Basic Training Program in VASCAR© Speed Measurement

Developed in cooperation with

The International Association of Chiefs of Police

and

The International Association of Directors of Law Enforcement Standards and Training

NTIS DISCLAIMER

PREFACE

Course Administrators and Instructors

This training curriculum is the product of the efforts of a representative group of VASCAR instructors from across this country, the International Association of Chiefs of Police, the National Highway Traffic Safety Administration (NHTSA), the International Association of Directors of Law Enforcement Standards and Training, and Traffic Safety Systems (the manufacturer). The course requirements are intended to present a model minimum level of training necessary to the accurate operation of the VASCAR speed measurement device. You are encouraged to modify and/or amend this model to' more closely fit State and local needs and case law.

The development of this course was also influenced by testing of the accuracy of the VASCAR-Plus time-distance speed measurement device, conducted by NHTSA at its Vehicle Research Test Center in East Liberty, Ohio. The results of this testing indicated that the device itself is capable of measuring vehicle "true speed" to within + 1.2 MPH at 100 miles per hour. This error is linear in nature for example the error at 50 MPH is + .6 MPH. The distance measurement feature is accurate to within one half of one percent or 2.8 feet in one tenth of a mile (580 feet).

OVERALL COURSE GOAL

The goal of all police work is to protect the lives, property, safety and well being of the public. Traffic law enforcement is no exception. Generally, traffic laws arise from, safety related needs. Preventing motor vehicle crashes requires well designed roads and vehicles and well regulated driving behavior. If' there were no traffic laws or traffic law enforcement, there would be no regulation of driving behavior. The most probable result would be chaos, confusion, frequent crashes and many more deaths and injuries. In general, the most important traffic laws are those that regulate the most dangerous driving behaviors.

Vehicle speed laws belong to this "most important" class. Research shows that excessive speed is a major contributing factor to motor vehicle crashes. Further, excessive speed increases the severity of the crashes that do occur. A high speed crash is much more likely to produce death or serious injury than a low speed crash. Research also shows that vehicle speeds can be reduced and that thousands of American lives can be saved each year.

WHERE DOES VASCAR FIT INTO ALL OF THIS?

VASCAR is an important and effective means of accurately establishing vehicle speed. It is not the only means available, and it may not be the best means in certain cases, but it has numerous advantages that make it a widely used method.

The National Highway Traffic Safety Administration and the International Association of Chiefs of Police believe that VASCAR is an effective enforcement tool. The' role of VASCAR in safety related traffic enforcement continues to be of critical importance. VASCAR provides a means of increasing enforcement effectiveness and permits police administrators to make better use of scarce personnel resources.

The overall goal of this training program is to improve the effectiveness of speed enforcement through the proper and efficient use of VASCAR speed measurement instruments. It is hoped that every officer who completes this course will become a better enforcer of the traffic laws governing vehicle speed. That is, the officer will detect more speed violations, apprehend more violators, and secure more convictions. .

SPECIFIC TRAINING OBJECTIVES

This course is designed to help you, the police officer, become a more effective speed enforcer. The knowledge and skills needed to accomplish this relate to proper VASCAR speed measurement and carry over into successful speed enforcement in general.

By the time this course is completed, you should be able to:

1. Describe the association between excessive speed and crashes, deaths, and injury as well as the highway safety benefits of effective speed control. It has already been stated that excessive speed can cause crashes. Knowing how excessive speed contributes to highway safety problems and how speed enforcement can effectively solve these problems will enable you to better understand your function in the overall traffic safety scheme.

(2) Describe the basic principles of VASCAR speed measurement. (This course certainly won't make you an expert in electronics or 'physics. That kind of expertise is not necessary to operate VASCAR. These basic principles are discussed only to give you an understanding of VASCAR's strengths and weaknesses and the kinds of problems that can occur if it is not operated properly. People usually adhere to prescribed procedures more faithfully if they know why those procedures are needed; this is certainly true of the VASCAR operator.)

(3) Demonstrate basic skills in testing and operating specific VASCAR instrument(s). ("perfect practice makes perfect." VASCAR instruments are fairly simple to operate, but practice is needed before an operator's skills become sharp enough to result in confident VASCAR speed readings.)

(4) Identify the specific VASCAR instrument used by your agency and describe the major components and functions. (Before a specific VASCAR device is used, the operator must understand its specific control functions, characteristics, advantages and limitations.)

(5) Identify and describe the laws, court rulings, regulations, policies and procedures affecting VASCAR speed measurement and speed enforcement in general. (Laws cannot be enforced unless they are known.) What constitutes a speed violation? What are the elements of the offense? What special rules of evidence apply to the offense? What special rules apply to VASCAR evidence? Until these and similar questions can be answered, an officer is not ready to enforce speed laws or use the VASCAR instrument.

(6) Demonstrate the ability to prepare and present records and courtroom testimony relating to VASCAR speed measurement. (The job does not end when a citation is issued. Evidence must be gathered and presented to support adjudication of the charge.)

At the end of the course, tests will be administered to determine how well the six objectives listed above have been reached. As the course progresses, try to keep them in mind to see how the various topics covered fit into the total learning experience.

COURSE CONTENT

This course consists of a series of units that address the six objectives just discussed. The topics covered include:

Speed offenses and speed enforcement. (Speed in relation to highway safety; types and benefits of speed regulation.)

Basic principles of VASCAR speed measurement. (Origin and history of VASCAR; principles of time-distance measurement of speed; factors affecting VASCAR operation.)

Legal and operational considerations. (Laws, court rulings, policies, etc., affecting VASCAR operations; general operating procedures.)

Operation of the specific VASCAR instrument. (Instrument components and their functions; operating procedures; operational demonstrations.)

Moot Court. (Case preparation, testimony, and cross-examination.)

The content outlines represent a complete course of training in VASCAR speed enforcement. Some agencies may decide that some of this content has been adequately covered in other courses and thus may delete or deemphasize certain items. If used as "refresher" training for more experienced officers, parts also may be deleted. It will be up to the VASCAR instructor to advise you of just what local adaptations have been made.

Some Final Words of Introduction

Before the actual training begins, some questions that have been asked recently by many motorists (as well as police officers and judges) must be considered. Just how good is VASCAR? Is it really accurate? Can it be trusted? Is VASCAR liable to clock vehicles at all kinds of false speeds? What are the facts?

In the Spring of 1991, the National HighwayTraffic Safety Administration (NHTSA) concluded extensive testing of the VASCAR-Plus time/distance speed measurement device. This testing was conducted at the request of the law enforcement community. The report,, Analysis of VASCAR, DOT HS 807-748, May 1991, is available through either the Office of Enforcement and Emergency Services, NHTSA, 400 7th Street NW, Washington, D.C. 20590 or through the National Technical Information Service, Springfield, Virginia 22161.

A synopsis of the results of this testing follows:

The VASCAR-Plus does not have an overall speed measurement accuracy of ±1 % . When electronically tripped (no human operator) the device was in error + 1.24 MPH at 100MPH. When operated by certified officers, the results show that VASCAR-Plus does not have an overall speed measurement accuracy of ±1%, but that a +2 MPH upper 90th percentile tolerance limit (95 % of the speed errors are less than +2 MPH) is achievable when the speed measurement is 4 seconds in duration for stationary methods (angular and parking), and in speed measurements of 5 seconds in duration for moving methods (following and approaching from the rear).

Speed enforcement based on VASCAR is not difficult to learn, but is complex enough that shortcuts in training can result in less than effective performance. The courts are aware of this, and many are now demanding evidence that the VASCAR operator has had sufficient training and experience.

So, finally, just how good is VASCAR? It is only as good as you, the operator, make it. If the specific training objectives cited in this course are met, you will be an effective police VASCAR operator.

Study Topics:

a. Become familiar with the course objectives.

b. Become familiar with the topics to be covered in later units.

c. Be prepared to answer the following questions:

- What is the overall goal of the course?
- What are the six training objectives of the course?
- What are the ultimate purposes of speed enforcement?
- If the courts do not expect or require that police officers be experts in VASCAR technology, why does this course include training in VASCAR's basic mathematical principles?
- If your proper basic concern is with speed enforcement, why does the course include training in preparing and presenting courtroom testimony?

Speed Offenses and Speed Enforcement

Excessive vehicle speed is a major cause of death and injury on our highways. Thus, the control of excessive speed has long been of paramount interest to traffic law enforcement. Effective regulation of speed requires first that police officers have a thorough knowledge of the various types of speed laws, as well as where and when they apply; next, that the officers enforce these statutes.

This unit will discuss the problem in general and the existing laws created to deal with that problem. By the completion of the unit, you are expected to be able to:

- o Describe the association between speed offenses and motor vehicle crashes and injuries.
- o Describe the major types of speed regulations, including their origin, development and scope.

Speed in Society

Since the earliest days of the automobile, speed has been its most controversial feature. Historically, manufacturers have had little trouble in finding a ready market for fast cars. Concern over the public's fascination with speed was voiced by the Supreme Court of Pennsylvania as early as 1906. In affirming a conviction under a city ordinance for speeding over 7 mph, the Court said:

"It is only necessary to resort to the most cursory observation to find evidence that many drivers of automobiles in their 'desire to put their novel and rapid machines to a test of their capacity, drive such vehicles through the streets with a reckless disregard of the rights of others."

Brazier v. City of Philadelphia, 215 Pa. 297, 64 A. 508, 510 (1906)

"This preoccupation with speed seems to be even more prevalent today, with our highly-mechanized society. People rush to work and rush to play. The automobile provides the means to maintain this harried existence. For some, it also serves as a means to relieve the tensions brought about by living at so rapid a pace. These individuals turn their automobiles into tools of aggression. This is not to say that most drivers are obsessed with speed. It is important, however, not to lose sight of the dangers inherent in high speeds."

High speeds affect all three elements of driving:

- The **OPERATOR** -- Increased speeds tax the driver's basic capabilities, such as reaction time.
- The **VEHICLE** -- Increased speeds impact on vehicle dynamics.
- The **ROADWAY** -- Increased speeds compound the potential hazards of any deficiencies 'in the road surface (potholes, construction, etc.) or situational conditions resulting from weather (ice, snow, rain).

High speed interacting with one or more of these elements can result in a crash.

To grasp the dramatic impact excessive speed can have, examine the simple task of stopping a vehicle. This task incorporates the three elements previously mentioned and is, therefore, greatly affected by increased speeds.

The average person has a reaction time of about 3/4 of a second. Suppose our average motorist is proceeding along a typical road clear of any snow, ice, or other surface problems. Driving at about 20 mph, the motorist notices a hazard ahead and reacts normally, At 20 mph, the car moves 22 feet during this 3/4 of a second. Assuming that the automobile is in proper working order, and additional 20 feet of braking distance is required to bring the car to a complete stop. In total, it has taken the car 42 feet to stop.

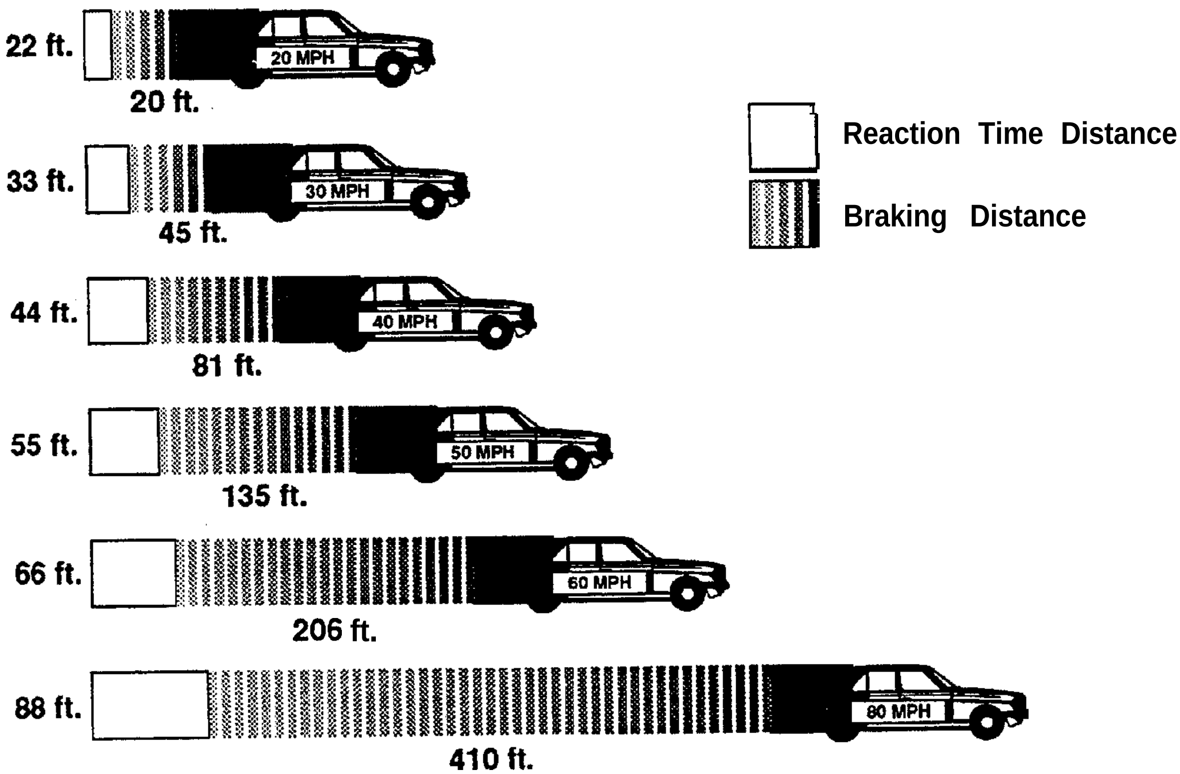
Suppose our average motorist is proceeding at 40 mph. Reacting to a hazard within the same reaction time span, the car will have traveled 44 feet before the driver begins to brake. However, the braking distance is now 81 feet. The braking distance at 40 mph is not twice the distance required at 20 mph, but four times the distance. Now a total of 125 feet is required to bring the vehicle to a halt.

Similarly, the braking distance at 80 mph would not be four times the distance required at 20 mph, by more than 20 times the distance -- 410 feet. The chart on the following page graphically illustrates the distance needed to stop a vehicle at speeds from 20 to 80 mph.

Remember, this example was based on an average driver with average reaction time, driving a car in good working order, under good road conditions. As speeds increase, a driver maintains less and less real control over the vehicle. Increased speeds tax the effectiveness of the driver's reaction time and the vehicle's stopping capabilities.

Additionally, if there had been any deficiencies in our hypothetical driver's reaction time, increased speed would have magnified those deficiencies.

Technical advances can increase a cars' capabilities or improve the design of roadways to allow for greater and greater speeds. It is much more difficult to "redesign" or improve a driver ' s capabilities.



Distance Required to Bring a Car to a Complete Stop

History of Sped Regulation

Various types of legislation to control speed have been introducted throughout our, country's history. The primary purpose of this speed regulation has been to make traffic movement more efficient with minimum danger to people and property.

According to Joseph Nathan's "Famous Firsts," the first traffic law in America was passed on June 12, 1652, by New Amsterdam (now New York). It prohibited the riding or drivingHistory of Speed Regulation

Various types of legislation to control speed have been introduced throughout our country's history. The primary purpose of this speed regulation has been to make traffic movementof horses at a gallop within city limits. Hartford, Connecticut, lays claim to the distinction of having the first automobile speed regulation. This law was enacted in 1901 and limited automobile speeds to 12 mph in the country and 8 mph within city limits.

As the number of automobiles increased, so did the number of laws governing their use. This volume of statutes and ordinances was based, in part, on the assumption that no one should drive a vehicle at a speed greater than is reasonable and prudent under. existing conditions. This assumption became known as the "basic speed law."

Enforcing the basic speed law involves procedures different from enforcing speed limits. Under the basic speed law, it must be shown that the violator's speed was unreasonable or imprudent given the existing conditions. This is not easy, since any basic speed law includes such ambiguous terms as:

"Reasonable" -- What is "reasonable"?

"Prudent" -- Just what is a "prudent" speed?

"Under existing conditions" -- This term can refer to the condition of the road (whether there are wet or slippery conditions), the condition of the vehicle (whether it is in proper working order), or the condition of the driver (is the person fatigued, intoxicated, etc.?).

Early efforts to enforce this somewhat ambiguous law resulted in some confusion. These enforcement efforts caused two major schools of thought regarding speed enforcement to emerge: those advocating "prima facie" speed limits and those advocating "absolute" speed limits.

Loosely translated, "prima facie" means "at first glance, " or "in the absence of further proof. " Prima facie speed limits are those stated as a specific rate and posted on the highway, e.g., "Speed Limit 35 mph. " However, the basic speed law is the one that has to be enforced and adjudicated. In other words, a speed limit is posted to tell the motorist what is considered a reasonable speed for that area. If a motorist exceeds this speed, the motorist is said to have violated the basic speed law "prima facie."

However, speed in excess of the prima facie limit is only an indication that the speed was unreasonable and imprudent. The accused is entitled to produce evidence in court to show that the speed was reasonable and prudent for the conditions and circumstances at the time in question. A court or jury provides the final decision.

Proponents of this type of law insist that it permits greater flexibility in practice. Not every speed exceeding the stated limits should be considered dangerous. Prima facie limits are not arbitrary, and it is contended that most drivers use good judgement and adjust their speed according to the conditions encountered.

"Absolute" speed limits are based on laws that simply prohibit driving faster than a specified speed, no matter what "the existing conditions." This school of thought insists that the basic speed law alone leaves too much room for individual interpretation by motorists - many of whom are not reliable enough to make correct decisions as to reasonable speeds. It is also maintained that prima facie limits are practically unenforceable, since questions arise in almost every case as to the rate of speed in relation to environmental conditions and what a reasonable speed really is for those conditions. Driving in excess of that absolute limit, regardless of conditions, is a violation. The only proof required is that the motorist exceeded the limit; circumstances and conditions have no bearing on the driver's guilt or innocence.

Speed limits can include both maximum and minimum speed restrictions. Different limits can be set for different conditions, such as:

Tie **of Day** -- Speeds are sometimes lowered during night or rush hours;

Type of Roadway -- Highway or urban routes can have different limits than roads in residential areas; and

Type of Vehicle or Equipment - Lower maximums are often set for buses or trucks.

In the early versions of the Uniform Vehicle Code, prima facie limits were recommended, and a majority of States adopted prima facie speed provisions. Meanwhile, the absolute type of law fell into disfavor. In the 1950's more and more States began to adopt absolute limits and abandon the prima facie approach. In fact, the 1956 Uniform Vehicle Code was revised to provide absolute maximum limits and all mention of prima facie was eliminated.

Current systems of speed control acknowledge that the speed control system must permit motorists to reach their destination as rapidly as possible while giving all due consideration to safety, reason, and prudence. Rapid movement of vehicular traffic is essential to efficient highway transportation.

Elements of the Offense

Successful enforcement of speed regulations -- whether prima facie limit, basic speed limit, or absolute speed limit -- involves more than simply detecting and apprehending violators. Speeding, just as any other offense, can only be successfully prosecuted when certain specific elements of the offense stipulated in each statute are established. The elements of the speeding offense are driver identification, location, speed and conditions. These elements are specified in general in Table 1. It should be noted that the elements of the different types of regulations are essentially. the same except for "speed," which is defined differently under each type of law. The "location" element in some jurisdictions may include only public highways and roads and in others, parking lots, public driveways, and private roads.

Table 1. Elements of the Speeding Offense

ELEMENTS	ABSOLUTE SPEED LAW	BASIC SPEED LAW	PRIMA FACIE
DRIVER	Accused must be shown to have been the driver at time of infraction	(SAME)	(SAME)
LOCATION	Any place to which the public has right of access for vehicle use	(SAME)	(SAME)
SPEED	In excess of specified limit	Unreasonable 0 r imprudent	In excess of posted limit
CONDITIONS	(Not applicable)	Having regard to actual and potential hazards	Same as Basic

Driver Identification

There are two aspects to driver identification. First, the officer must be able to identify the driver of the vehicle at the time of the initial stop and second, identify the same driver in court at a later time.

After making the initial stop, the officer should make an immediate visual identification of the driver. Other vehicle occupants may attempt to change places with the driver in an effort to confuse the investigation. An alert officer can counter these activities by initially noting driver characteristics such as clothing colors, hats, beards, or other distinguishing characteristics that can be observed at a quick glance. When the officer has completed this first identification of the driver, more specific details that will aid the officer in identifying the suspect in court should be noted.

Location

Establishing where the defendant's vehicle was being driven when the infraction occurred is usually not difficult. The officer's testimony that the violation was observed to have taken place on a certain street or highway is sufficient. If there is doubt as to whether the location of a particular roadway is considered public or private, look it up under State statutes or check with a supervisor. If the offense occurred off-highway and is included under your statute, the location can be defined by reference in permanent landmarks.

Speed

Establishing a defendant's speed has differing degrees of importance depending on which type of speed law covers the location of the infraction.

In the case of the basic speed law, the measurement of speed alone will not establish the element of "speed". Remember that the basic speed law states that it shall be unlawful to operate a motor vehicle at an unreasonable or imprudent, speed. There are no clear definitions of just what an "unreasonable" speed is, so a measurement of speed is useless without some indication that the speed was excessive.

Prima facie limits suggest what speeds may be presumed to be excessive. The courts will ultimately decide whether a particular speed was unreasonable or imprudent. It is incumbent upon the officer to produce more detailed information to show the courts that the defendant's speed was excessive.

Conditions

In establishing that a defendant's speed was unreasonable or imprudent, the officer must gather information to show it was so in light of existing conditions.

Such conditions include:

- 1. WEATHER -- rain, snow, sleet;
- 2. ROADWAY CHARACTERISTICS -- traffic volume, road surface conditions; and,
- 3. THE VEHICLE -- brakes, tires, or such vision obstructions as a dirty windshield.

Obviously, this type of information does not have to be established in cases involving absolute limits.

Speed Limit Enforcement

Perhaps the most compelling and important reason for stressing enforcement of speed limits is simply that a very substantial number of fatal crashes occur as a result of excessive speed in all speed zones whether high or low.

STUDY TOPICS:

a. Review the statute(s) governing vehicle speed along a typical patrol route. Which statute(s) governs speed there?

b. Be prepared to answer the following questions:

1. Distinguish between prima facie speed limits, the basic speed law, and absolute speed laws.

2. What are the elements of a speeding offense?

3. What would be an appropriate response to this statement: "Local speed limits are so low that enforcing them is not really worthwhile."

THEORY OF OPERATION

LEARNING OBJECTIVES

At the conclusion of this chapter the student will be able to:

1. Describe the VASCAR unit in terms of its two basic components.

2. Explain the "pulse" concept and how it is used to measure distance.

3. Describe and apply the mathematical formula used to determine speed.

4. Distinguish between the two methods of determining distance: dialing and driving.

WHAT IS VASCAR?

VASCAR is a time-distance speed measurement device that is used by many State and local police agencies to enforce laws against speeding. VASCAR stands for Visual Average Speed Computer and Recorder. The instrument calculates an average speed using the basic formula given below:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

VASCAR allows an officer to "drive in" or "dial in" a distance. The officer then "times" the target vehicle with the instrument's timing feature as the target vehicle covers the distance. VASCAR then uses these measurements to compute a speed in miles per hour (mph).

MATHEMATICAL FORMULA

The mathematical formula used by VASCAR is a simple algebraic equation.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{\text{Miles}}{\text{Hour}}$$

For the purposes of law enforcement officers, speed is normally expressed in terms of miles per hour. Distances and time, however, can be expressed in a number of different ways. For example, distances can be measured in miles, feet. or inches; and time can be measured in hours, minutes or seconds. When using VASCAR, a police officer will normally measure distance in feet and time by the second. Therefore some elementary conversions are necessary for the basic speed formula.

Keep in mind that 1 Hour = 60 Minutes = 3600 Seconds

Also, 1 Mile = 5280 Feet

NOTES PAGE

The crystal is accurate to 1/100 ths. of a percent but built into the software is the accuracy of 3/10 of 1%. The VASCAR time base is accurate to within 3/10 of 1%.

The distance is measured by the odometer module in increments of one ten-thousandths of a mile, or to an accuracy of less than 1/2 of 1% (or plus or minus less than 2.5 feet in a tenth of a mile).

4. VASCAR measures speed in 4 basic configurations with many variations. The methods are limited only by the imagination of the officers. Any combination of distance and time will produce a speed reading.

5. Low power consumption - the unit draws less than 1 amp; however, it is not recommended that the instrument be left on overnight.

6. Distance is measured in units of feet, miles, or the unit can be calibrated to the metric system, if necessary.

7. VASCAR measures the average speed of the target vehicle. By definition, average speed cannot exceed peak speed and is generally lower.

SPECIFIC DESCRIPTION

A complete VASCAR unit consists of two main parts: the control head and the odometer module.

The control head is normally mounted inside the patrol car (or aircraft), and is in easy reach of the police officer who operates the vehicle. Many police departments mount the control head on an equipment rack between the two front seats or on the dash board area. Regardless of the mounting location, the individual controls should be easily within reach of the police officer who should also have a clear view of the digital display on the control head.

The odometer module is a transducer that sends magnetic pulses to the computer in relation to distance travelled by the patrol car. The module is connected to the transmission of the automobile by the odometer module cable. The accuracy of the odometer module, and the VASCAR unit itself, is independent of the accuracy of the speedometer.

The odometer module sends ten magnetic pulses to the computer for each turn of the odometer module cable. The transmission of the average automobile will turn the odometer module cable approximately 1000 times in a mile. One thousand turns of the cable, times ten pulses per turn, equals ten thousand pulses per mile travelled.

$$\frac{1000 \text{ turns}}{\text{mile}} \times \frac{10 \text{ pulses}}{\text{turn}} = 10{,}000 \text{ pulses / mile}$$

Bach pulse is equal to 1/10,000th of a mile. This relationship can also be used to calculate the theoretical distance travelled, or inches measured, in each "pulse":

$$\frac{5280 \times 12}{10,000} = 6.3 \text{ inches}$$

Therefore, the VASCAR unit measures distance in 6.3 inch increments.

A typical automobile odometer module cable turns 1,000 times in a mile and the odometer module creates 10 pulses per turn. Therefore, in theory, 10,000 pulses are generated per mile travelled. In reality, however, not every odometer module cable turns at 1,000 times per mile. Because of this, the VASCAR device must be calibrated to read the correct distance, or in other words, count the number of pulses in a mile. (See Chapter 3 for specific calibration procedures.)

Bach VASCAR control head measures approximately 4 x 4 x 7 inches. The face of the head contains the following switches and/or features: an on-off toggle switch, an LED display, a red time toggle switch, a black distance toggle switch, a red time recall button, a black distance recall button and five thumbwheel switches.

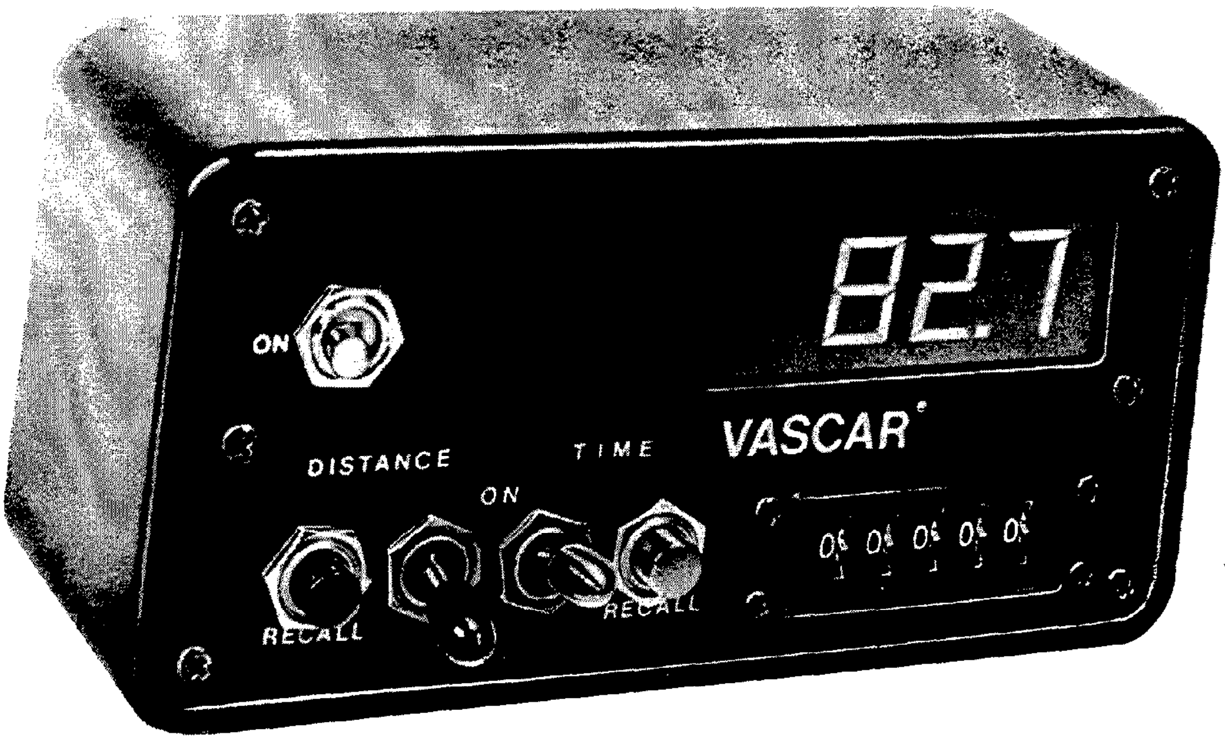


Figure 2: Control Head

THEORY OF OPERATION

The control head also contains a computer that calculates the speed in miles per hour by dividing the distance the target vehicle travels by the measured time it takes to travel that distance. The miles per hour reading will be displayed in one-tenth mph increments. For example, 65.7 mph, 72.5 mph, etc. will be displayed on the LED readout.

"Time" is determined by the police officer by activating the red time switch as the target vehicle traverses the distance from point A to point B.

"Distance" is either "dialed in" or "driven in" by the police officer.

A. **"Dialing in Distance" -** A premeasured distance can be dialed into the VASCAR unit by using the five thumbwheel switches on the control head. The operator must first dial up a "9" on the far left thumbwheel. This first digit serves as an entry number. The operator then dials in the remaining digits which correspond to a decimal representation of a mile. For example:

Officer X plans to clock cars over a known distance of one-eighth (1/8) mile. One-eighth mile is equivalent to 0.1250 mile when expressed in decimal form (1 divided by 8 = . 0.1250). To "dial in" this distance he would set up the thumbwheel display as follows:

9 - 1 - 2 - 5 - 0

Officer X would then depress the distance button and release it. **Then the operator turns the left most dial from 9 to 0.** The course distance of 1/8 mile is now registered in the computer, The distance that has been entered into the computer can now be verified by depressing the Distance Recall Button (LED should read 0.1250). Officer X is ready to time target vehicles by turning "on" the time switch when the target vehicle crosses the first reference point and turning "off" the time switch when the target vehicle crosses the second reference point.

Other examples of **premeasured distances** that can be entered in "dial a distance" are:

1/4 mile - (9)2500
1/3 mile - (9)3333
1/2 mile - (9)5000

Other distances can be entered, as well. For example, an officer on patrol may frequently use a premeasured course of 400 feet to clock vehicles. To enter this distance into the VASCAR unit he would first have to convert it to a decimal portion of a mile. In other words, he would have to divide the distance in feet by 5280 (the number of feet in a mile).

$$\frac{400 \text{ feet}}{5280 \text{ feet}} = 0.0757$$

The officer would then "dial in" (9)-0-7-5-7 and press the black distance recall button to enter the distance. **REMEMBER also to remove the "9" from the first (far left) thumbwheel before beginning clocks.** Vehicles can now be clocked over this 400ft course.

As practice exercises, convert the following distances to their decimal equivalents:

500 feet 1320 feet 1500 feet

IMPORTANT: Even though a distance. has been "dialed in" to the VASCAR unit, an officer can still clock a vehicle in the "moving mode" (measuring both time and distance). If neither the power nor the distance switch have been toggled during Dial-a-Distance, the original calibration number is still active in the computer, thus allowing immediate pursuit and use of VASCAR in the moving mode.

B. "Driving in a Distance" (or Distance Measured with the Patrol Car). In this method the officer would measure the distance between two reference points by driving from point A to point B. Refer to Chapter 3 for a complete description of the procedure used to measure distance with the patrol vehicle. This distance is automatically recorded into the VASCAR computer and serves as the distance measurement in the basic speed equation.

Distances can be "driven in" in two basic ways. First, the officer can use VASCAR to measure the distance between two reference points (Chapter 3) and then position his patrol vehicle where he can observe target vehicles passing between the reference points. Since the distance input will have been recorded as the police officer "drove in" the distance, all that would be needed at this point would be a time measurement between the two reference points. The VASCAR operator would then use the time switch to obtain the speed measurement of the target vehicles.

The second method of "driving in" the distance would be used during the moving mode of clocking vehicles. In this case the patrol car is moving as the VASCAR operator clocks the target vehicle. The time is measured as the target vehicle passes from point A to point B and a distance measurement is "driven in" as the patrol vehicle passes the same reference points. The activation of the time and distance switches are independent of each other.

CHAPTER SUMMARY - THEORY OF OPERATION

VASCAR is a time-distance speed measurement device that calculates speed by using the basic speed formula:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

The VASCAR instrument consists of two basic components: the control head and the odometer module.

The odometer module is a transducer that sends magnetic pulses to the VASCAR computer in relation to the distance travelled by the patrol car. The VASCAR computer counts these magnetic pulses and then uses them as the distance input for the basic speed formula.

The control head contains the VASCAR computer as well as all operational switches, buttons and the LED readout. The face of the control head contains the following components:

1. On/Off toggle switch for power
2. RED time switch
3. BLACK distance switch
4. RED time recall button
5. BLACK distance recall button
6. 5 thumbwheels
7. LED (readout) display

verify the length either because you personally measured the course or it was measured by your Highway Department or a surveyor. In either case it is recommended that a steel (measuring) tape be used in the measurement of the calibration course. After measuring, the course should be permanently marked so that the operator may return to the pre-measured course when necessary. Suggested methods of marking are with paint,' surveying spikes, or concrete nails driven into the surface of the roadway.

– 2. It is recommended that the operator select a point on the patrol vehicle to align with the marks at the beginning and end of the calibration course to ensure a high degree of accuracy. Examples of such marks might be body molding screws, manufacturer door jamb emblems, body seams, door edges, or electrical tape placed across the driver side door jamb.

– 3. Calibration Steps

– a. Turn power switch to the "OFF" position

– b. Set all "5" thumbwheel switches to "0" position

– c. Turn power switch to the "ON" position, LED's should indicate all 8's. This assures that all of the numetrons in each of the LEDs are illuminating.

– d. Set thumbwheel switches to the calibration course length by entering the numbers from left to right:

1/4 mile.....02500
1/3 mile.....03333
1/2 mile.....05000

– e. At the start of the calibration course, the operator should place the reference point of the patrol vehicle (e.g. tape, screw head body seam, etc.) on the mark at the beginning of the calibration course and place the distance switch (black) UP. Drive to the end of the calibration course smoothly (without rapid acceleration or tire spinning) and in as straight a line as possible. After slowly positioning the reference point on the patrol vehicle on the mark at the end of the calibration course, place the distance switch (black) DOWN.

– f. The number that appears on the display is the calibration number (e.g. 09987 or 10002).

– g. Enter the Calibration Number by using the thumbwheels, from left to right. Turn the power switch to the "OFF" position, then to the "ON" position. The LED display will indicate all 0's. The unit is now calibrated. It is recommended that the calibration number be recorded for possible future reference (i.e., court notes, calibration log, etc.) and kept somewhere readily available. Some

NOTES PAGE

operators prefer to tape the number to the control head of the unit.

o D. Method of Verifying Accuracy

- Drive through the measured calibration course with both the time and distance switch placed in the "ON" position at the beginning of the course and "OFF" at the end of the course. The same care in driving should be taken as when calibrating the unit. Push the distance recall button and read the displayed distance on the LED display of the VASCAR unit. A reading of ± 1/4 of 1% is acceptable. (Example: For a 1/4 mile calibration course, the acceptable reading should be between 0.2494 and 0.2506 or +/-.0006.)

o E. Checking LED Display

- It is recommended that the LED readout be checked daily to ensure that all the numetrons are functioning properly (no portions of the numbers burned out). This will prevent potential misreading of speed measurements by the operator. To do this, simply turn the power switch "OFF", set all the thumbwheels to "0" position and turn the power switch back to the "ON" position. At that point all LED's on the display. should indicate 8's. If any portion of the LED's are not functioning properly, the operator should take the unit out-of-service and take immediate steps to have the unit repaired.

II. Measure of Time and Distance in the Moving Mode

o A. When used in the moving mode, the VASCAR computer is programmed to require the operator to enter a new time and a new distance in order to get a new speed. This safety feature prevents an officer from inadvertently using an old time, or an old distance, to clock a new target vehicle.

o B. To measure a new time or a new distance in the moving mode, the operator must "turn on" both the time and distance switches' at the beginning and "turn off" both the time and distance switches at the end. The VASCAR-plus computer is designed to display either the entered time or distance. To perform this function, the operator should press the appropriate "recall" button.

- To display entered **time,** press the **"RED"** button.
- To display entered **distance,** press the **"BLACK"** button.

o C. The distance displayed is normally in miles but can be in feet or kilometers. The unit displays distance in ten-thousandths of a mile up to 9.9999 miles. In distances of 10 miles and greater the unit displays the distance in thousandths of a mile. The unit has the capability of measuring distances that range from .0002 (1.05 ft.) to 99.999 miles.

To measure distance in feet, the following procedure must be followed.

- 1. The operator must calculate a special calibration number which is the number of odometer pulses per foot. This special calibration number is simply the regular calibration number divided by 5280 (the number of feet in a mile). Example: if the normal calibration number is 09980, the special calibration number is 9980 / 5280 = 1.8901.

- 2. With the power switch "ON", the operator dials this new special calibration number with the thumbwheels, turns the power switch "OFF", then "ON". The unit is now ready to measure distance in feet. The operator turns "ON" both the time and distance switches at the beginning and turns "OFF" both the time and distance switches at the end. Rush the distance recall button and the LED display will read in feet.

- 3. VASCAR can be used to measure length of skidmarks at accident scenes. Simply dial in your special calibration number as described, then run the length of the skidmark, following very carefully the shape of the mark. The readout will be in feet. You can also determine the relative location of an accident by driving in the distance from the accident scene to the nearest identifiable reference point or landmark. This can be done in either feet or miles.

- 4. A simpler method of measuring a distance in feet can be performed with the regular calibration number still entered into the thumbwheels. The operator turns both the time and distance switches "ON" at the beginning of the distance to be measured and bothswitches "OFF" at the end. The distance recall button is then pushed and the results multiplied by 5280 (number of feet per mile).

  EXAMPLE: Distance recall results of 0.1254 mile converts to 662 feet.
  (0.1254 X 5280 = 662)

o D. The odometer module of the VASCAR unit is driven by the speedometer cable but is independent of the accuracy of the speedometer itself. In measuring distance, the speedometer cable is designed to turn approximately 1000 times in a mile. The odometer module is designed to generate 10 pulses per turn. Using these numbers, the theoretical total number of pulses generated per mile is 10,000. To determine the distance represented by each pulse for this vehicle, the operator would use the following formula:

$$\frac{\text{feet per mile (5280) X inches per foot (12)}}{\text{calibration number.}} = \text{inches per pulse}$$

(5280 x 12) / 10,000 = 6.3 inches per pulse

For the operator to determine the actual distance represented by each pulse of their particular patrol vehicle, they will use the previous formula with their unit calibration number.

Example: if your unit calibration number-is 09890, then
(5280 x 12) / 09890 = 6.4 inches per pulse

- o E. Because of the design of the odometer module, any situation causing the patrol vehicle to break traction, such as spinning tires during acceleration or skidding tires during deceleration, will result in an improper distance input to the computer. This type of situation will produce an error in a target vehicle's computed speed.
- o F.The time is displayed in seconds up to a maximum of six (6) minutes. For time measurements that extend longer than this, the reading is displayed in hours (i.e., 30 minutes will be displayed as 0.5000). The maximum time that can be displayed is 10 hours.
- o G.The time and distance are measured independently. The operator can activate the time and distance switches in any order, depending on the actual relative positions of the patrol vehicle, the target vehicle and the reference points. The speed of the patrol vehicle has no bearing on the measured speed of the target vehicle.

III. Reference Points

- o A.A reference point can be any **detectable, stationary** point or object on or near the roadway that is clearly visible and identifiable to the operator.
  - (Examples of reference points are: expansion joints, pot holes, road patches, painted traffic line markers, line of texture or color changes such as from asphalt to concrete, sign posts, mail boxes, utility poles, bridges, overpasses, shadows cast on the roadway, a part of the patrol vehicle itself, or any the operator chooses to make.)
- o B.During daylight operation, operators pinpoint the exact location of a target vehicle through the use of reference points, such as shadows which cause light density changes. These shadows or light density changes can be caused by either the target vehicle itself or by other objects; such as bridges, trees, sign poles, etc.Even on an overcast day, a vehicle will have a shadow beneath it. In fact, any stationary object can be used for a reference point. The key is to watch for either the shadow cast on the target vehicle by the reference point or the shadow cast by the target vehicles as it passes the reference point.
- o C .Nighttime operation is accomplished much the same as in daylight operation except shadows are no longer available. However, we now have headlight illumination which was not available during the daylight operation. Because of the well defined line of light extending at near right angles from the front of the

target vehicle across both sides of the road, the VASCAR operator knows exactly when the vehicle passes an object on the side of the road. (An example would be an interstate guardrail. The target vehicles light trail follows the guardrail down the highway illuminating it so that it is visible for great distances. The instant the vehicle passes the guardrail, the rail goes dark and is no longer visible to the eye.)

o D. It is very important that which ever part of the target vehicle you use (i.e., front, rear, or shadows) at the beginning of the clock, you use the same part at the end of the clock. This also holds true for the patrol vehicle in measuring the distance. Consistency in determining when the target vehicle and patrol vehicle reach any reference point is imperative.

o E. Reaction time, which is the time lapse between perception and performance, is not a factor during operation because of anticipation. Anticipation is looking forward to or planning ahead; such as, clocking a 100 yard dash -- you are anticipating when the runner will break the tape. Your instructor will discuss anticipation in greater detail during the field training segment of this course.

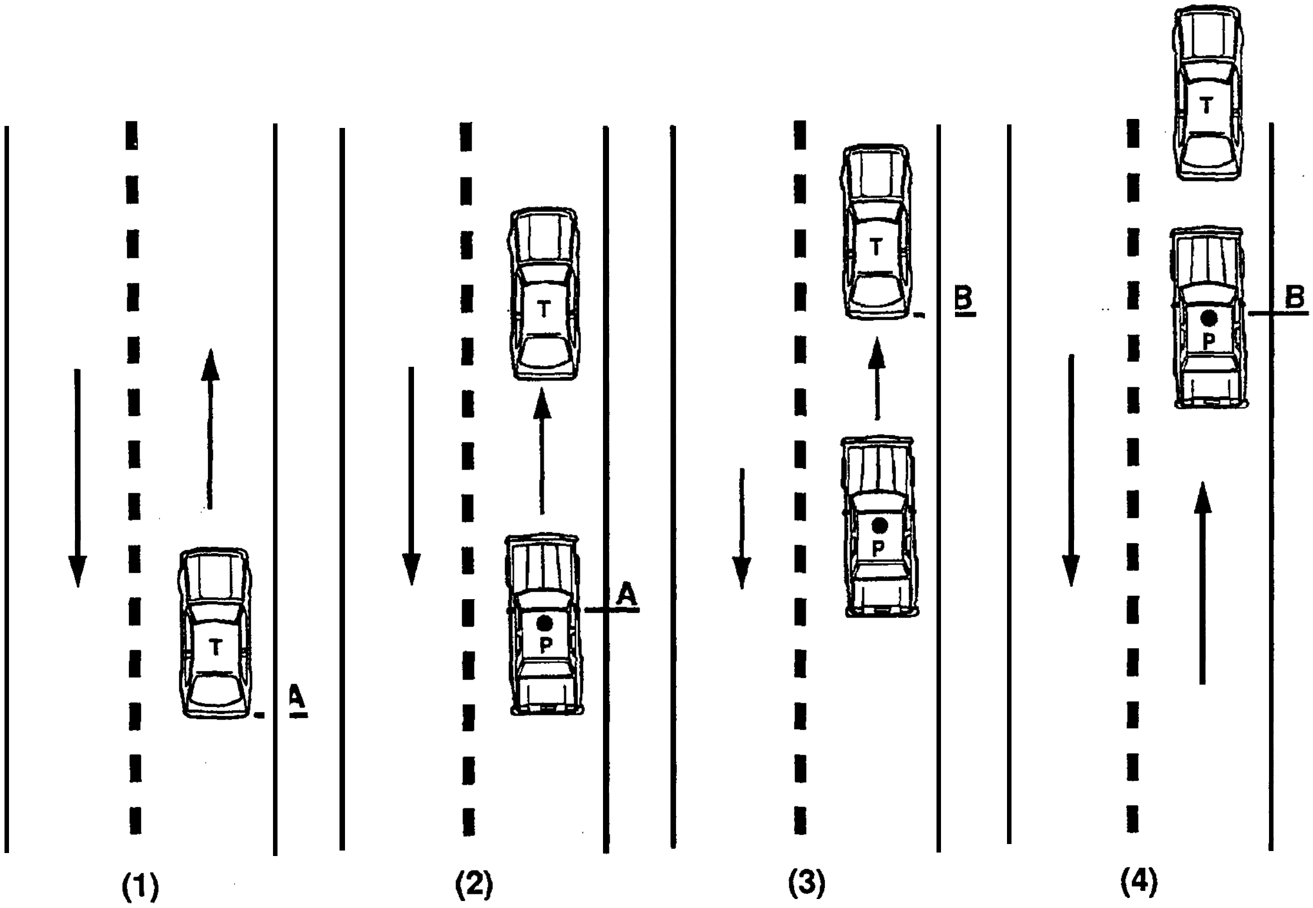
o F. Depth perception is defined in Webster's New Collegiate Dictionary as "the ability to judge the distance of objects and the spatial relationships of objects at different distances." This is not a factor in the use of VASCAR because the operator is looking for an occurrence to happen, such as the shadow "striking" or "darkening" the target vehicle or patrol vehicle.

o G. Weather does not effect the accuracy of VASCAR. The only restriction created by inclement weather is that the reference points may now need to be closer to 'the target vehicle and the operator must use reference points which are readily identifiable in spite of reduced visibility.

CHAPTER 4 -The Basic Speed Clocking Methods

FOLLOWING:

Officer turns time switch "ON" when-target vehicle passes reference point "A" and turns distance switch "ON" when his police vehicle passes reference point "A." Officer turns "OFF" time switch when target vehicle passes reference point "B" and turns "OFF" distance switch when his police vehicle passes reference point "B." (NOTE: The distance between the two vehicles need not be maintained. The speed of the two vehicles need not be the same.)



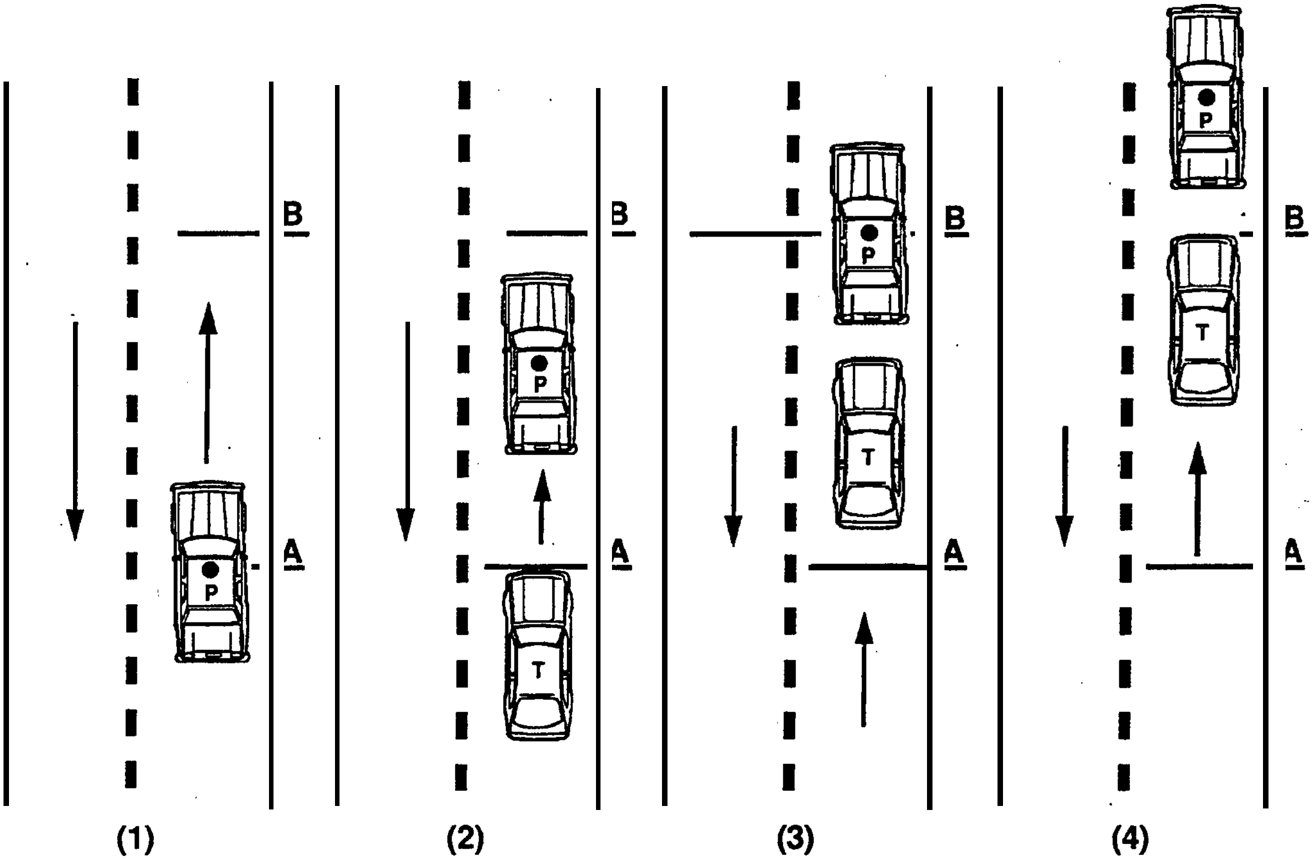
	1	2	3	4
ON	T	D		
OFF			T	D

Following

(Target Vehicle) APPROACHING FROM THE REAR:

- A. Officer turns "ON" distance switch when the police vehicle passes reference point "A."
- B. Officer turns "ON" time switch as target vehicle seen through the rearview mirror passes reference point "A."
- C. Officer turns "OFF" distance switch when police vehicle passes reference point "B."
- D. Officer turns "OFF" time switch as target vehicle seen through the rearview mirror passes reference point "B."

HERE THE DISTANCE SWITCH IS USED FIRST.



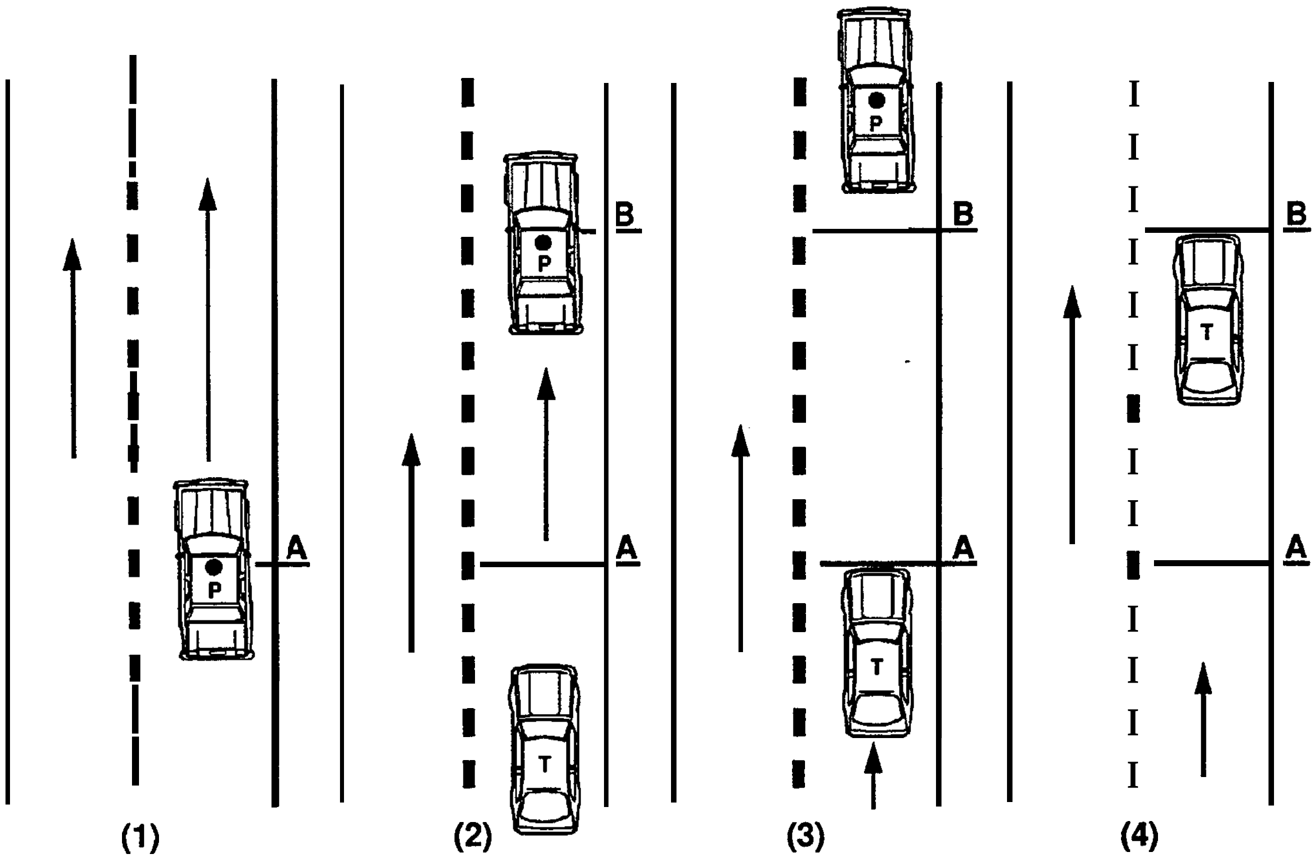
	1	2	3	4
ON	D	T		
OFF			D	T

Approaching From Rear

(Target Vehicle) APPROACHING FROM THE REAR

- A. Officer turns "ON" the distance switch at point "A."
- B. Officer turns "OFF" the distance switch at point "B."
- C. Using the rear-view mirror, the time switch is turned "ON" when the target vehicle reaches point "A."
- D. The time switch is turned "OFF" when the target vehicle reaches point "B."

YOU WILL NOTE THAT HERE THE DISTANCE WAS MEASURED FIRST AND THEN THE TIME COMPUTATION.



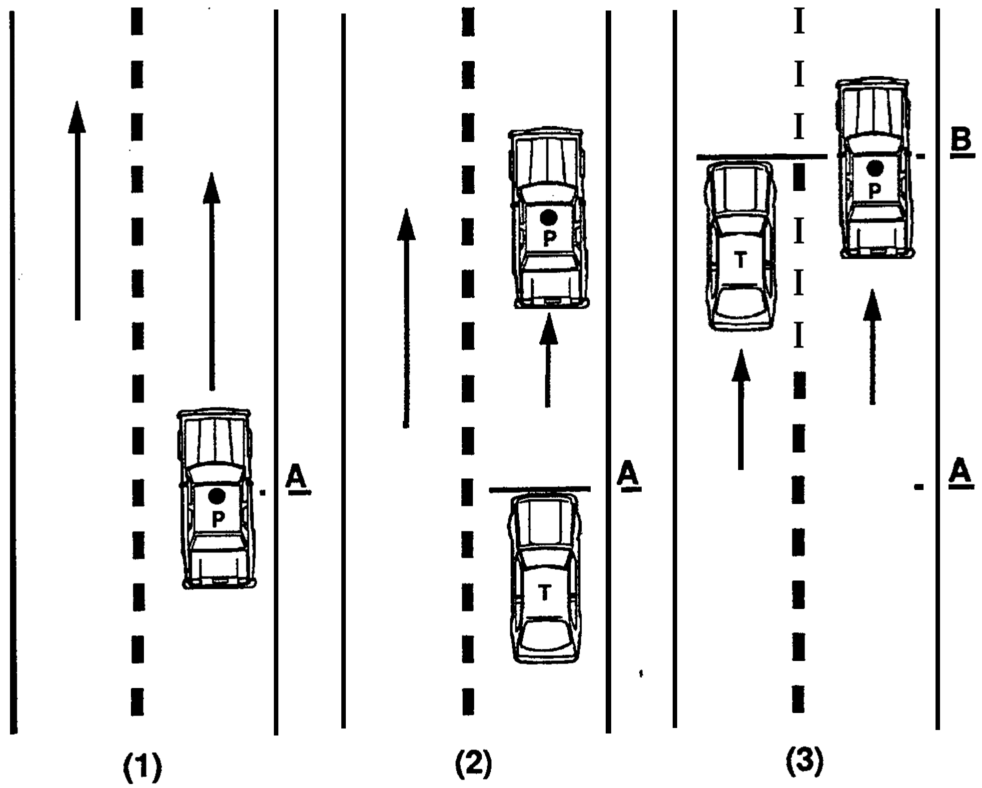
	1	2	3	4
ON	D		T	
OFF		D		T

Approaching From The- Rear

(Target Vehicle) APPROACHING FROM THE REAR
Utilizing the rear-view mirror, using one road location point, and using the target vehicle as the second point as the target vehicle passes the clocking vehicle.

This method is started in the same way as in (Figure 4) but is completed differently.

- A. When the clocking vehicle reaches a location point "A" the distance switch is turned "ON."
- B. Using the rear-view mirror, the time switch is turned "ON" when the target vehicle reaches the same point.
- C. The target vehicle continues to overtake until it gets alongside the clocking vehicle. At this point both the time and distance switches are turned "OFF" simultaneously.



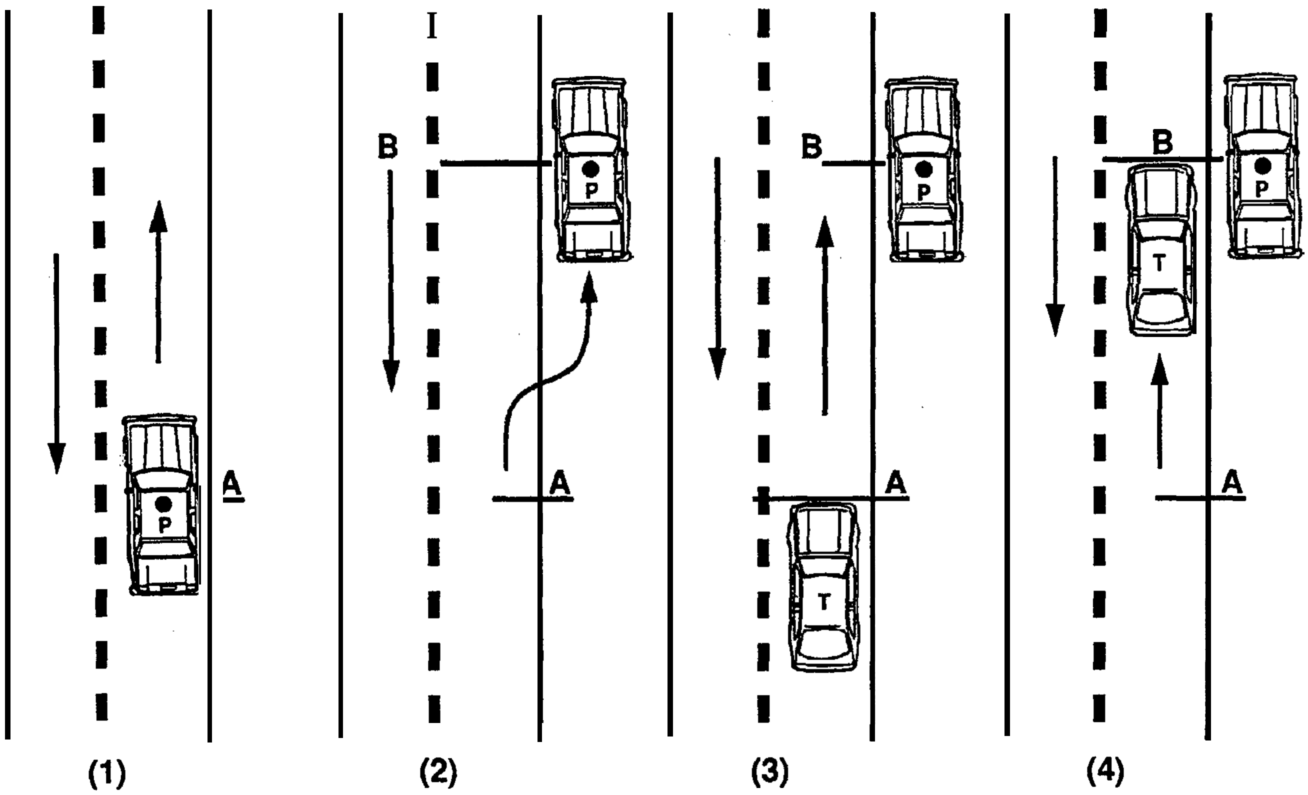
	1	2	3	4
ON	D	T		
OFF			DT	

Approaching From The Rear

STATIONARY MODE (Driving In The Distance)

The police officer drives from reference point “A” to reference point "B" with the distance switch “ON” at reference point “A” and “OFF” at reference point "B" and parks off the road. When the target vehicle, as seen through the rearview mirror passes reference point “A” the officer turns “ON” the time switch and when vehicle passes reference point "B"he/she turns the time switch “OFF."

(*NOTE* reference point "B" will always be the police vehicle).

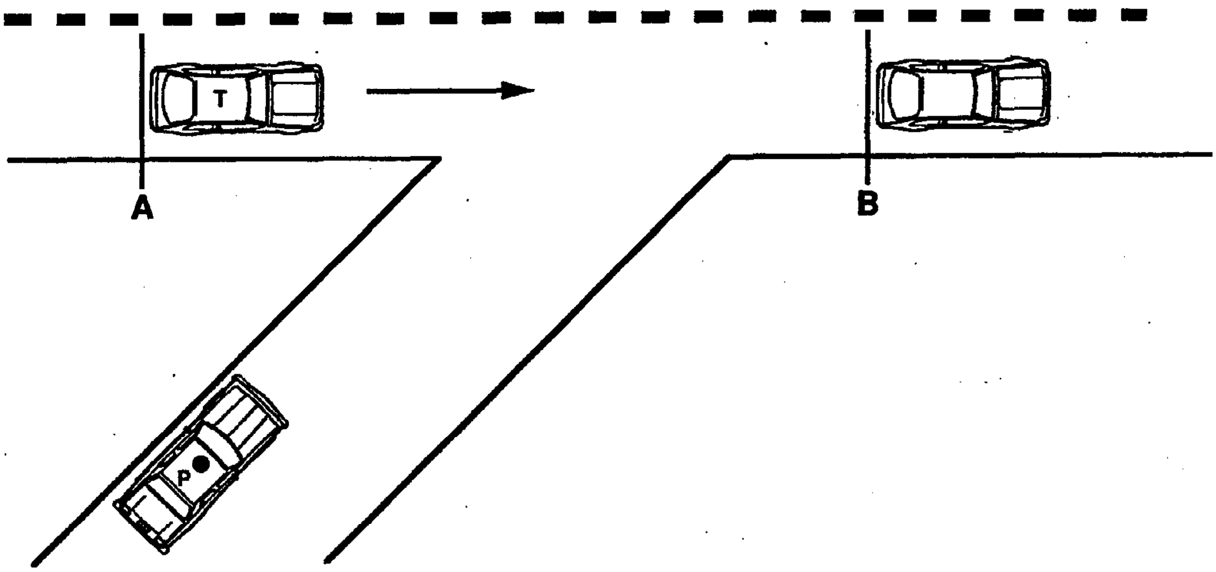


	1	2	3	4
ON	D		T	
OFF		D		T

Driving In The Distance

STATIONARY MODE (Dial-In-A-Distance)

The police officer parks the police vehicle in a position from which the reference points, "A" and "B" can be clearly seen. Having previously measured the distance between reference points "A" and "B", the officer now dials in the distance on the thumbwheel switch. By use of the time switch only ("ON" at "A" and "OFF" at "B") the officer can repeatedly check speeds until a violation is observed. (Refer to Chapter 2 for Dial-A-Distance operation procedure.)



Dial-In-a-Distance

ANGULAR SPEED CHECKS

– General Instructions

To set up an angular speed check site, the operator must find an intersecting roadway where he/she can park the police vehicle well off the course roadway.

The officer carefully marks this parking location so that the police vehicle can be returned to that exact location. The officer then establishes a line of sight from the parked position to a permanent fixture, i.e., a signpost, tree, etc., either between him or herself and the highway or a fixture across the highway.

The VASCAR operator then has someone go to the highway and walk the center line until that person is standing in the established line of sight. The person on the highway places a distinctive mark on the center line at that point using paint, chaulk, highly visible tape, etc.

The VASCAR operator then establishes another line of sight from the same parked position to another permanent fixture and the assistant marks. the center line of the highway at this second established line of sight.

(NOTE: It is unnecessary for the VASCAR operator to see these marks from the parked position. He/she need only know that these marks are in the line of sight. These marks are put on the highway merely to allow you to measure the distance between your two lines of sight at the center of the highway.)

The operator need only pre-measure, with the VASCAR, the distance between these two marks, park again in his same established position, and time suspected speeders, as the inside comer of their vehicle strikes or moves from one line of sight to the other.

You will note that the graphics indicate the part of the vehicle to use as a target. For example, if you use the front corner of a vehicle on the angular line of sight, and the front wheels of the vehicle on the perpendicular line of sight, the target vehicle will have traveled the distance you have measured.

It is recommended in establishing an angular speed check site that once you have selected. your parked position and tentatively picked out your lines of sight, you observe the traffic to make sure that you have time to anticipate whether a vehicle is speeding before it enters your line of sight. This will prevent making false starts.

The following graphic (see Page 4-18) is for your reference in instructing the establishment of an angular speed check site.

NOTE (In the event different angular speed measurement methods are used in your jurisdiction, a graphic and narrative should be developed.)

Special caution should be exercised in using this method of clocking on multi-lane roadways. For example, vehicles travelling in the lane closest to the curb will travel a shorter distance between the line of sight points which were established for vehicles being operated in the far left lane. Conversely, vehicles in the left lane will traverse a longer distance than cars in the curb lane if the line of sight points were established for curb lane traffic.

Caution should also be exercised when using short distance speed check sites, i.e,. 200 or 250 feet. It is recognized that agencies located in high population density urban areas may have no alternative other than to use "short courses", particularly in eastern cities where a city block might be no longer that 200 or 250 feet. If a "short course" must be used to eliminate an identified speed related highway safety problem, there are certain safegaurds that should be exercised:

- a. Since it is most probable that the need to use "short courses" has existed for some time, officers should be trained to operate on short courses.
- b. If officers are trained to use "short courses" they should also be tested on "short courses" and a pass/fail criteria should be established that is consistent with agency policy on issuing citations.
- c. Instructors should be aware that during testing of Vascar conducted by the National Highway Traffic Safety Administration (NHTSA), "short course" (200 feet) timing resulted fairly consistently in +2 mph errors (Analysis of Vascar DOT HS-807-748). In addition, not all officers appear to be physically equipped to perform accurate speed measurements of vehicles travelling at high speeds over "short courses." For this reason NHTSA recommends that short courses be used only in speed zones of 40 MPH or less.
- d. NHTSA recommends that in testing student officer's using the "short course" that no error in speed measurement in excess of +2 MPH be considered as "passing." Further details on recommendations for testing can be found in the chapter covering testing (Chapter 7).

NOTES PAGE

NOTES PAGE

5. MEASURING GAP TIME FOR FOLLOWING TO CLOSELY:

- A. Turn both time and distance switches "ON" when the rear of the leading vehicle passes a mark on the roadway, then "OFF" when the front of the following vehicle reaches the same mark. Press the time recall button, and the gap time will be displayed in increments of hundredths of a second.
- B. The recommended safe following distance is two seconds, which is recognized by the National Safety Council.

* (Insert State or local statutes for following too closely)

6. AIRCRAFT:

- A. VASCAR is operated in an aircraft utilizing the dial-in-a-distance mode and a premeasured distance.

(NOTE: It is important when setting up the distance a steel tape be used and the reference points be clearly visible from the aircraft.)

The operator's testimony should be clear and concise.He/she should cite only the facts of which he/she is certain.

The VASCAR operator's testimony must establish:

- That all of the elements of the offense were present.
- That the speed measurement was obtained in full compliance with accepted procedures.

(Instructors - A more detailed examination of court testimony may be found in the optional Chapter 8, "Moot Court.")

The operator should know the following concerning the operation of VASCAR.

- VASCAR is a programmed computer that uses microprocessor technology. It is programmed to compute the simple formula, average speed is equal to distance divided by time. This computer has both distance and time input capabilities that allow it to calculate and display the speed of any vehicle the operator is clocking.
- The distance can either be measured using the moving patrol vehicle by activating the distance switch on the unit, or by dialing a known distance into the computer. In the case of the former (drive-in-distance), the distance is provided to the computer by an odometer module. The odometer module is a device that generates magnetic pulses in proportion to the distance travelled. The number of pulses per mile is calibrated for each vehicle and is accurate.

  The time is measured by activating the time switch as the target vehicle travels between two specific reference points. The time base is a an accurate quartz crystal. The computer program accumulates time in 0.036 second increments.
- The time base of the quartz crystal is one million oscillations per second.
- The distance input in the moving mode is produced by the odometer module through magnetic pulses and for which each patrol vehicle is calibrated.
- The distance in the stationary mode is dialed directly into the computer and that the entered distance was verified by pushing the distance recall button switch.
- Be able to explain why reaction time and depth perception are not a factor.
- Be familiar with the formula for possible error in speed.

Also, 1 Mile = 5280 Feet

Therefore, the working formula for calculating speed is simply:

$$\text{Speed (in MPH)} = \frac{3600}{5280} \times \frac{\text{Distance Travelled in Feet}}{\text{Time in Seconds}}$$

The second portion of the formula (Distance in feet/Time in seconds) is also referred to as the Average Distance Travelled In One Second. The value 3600 refers to the number of seconds in one hour. The value 5280 refers to the number of feet in one mile. For calculation purposes the values:

$$\frac{3600}{5280} \text{ reduces to } \frac{15}{22}$$

or

$$\text{Speed} = \frac{15}{22} \times \text{Average Distance Travelled In One Second}$$

MPH Calculations

Example 1

A vehicle is clocked traveling 528 feet in six seconds. What is the speed in miles per hour?

To, solve this problem use our working speed formula:

$$\text{Speed (mph)} = \frac{15}{22} \times \text{Average Distance Travelled in One Second}$$

or

$$\text{Speed (mph)} = \frac{15}{22} \times \frac{528}{6}$$

$$\text{Speed (mph)} = \frac{7920}{132}$$

Speed = 60 Miles per Hour

Example 2

A vehicle is clocked traveling 900 feet in seven seconds. What is the speed in miles per hour? The speed in MPH is:

$$\text{Speed} = \frac{15}{22} \times \frac{900}{7}$$

Speed = 87.7 MPH

Calibration of the Unit

Establish a calibration course on a flat roadway with low traffic volume. The suggested minimum length is 1/4 mile; however, a longer calibration course length may be established if desired or required by statute or departmental policy. You must be able to verify the length either because you personally measured the course or it was measured by a qualified surveyor. In either case it is recommended that a steel measuring tape be used in the measurement of the calibration course. After measuring, the course must be marked in a permanent manner to enable the operator to return to the pre-measured course as needed. Suggested methods of marking are with paint, surveying spikes, or concrete nails.

It is recommended that the operator select a point on the patrol vehicle to align with the marks at the beginning and end of the calibration course to ensure a high degree of accuracy. Examples of such marks might be body molding screws, manufacturer door jamb emblems, body seams or door edges.

Calibration Steps

a. Turn power switch to the "OFF" position

b. Set all thumbwheel switches to " 0 " position

c. Turn power switch to the "ON" position, LED's should indicate all 8's.

d. Set thumbwheel switches to the calibration course length:

1/4 mile.....02500

1/3 mile.....03333

1/2 mile.....05000

e. At the start of the calibration course, the operator should place the reference point of the patrol vehicle on the mark at the beginning of the calibration course and place the distance switch (black) UP. Drive to the end of the calibration course smoothly and in as straight a line as possible. After positioning the reference point on the patrol vehicle on the mark at the end of the calibration course, place the distance switch (black) DOWN.

f. The number that appears on the display is the calibration number (e.g., 09987).

g. Enter the Calibration Number into the thumbwheels, from left to right. Turn the power switch to the "OFF" position, then to the "ON" position. The LED display will indicate all 0's. The unit is now calibrated. It is recommended that the calibration number be recorded for possible future reference (e.g., court notes, calibration log, etc.).

Dial-in-Distance

A pre-measured distance can be dialed into the VASCAR unit by using the five thumbwheel switches on the control head. The operator must first dial up a "9" on the far left thumbwheel. This first digit serves as an entry number and will later be deleted from the thumbwheel display. The operator then dials in the remaining digits which correspond to a decimal representation of a mile. For example:

- Officer X plans to clock cars over a known distance of one-eighth (1/8) mile. One-eighth mile is equivalent to 0.1250 mile when expressed in decimal form (1 divided by 8 = 0.1250). To "dial in" this distance he would set up the thumbwheels as follows:

9 - 1 - 2 - 5 - 0

Officer X would then depress the distance button and release it. Then zero the far left thumbwheel by removing the "9". The course distance of 1/8 mile is now registered in the computer.

Measure Distance

To measure distance in feet, the following procedure must be followed.

o The operator must calculate a special calibration number which is the number of odometer pulses per foot. This special calibration number is simply the regular calibration number divided by 5280 (the number of feet in a mile). Example: if the normal calibration number is 09980, the special calibration number is 9980 / 5280 = 1.8901.

o With the power switch "ON", the operator dials this new special calibration number with the thumbwheels, turns the power switch "OFF", then "ON". The unit is now ready to measure distance in feet. The operator turns "ON" both the time and distance switches at the beginning and turns "OFF" both the time and distance switches at the end. Push the distance recall button and the LED display will read in feet.

o VASCAR can be used to measure the length of skidmarks at accident scenes. Simply dial in your special calibration number as described, then run the length of the skidmark, following very carefully the shape of the mark. The readout will be in feet. You can also determine the relative location of an accident by driving in the distance from the accident scene to the nearest identifiable reference point or landmark. This can be done in either feet or miles.

o A simpler method of measuring a distance in feet can be performed with the regular calibration number still entered into the thumbwheels. The operator turns both the time and distance switches "ON" at the beginning of the distance to be measured and both switches "OFF" at the end. The distance recall button is then pushed and the results multiplied by 5280 (number of feet per mile).

EXAMPLE: Distance recall results of 0.1254 mile converts to 662 feet.
(0.1254 X 5280 = 662)

Drive-in-Distance

In this method, the officer would measure the distance between two reference points by driving from point A to point B. Refer to Chapter 3 for a complete description of the procedure used to measure distance with the patrol' vehicle. This distance is automatically recorded in the VASCAR computer and serves as the distance measurement in the basic speed equation.

Distances can be "driven in" in two basic ways. First, the officer can use VASCAR to measure the distance between two reference points (Chapter 3) and then position the patrol vehicle where the target vehicles can be observed passing between the reference points. Since the distance input will have been recorded as the police officer "drove in" the distance, all that would be needed at this point would be a time measurement between the two reference points. The VASCAR operator would then use the time switch to obtain the speed measurement of the target vehicles.

The second method of "driving in" the distance would be used during the moving mode . of clocking vehicles. In this case the patrol car is moving as the VASCAR operator clocks the target vehicle. The time is measured as the target vehicle passes from point A to point B and a distance measurement is "driven in" as the patrol vehicle passes the same reference points. The activation of the time and distance switches are independent of each other.

Verify a Pre-measured Distance

The distance that has been entered into the computer can now be verified by depressing the Distance Recall Button (For example the LED should read 0.1250 for a pre-measured distance of 1/8 mile).

Verification of Calibration

Drive through the measured calibration course with both the time and distance switch placed in the "ON" position at the beginning of the course and "OFF" at the end of the course. The same care in driving should be taken as when calibrating the unit. Rush the distance recall button and read the displayed distance on the LED display of the VASCAR unit. A reading of $\pm$ 1/4 of 1% is acceptable. (Example: For a 1/4 mile calibration course, the acceptable reading is between 0.2494 and 0.2506 or +/-.0006)

Demonstration of speed measurement modes

Demonstration of the speed measurement modes can be accomplished in a variety of ways, Most frequently done on a closed course, on a closed roadway or on a traffic way.

The target vehicle is most often a law enforcement vehicle equipped with VASCAR. The target vehicle speed reading may be used to compare with student's measurement results. The instructor may be in a car with the student or operating the target vehicle, however it is much more desirable to have the target vehicle operated by a trained VASCAR operator other than the instructor.

Pre-measured courses can be established on any of the sites selected for demonstration.

Prior to demonstrating a speed measurement method, the instructor should re-explain the clocking method. Then have the student go through the steps.

Briefly explain calibration, verification of calibration, dial-in-distance, etc., and then have the student demonstrate.

2. Field Certification Test

This test consists of actually using the four basic methods with at least five different clocks made on each method for a total of 25 speed clocks using a second VASCAR or other electronic timing device for verification.

- o following - 5 clocks
- o being followed - 5 clocks
- o stationary - (dial a distance, drive in distance, t-intersection, angular) - 10 clocks (instructor's choice of stationary methods).
- o opposite direction - 5 clocks

In order to be certified, it is generally accepted that the student must not have an average error more than 3/4 miles per hour in each of the methods for which testing is administered, and have no speed deviation in excess of two miles per hour on any single clock.

To set a possible testing site, it is suggested that the course be at least 528 feet (1/10 mile) in length for any moving clock and at least 200 feet in length for any stationary clock. It should be noted, however, the shorter the distance clocked, the greater the potential for error. Recall the VASCAR testing. It is further suggested that a student be permitted to delete any clock which he/she is unsure of prior to being made aware of the instructors results and to have an opportunity to re-clock that particular method.

VASCAR Written Examination (Example)

1. VASCAR measures speed by multiplying the distance travelled by the time it took to travel that distance.

TRUE OR FALSE

2. Explain how to calibrate a VASCAR unit. ____________________

____

3. Explain what is meant by a reference point. ________________

____

4. Explain why depth perception should not be a factor in clocking a speeder.

____.

5. Explain why reaction time should not be a factor in clocking a speeder.

____

____

16. To assure VASCAR accuracy, the speedometer of the patrol car must be accurate.

TRUE OR FALSE

17. T h e ________ number remains the same even though you dial a distance into the thumbwheels.

a. calculation

b. computer

c. calibration

d. none of the above

18. The same ________________ must be used for both the target and patrol vehicle.

19. VASCAR speed computers measure distance in______ of a mile increments.

a. tenths

b. hundredths

c. thousandths

d. ten-thousandths

20. With VASCAR turned off and the calibration number entered on thumbwheels, to calibrate VASCAR the operator must ________________________.

21. The accuracy of the calibration number is imperative because it is directly related to measuring__________.

a. time

b. distance

c. anticipation

d . reaction

22. VASCAR is a electronic micro-processor speed measuring device. When a time and distance is entered into the computer the result will always be a(n) __________ speed.

a. closing

b. peak

c. pace

d. average

23. The average speed of the target vehicle is __________ higher than the peak speed.

a. never

b. always

c. usually

d. none of the above

MOOT COURT

This unit is designed to help you prepare further for the courtroom. You will be required to prepare a similar statement of direct testimony based upon specific case descriptions.. Some trainees will also be given the opportunity, in class, to participate in a moot court, giving testimony and later submitting to cross-examination by the defense. After the exercise there will be a group discussion.

After completion of this unit you should be better able to:

o Prepare effective direct testimony for VASCAR cases.

o Respond properly and effectively to cross-examination.

Requirements and Procedures

In preparation for the moot-court segment of this course, you are expected to prepare a complete set of direct testimony for a hypothetical case in which a speeding offense was alleged to have occurred. Think of this as writing a script for a courtroom drama. You will not only be the playwright, but you will also assume the role of the arresting officer.

The script you prepare might include two speaking roles: the Officer and the Prosecutor. The prosecutor's role will be to ask a series of questions, and the officer's role will be to respond to those questions. Alternatively, the script may be written without a prosecutor, consisting only of a monologue by the officer. The choice must be based on your traffic offense adjudication procedures.

In either case, it's expected that your script will be good, realistic, and well thought out, since the officer's testimony is the principal body of evidence that will be introduced to establish the elements of the offense.

The script you prepare can be based on the hypothetical case described on the following pages. Each case description should include a sketch of the scene of the alleged violation and an outline description of the various circumstances and conditions alleged to have characterized the incident.

– 1. Feel free to introduce or not introduce the sketch into evidence. It is there to help you visualize the scene.

– 2. The trainee is not free to change the sketch.

– 3. You are expected to complete your sketch by indicating on it the exact position of the patrol car with its VASCAR unit. This information is felt to be of considerable importance to both the prosecution and the defense.

– 4. The type, make, and model of VASCAR used in the case will be the one used by your agency.

- 5. The circumstances, characteristics, and conditions listed in the narrative information cannot be changed.

- 6. Included in the testimony may be any or all of the circumstances and conditions listed in the narrative description. You do not have to include any item if you do not feel it is relevant to the case. If questioned about any of the "facts" described in your sample case, you may not change any of the information presented in the narrative.

- 7. You may make up any "facts" not covered in the narrative description. Any such "facts" added must not contradict or change in any way the information in the narrative description.

For your assistance in developing a script the following model of a monologue version of testimony is provided.

A Model of Testimony Concerning VASCAR Speed Measurement

"My name is Bernard Moran. I am a trooper assigned to the Traffic Unit of the Connecticut State Police Department. As a part of my duties for the past year, I have operated a VASCAR speed measurement device for this department. I have successfully completed a basic training program for VASCAR speed measurement, and I currently hold a Certificate of Competence issued by my department.

On the afternoon of June 1,1991, I was operating VASCAR in a stationary mode on Post Road at the corner of Old Kings Highway. The VASCAR unit was operating in a normal manner. I had verified the calibration of my assigned unit at the beginning of my tour of duty that same day, at about 3:00PM, on the 1/4 mile calibration course, adjacent to my duty station, established by the Department of Highways surveyor. I used the dial-in-distance option to enter the course length established on Old Kings Highway into the VASCAR.

At approximately 3:35PM, I was observing traffic approaching from the south, on Old Kings Highway, traversing the 1/4 mile course at that location established by the State Highway Department. At about 3:40 PM, I observed a light blue 1991 Ford, Connecticut registration number 1A-1750 (later found to be driven by the defendant, Harry Gofaster) traveling north on Old Kings Highway. From visual observation, I estimated the speed of the Ford to be approximately 60MPH. When the defendants vehicle crossed reference point "A" which is a four inch white line painted across both Northbound lanes, I turned the time switch on. When the vehicle crossed reference point "B" which is the southern edge of the crosswalk on the southeast comer of the intersection, I turned the time switch off. The speed reading obtained was 55 MPH. The posted speed limit on Old Kings Highway at the intersection of Post Road is 35 MPH.

Persons in Vehicle

(other than accused):

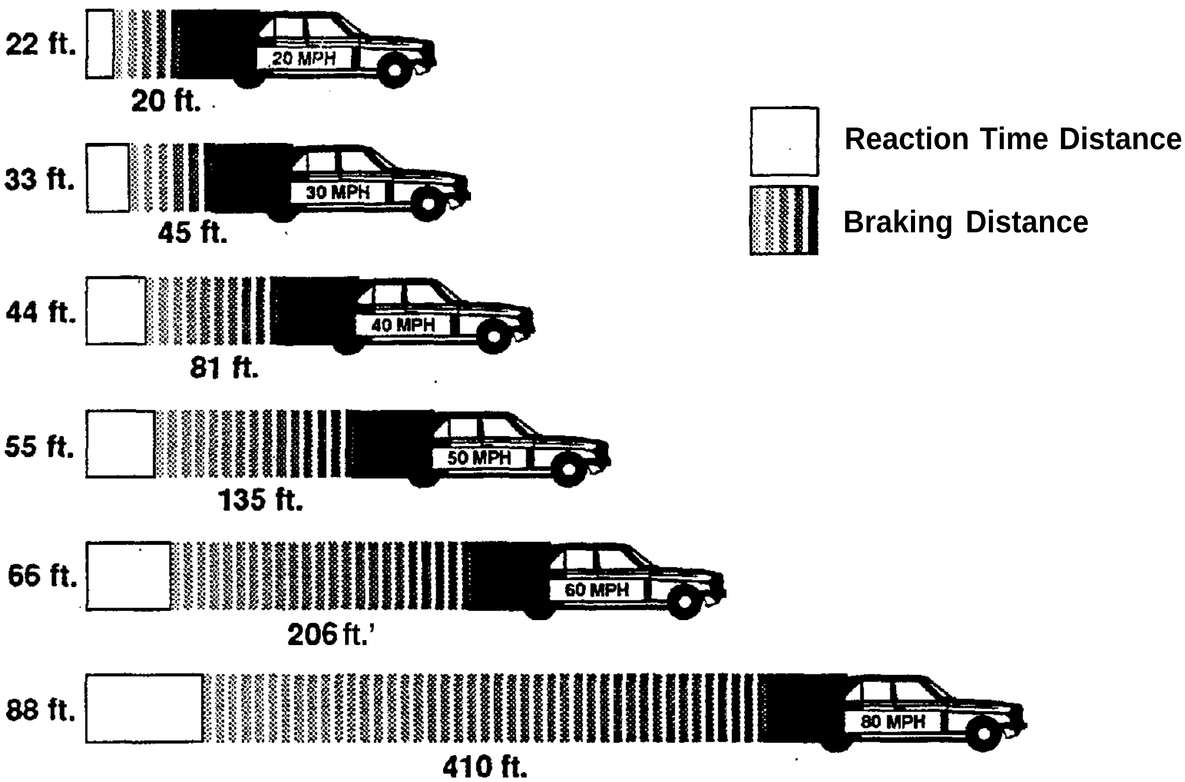
Fred J. Able — Male, Age 15

Tina B. Brandt — Female, Age 16

Situation Description:

'The subject vehicle is alleged to have been traveling at 67 mph. A speed limit of 55 mph is in force at the subject location. The subject location is a four-lane (two-north, two-south) divided, limited-access highway in a suburban, residential neighborhood. A 15-yard-wide grassy median divides northbound and southbound traffic. The subject vehicle is alleged to have been in the left-hand (inside) northbound lane and passing a series of slower moving vehicles in the right-hand (outside) lane when the speed measurement was made. A late model Ford pickup truck, approximately 150 feet behind the subject vehicle, was the only other vehicle in the left-hand northbound lane within a quarter mile of the subject vehicle. Three persons, including the driver, were observed to be in the front seat of the subject vehicle.

CHAPTER 9 -- VISUAL AIDS



Distance Required to Bring a Car to a Complete Stop

DOT HS 807 845
June 1992