. If this breathalyzer test showed a BAC equal to or above the peak BAC, the driving was delayed until a falling BAC could be confirmed. The total time between beginning the first drink and the expected driving time was 100 minutes.

A similar sequence was followed for the high dose drivers, except that they received four split doses instead of two. These drivers received their four drinks at approximately 30 minute intervals with the instructions to consume each drink within a 10 minute period. Additional breathalyzer tests were given after most of the absorption periods to confirm that the drivers' BAC was reaching the projected level. Driving was not scheduled until a falling BAC was detected after the final absorption period. Approximately 140 minutes elapsed between beginning the first drink and driving.

Dosed drivers were not released from the study until their BAC fell to 0.01%, or until researchers were available to drive them home. They were given the opportunity to take a breathalyzer test at least once per hour while waiting to be released and were advised of the results.