

# **TECHNICAL MEMORANDUM**

## **AUTOMATED ENFORCEMENT**

by

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## **1.0 INTRODUCTION**

Limited resources constrain the efforts of police in traffic law enforcement, and compliance with traffic laws varies using traditional methods. New technologies such as automated enforcement (AE) may offer partial solutions to these problems. Areas where the use of automated enforcement has been considered include:

- speed limit enforcement
- high occupancy vehicle lane enforcement
- red-light traffic signal violations

This paper contains information on current technology, usage, legal issues, and public acceptance of automated enforcement. The majority of the information in this paper is from a Midwest Research Institute 1989 report (1) where the authors collected and analyzed information on recent advances in speed and red-light enforcement technology and enforcement strategies employing these technologies. A literature search and information from the 1990 Transportation Research Board (TRB) meeting provided additional information included in this paper.

## **2.0 TECHNOLOGY**

### **2.1 SPEED LIMIT ENFORCEMENT**

The speed enforcement devices reviewed by Blackburn, et al. (1) fit into three categories: down-the-road doppler radar, cross-the-road doppler radar, and time/distance measuring concepts. These devices are described in Tables 1, 2, and 3, respectively. All devices reviewed have the capability of automatically photographing the vehicle that the equipment identifies as being in violation. Blackburn, et al. emphasized that the systems described are not endorsed nor are any of them recommended over another.

#### **2.1.1 Down-The-Road Doppler Radar**

Down-the-road radar is commonly used in the United States. It emits a microwave beam that is directed down the road, usually head-on into oncoming traffic. The reflected Doppler frequency is then converted into a speed measurement. While the radar principle is highly accurate, the down-the-road concept has some operational limitations. Although the radar often can determine vehicle speeds at long range (1/4 to 1 mile), they are not able

to discriminate between vehicles. If two or more vehicles are visible to the beam, officer judgement must be used as to which vehicle is producing a "reading". The long range of the radars, coupled with their moderately high power, enable them to be detected by drivers with radar detectors. (1)

### 2.1.2 Cross-The-Road Doppler Radar

The cross-the-road radar systems use a very narrow, low-power beam directed at an angle on the order of 20° from the direction of traffic. Then, signal-processing logic determines whether a stable speed is being observed. Upon passing the logic tests designed by the particular manufacturer, a speed reading is displayed. The vehicle to which it applies is readily apparent to an observer viewing along the beam. If more than one vehicle is in the beam at once, normally no reading will be displayed. Advantages of cross-the-road radar systems include their ability to make positive identification of speeding vehicles, to detect nearly all speeders (even in dense traffic), to be relatively free from effects of electrical and other interferences, and to be effective even against vehicles with radar detectors (the vehicle is in the beam and its speed is noted before a driver could react). (1)

Table 1. Down-The-Road Doppler Radar Devices.

COMPANY (COUNTRY)	DEVICE	COMMENTS
Plessey South Africa, Ltd.  (South Africa)	Plessey Dual- Antenna Speed Monitor (no camera system)	<ul style="list-style-type: none"> <li>● Prototype recently developed. Currently being demonstrated to South Africa law enforcement agencies</li> <li>● System is composed of a main control unit connected to two Doppler radar units</li> <li>● Two antennas are deployed about 80 m apart, aimed essentially parallel to traffic flow and to each other such that they "illuminate" a common or capture area. A speed is displayed on the main unit only when a vehicle is identified by both antennas (vehicle is in capture area).</li> </ul>
Trafikanalys AB  (Sweden)	RC 110 (manned system) ASTRO 110 (fully automatic)	<ul style="list-style-type: none"> <li>● The 2.5 year old Swedish firm was asked to develop a new-generation ASE device under an agreement with the National Swedish Police Board.</li> <li>● System consists of control unit, radar antenna, and camera</li> <li>● Radar provides tracking of <u>all</u> vehicles between 10 and 75 m away from the radar head</li> <li>● System automatically calibrates itself every 15 minutes.</li> </ul>

Table 2. Cross-The-Road Doppler Radar Devices.

COMPANY (COUNTRY)	DEVICE	COMMENTS
AWA Defense Industries Pty. Ltd.  (Australia)	Vehicle Speed Radar (VSR) Model 449	<ul style="list-style-type: none"> <li>● Manufactured radar speed detection devices for 14 years</li> <li>● Narrow beam detection of closely spaced vehicles</li> <li>● Microprocessor analyzes Doppler signals</li> <li>● Continuously automatic testing</li> <li>● Application has been made with Federal Communication Commission for type acceptance in the US</li> </ul>
Gatsometer B.V.  (Holland)	Gatso Micro Radar Type 24 and Type RadCom 24	<ul style="list-style-type: none"> <li>● Company also has two older units: Gatso Mini Radar MK 3 and MK 4.</li> <li>● Devices can be used for stationary and moving speed enforcement</li> <li>● Moving operation - take rear photos of vehicles passing the patrol car (using a hand-held unit)</li> <li>● Capable of operating with separate speed limit settings for passenger cars and for trucks.</li> <li>● In 1987, Type RadCam 24 was evaluated for 6 months in the U.K. Constabulary thought the system was a reliable, robust piece of equipment.</li> </ul>
Traffipax-Vertrieb  (West Germany)	Speedophot	<ul style="list-style-type: none"> <li>● Can be used in either stationary (patrol car or tripod) or moving operation</li> <li>● Departing traffic -- PC and trucks speed limits; oncoming traffic -- one speed limit</li> <li>● Technology available to transfer all the data recorded on a fully exposed 30-m roll of film (800 exposures) automatically onto a data medium called a memory card.</li> </ul>
Zellweger Uster AG  (Switzerland)	Multanova 6F (most current device offered by company)	<ul style="list-style-type: none"> <li>● Mountable in a patrol car (stationary operations) or on a tripod (operations alongside the roadway).</li> <li>● Device can measure oncoming or departing traffic either selectively or simultaneously. Can measure one speed limit for oncoming traffic and separate speed limits (truck and passenger car) for departing traffic. Any vehicle in the near lanes that supplies a consistent return Doppler signal for a time period equivalent to at least 12 m of travel is automatically defined as a truck.</li> <li>● Traffic Monitoring Technologies (Friendswood, Texas) packages the Multanova 6F in the rear of a four-wheel drive vehicle and leases the detection equipment and vehicle for a service fee.</li> </ul>

Table 3. Time/Distance Measurement Devices.

COMPANY (COUNTRY)	DEVICE	COMMENTS
Eltraff S.r.l.  (Italy)	Velomatic 103A	<ul style="list-style-type: none"> <li>● Three components: control and calculator unit, a sensor, and a photographic system. Two types of sensors can be used with the device: an optoelectronic sensor or a capacitive sensor.</li> <li>● As a vehicle passes in front of one of the optoelectronic sensors, the amount of light detected by the sensor changes in some fashion. If the second sensor experiences the same pattern of change an instant later, the system logic determines the time lag between them and, hence, the vehicle speed.</li> </ul>
Proof Digitalsystemer A/S  (Denmark)	ProViDa/PDRS	<ul style="list-style-type: none"> <li>● Vehicle-mounted, computerized video/data system. Used to monitor traffic and determine vehicle speeds from time and distance measurements.</li> <li>● Consists of five major components: 1) a color video camera, 2) a video/data generator with data/time unit, 3) a PolicePilot speed indicator with data outlet, 4) a ProofSpeed precision speedometer, and 5) a mobile VHS video recorder with a 4 ½-in color monitor.</li> <li>● Device is used either in a pacing strategy or when the patrol vehicle is stationary.</li> </ul>
Trans-Atlantic Equipment Pty, Ltd.  (South Africa)	Speed-Guard DeLuxe Model 3000 and Trafficam Speed Camera	<ul style="list-style-type: none"> <li>● Sensors are pencil-thin rubber tubes permanently installed 2.5 m apart in any road surface and connected by cable to 6-V DC transducers.</li> <li>● Takes rear photographs of offending vehicle</li> <li>● Speed Guard contains a micro-processor, built-in rechargeable batteries, and a charger.</li> <li>● Equipment can be operated automatically in any direction.</li> </ul>
Truvelo Manufacturers  (West Germany)	Truvelo M4 <sup>2</sup> Combi	<ul style="list-style-type: none"> <li>● Device uses two sets of roadway cables placed parallel to each other (two fully independent measuring systems in parallel). The speeds are compared and are accepted and displayed if within an acceptable tolerance (2 km/hr). The camera and flash system are activated whenever a vehicle is detected traveling faster than the preset speed limit.</li> <li>● Photographs can be taken from either behind or in front of the vehicle.</li> <li>● Can be operated totally automatically or tripod-mounted or installed in a fixed enclosure.</li> </ul>

### 2.1.3 Time/Distance Measuring Devices

Time/Distance measuring devices uses sensors near, on, or in the pavement to determine the time interval taken by a vehicle to pass a specific distance. An example of a sensor used near the pavement is an optoelectronic sensor. As a vehicle passes in front of an optoelectronic sensors, the amount of light detected by the sensor changes in some fashion. If the second sensor experiences the same pattern of change an instant later, the system logic determines the time lag between them. Sensors used on the surface of the pavement for temporary installation include coaxial microphone cables. Sensors imbedded in the pavement at a fixed location include piezoelectric detector cables. (1)

### 2.1.4 Testing of Devices

Blackburn and Glauz (2) tested four ASE devices from Europe in 1978. Three devices (Gatso Mini Radar MK4, Multanova Radar MU VR 4FA, and Traffipax Model V/R) use radar aimed diagonally across the road while the fourth ASE device (Truvelo Model 4) uses piezoelectric roadway sensors to determine a vehicle's speed. All four devices can be used with a camera to obtain photographic evidence of a violation, and some can operate automatically with only minor periodic maintenance. The Multanova ASE device was judged to be the best of the four examined, but all of the devices were subject to periodic malfunctions, especially film jamming and tearing in cold weather and blown fuses. The vehicle owners could be identified in 90 percent of all case where the license plate number could be read and the state identified. Usually, however, the state name and expiration date were too small to be read, so substituting a longer focal length lens was suggested.

## 2.2 HIGH OCCUPANCY VEHICLE LANE ENFORCEMENT

Miller and Deuser (3) in 1978 reported on various "innovative" techniques that may aid in the enforcement of HOV facilities. These techniques were innovative in the sense that they were not widely used within the context of traffic law enforcement practice current at that time. The techniques identified include:

- Use of photographic systems and instrumentation in detecting HOV violations and identifying the violators.

- Use of law enforcement para-professionals (a trained aide who assists a professional person) in detecting HOV violations and identifying the violators.
- Mailing of traffic citations and warning letters to the registered owner (identified through the license plate) of a vehicle violating the HOV facility.
- Remote apprehension of the HOV violator on an exit ramp or other downstream location by an enforcement officer working in tandem with another officer detecting the HOV violation.
- Mass screening of license tags to identify habitual violators.

### **2.3 RED-LIGHT TRAFFIC SIGNAL ENFORCEMENT**

During the Blackburn, et al. (1) study, six manufacturers were identified as producing red-light violation detection systems. The systems use roadway sensors (inductive loops, cables, or tubes) for vehicle detection and 35-mm cameras to record photographic evidence of the violation. Table 4 describes the systems marketed by the six manufactures.

## **3.0 USE OF AUTOMATED ENFORCEMENT DEVICES**

### **3.1 SPEED LIMIT ENFORCEMENT**

Innovative speed enforcement strategies used over the last several years in the United States include:

- unattended radar
- portable billboard speed display
- aircraft surveillance
- manned automated speed enforcement

Unattended radar, as a deterrent, has been examined in Kentucky and Virginia. Some law enforcement agencies have experimented with this deterrence idea, attended or unattended, to see if the simple presence of microwave transmissions would slow traffic. Portable billboard speed displays have been used in some areas as an enforcement measure, but mainly as a public relations measure to inform motorists of their speeds in the hope that the speeding motorists would voluntarily reduce their speed. Aircraft surveillance has been, and continues to be, an enforcement strategy for many jurisdictions. (1) Following are summaries on identified automated speed enforcement projects.

Table 4. Red-Light Violation Devices.

COMPANY (COUNTRY)	DEVICE	COMMENTS
Eltraff S.r.l. (Italy)	See Comments	<ul style="list-style-type: none"> <li>• Accessories convert Velomatic 103A Speed Meter to document traffic light offenses</li> <li>• Coaxial cable on pavement or inductive loop detects passage of traffic</li> <li>• Camera photographs rear of vehicle crossing sensor whenever red light is on. Second rear photograph is taken 1.5 sec later</li> </ul>
Gatsometer B.V. (Holland)	RLC Type 36-m, 36-4m, 36-ms, and 36-msg	<ul style="list-style-type: none"> <li>• Four systems differ in capabilities, but all have the same basic components</li> <li>• Time interval between first and second rear photograph is adjustable (minimum interval 0.8 sec)</li> <li>• Gatsometer Red-Light Camera Type 36-ms was field-tested in the U.K.</li> </ul>
Traffipax- Vertrieb (West Germany)	Traffiphot III	<ul style="list-style-type: none"> <li>• System can take either rear or frontal photographs. Time between the two exposures can be set between 0.5 and 5 sec</li> <li>• When frontal photographs are taken, the Traffiphot is equipped with red filters. Red flash illuminates inside of car without blinding driver. Also for frontal photographs, the second photograph can be taken when the vehicle crosses an additional induction loop in the intersection (thus aiding in providing a clear identification of the driver).</li> <li>• System was field tested in New York City between Jan 88 and early 89</li> </ul>
Trans-Atlantic Equipment (South Africa)	Trafficam	<ul style="list-style-type: none"> <li>• Roadway sensors are rubber tube sensors (pencil thin)</li> <li>• Second photo is taken 0.5 sec after the first</li> </ul>
Truvelo Manufacturers (West Germany)	See Comments	<ul style="list-style-type: none"> <li>• Red-light violation module converts Truvelo Combi from a ASE to an Red-Light Camera system</li> <li>• Tripod installation: one piezoelectric cable is across the stop line and a photocell detector is clipped onto the housing of the red light.</li> <li>• Fixed installation: control unit is connected to an embedded inductive loop</li> </ul>
Zellweger Uster AG (Switzerland)	Multafot	<ul style="list-style-type: none"> <li>• Can be installed to take either rear or frontal photographs</li> <li>• Second photograph is taken at a preset time interval (0.5 to 2 sec) after the first</li> <li>• System was field tested in two U.S. cities: New York City (Jan 88 to early 89) and Pasadena California (first half 89)</li> </ul>

### **3.1.1 Arlington, Texas**

ORBIS III, which detects and photographs speeders, recording speed, time, date, driver, and license plate, was used on four roadway segments in Arlington, Texas from mid-January to mid-April, 1976. Dreyer and Hawkins (4) examined the effectiveness of a mobile ORBIS III unit in increasing driver compliance with posted speed limits. The sites were selected to provide data on the impact of the mobile ORBIS III unit in various roadway environments (rural, residential, urban, and urban thoroughfare) with various posted speed limits. The greatest impact in reductions of percent speeders was realized on the urban roadways at high levels of enforcement. Significant, but less dramatic reductions were also observed at the rural and residential sites. Speed distribution profile data showed a small decrease in mean speeds at three of the four sites, with the impact of the unit lasting for some time after the equipment was removed from operation.

In 1978, Miller and Deuser (3) reported that an ORBIS III officer was required to testify extensively as to the innermost workings of the ORBIS unit and its acceptability in the scientific realm during court cases. They also reported that the ORBIS III system was discontinued in 1978 partially because of the court's requirement that an expert witness testify at each case concerning the unit's technical operation.

### **3.1.2 Galveston County and LaMarque, Texas**

The following is a summary of Blackburn, et al. (1) comments on the experience of using ASE equipment in Galveston County and LaMarque, Texas. Manned ASE equipment was used from about July 1986 to July 1987 in Precinct 8 of Galveston county. The device used was a Multanova 6F rented from Traffic Monitoring Technologies (TMT). The system, which included a Robot camera, was mounted in the rear of a four-wheel-drive vehicle. An auxiliary, manually operated camera was used to photograph the rear of the vehicle if the vehicle had no front license plate. The speed enforcement was confined to a portion of interstate highway between Houston and Galveston and outside of incorporated areas.

TMT provided the equipment and vehicle, the film, film processing, film review for identification of the license plate number, printing of the citations (including second mailings as a follow-up), and mailing of the citations (using the county stationery). For this service, TMT charged the Constable's Office \$20 for each fine collected. Between 4,000 and 5,000

citations were issued over the one-year period resulting in about \$70,000 in fines collected. Between 40 and 48 percent of the vehicle owners responded with payment to the first letter. The follow-up letter said those refusing to pay would be arrested, and some were. Owners of commercial vehicles and out-of-state vehicles were difficult, it not impossible, to track and punish.

Sixteen of the speeding cases went to jury trial. The prosecution won all of the cases. Four speeding convictions were appealed to the County Court of Appeals where the convictions were overturned. The County Attorney then decided not to prosecute any more of these cases. The operation was stopped by the District Attorney's office in July 1987. Also at the time, public opinion developed against the use of the equipment, and some irate motorists were even detected throwing rocks at the enforcement vehicle to knock out the flash, which was claimed to be blinding the motorists. The citations issued are under judicial review, and it is possible that the \$70,000 in fines collected may have to be refunded.

At the time the ASE equipment was used in Texas, there was no provision in the law to permit vehicle owners to be charged for speed violations committed by any driver of the vehicle. The ASE equipment was used because no law prohibited its use. A bill (House Bill 830) was introduced in early 1987 in the Texas legislature to provide the proper legal environment in Texas for use of ASE equipment. However, the bill was never released from the subcommittee of the House Transportation Committee.

The same equipment was also pilot-tested by the city police of LaMarque, Texas, for a 90-day period during early 1987. The problems in Precinct 8 impacted the equipment's use in LaMarque, and several city officials reportedly lost their jobs over the pilot tests.(1)

### **3.1.3 Paradise Valley, Arizona**

In October 1987, the Police Department in Paradise Valley, Arizona, began using a Multanova 6F leased from TMT. TMT's services include leasing the equipment and vehicle, film review, and mailing of the citations for which they receive \$20 for each paid ticket or owner attending a defensive driving course. The "Photo Radar" unit is deployed at various times of the day and night and is used about 25 to 30 hrs/week. A diamond-shaped warning sign with the message "Photo Radar in Use" is deployed upstream of the enforcement vehicle to notify motorists of the operation.

In 1987, Arizona changed its statutes regarding speeding penalties. Prior to the law change, a speeding offense was a misdemeanor, regardless of the speed level. Now, drivers caught speeding more than 20 mph over the posted speed limit are charged with a misdemeanor (a criminal traffic offense). Drivers caught speeding 20 mph or less over the posted speed limit are charged with a civil infraction. In August 1987, the City Council passed an ordinance stating that registered owners of vehicles are presumed responsible for certain violations involving the vehicle, including speeding.

During the first year of operation, about 11,000 speeding citations were issued. The department now claims to be generating 24 citations per hour of deployment. Approximately 68 percent of the owners sent the speeding citations either pay the fine or agree to attend the defensive driving school. The city police believe the use of the equipment has contributed to a 43 percent reduction in citywide accidents compared to the same period prior to implementation. (1)

#### 3.1.4 Pasadena, California

The Pasadena, California, Police Department used a Multanova 6F photo radar system during a pilot study in December 1987. Warnings were issued during the test period to 1,420 drivers. The pilot study was deemed to be so successful with the public, judges, and law enforcement officers that a decision was made to begin speed enforcement with the device on nonfreeways on June 1, 1988. A press release concerning the operation was distributed on May 17, 1988. A news conference involving radio, TV, and newspaper coverage was held on June 2 to further explain the operation and safety benefits of the equipment.

The "Photo Radar" unit is deployed at various locations and is used about 16 hrs/week. A rectangular-shaped sign with the message "You Have Just Passed Through Photo Radar (You May be Notified by Mail)" is deployed downstream of the enforcement vehicle to notify motorists of the operation. Informational signs are also posted at the city limits of Pasadena to alert motorists that the speed limit is enforced with photo radar.

Pasadena police like the equipment and claim very few problems with the equipment, the courts, or adverse public opinion. During the first three months of operation, about 7.5 percent of the motorists passing the enforcement locations were "speeding" (exceeding the

speed limit by a predetermined amount). Seventeen months after the operation began, the percentage of vehicles detected as speeding dropped to 5 percent. During the first seven months of operation, 4,082 speeding citations were issued out of 9,728 violations detected from 160,354 vehicle passages. Citations were issued in only those cases where the photograph was clear enough to see the violator's face and the license number could be identified. Seventeen months after the operation began, a total of 14,733 had been issued. About 84 percent of the owners sent the speeding citations either paid the fine or identified who was driving at the time of the offense. None of the 283 court cases have been lost by the city, and none of the decisions have been appealed. (1)

### **3.1.5 Other Interest in Automated Speed Enforcement Devices**

Other states have expressed interest in using automated speed enforcement devices. The Maryland State Police have joined the Virginia State Police to form a task force under contract with NHTSA to conduct a pilot study of using ASE equipment on the Capitol Beltway. The Wisconsin State Highway Patrol in 1987 performed an in-house study of the possible use of manned ASE equipment. The main emphasis behind the requested study was to see if some of the Patrol's force could be freed from enforcing speed limits on certain interstate highways and used to enforce speed limits and drunk driving violations on other facilities. A detailed two-year plan was developed and is currently on hold until ways can be found to make use of state data to identify highway segments with high traffic volumes and where substantial speeding and accidents occur. Minnesota Governor's Office and Colorado Office for Highway Safety are both in favor of using automated speed enforcement technology and are developing plans for implementing their use. (1)

## **3.2 HIGH OCCUPANCY VEHICLE LANE ENFORCEMENT**

### **3.2.1 Virginia**

Virginia Department of State Police mails citations to registered owners of vehicles that law-enforcement officers have spotted violating HOV restrictions. The ability to mail citations frees officers from the task of pursuing and apprehending violators on the spot, which can slow traffic in both the HOV lanes and adjoining lanes. Early reports suggest

that the program has both increased officer productivity and reduced the number of violators on Virginia's HOV lanes. (5)

### 3.2.2 California

Currently a study for the California Highway Patrol is being conducted on the feasibility and accuracy of three- and four-camera set-ups in determining vehicle occupancy, documenting violator identify, and guiding HOV-lane enforcement. (5)

### 3.2.3 San Francisco-Oakland Bay Bridge Priority Lane Project

In 1978, Miller and Deuser (3) reported on enforcement of the San Francisco-Oakland Bay Bridge Priority Lane. Observers were stationed in the priority lanes at the toll booths and recorded license plate numbers of all lane violators. After the same license plate was observed more than once, the plate number was sent to the Department of Motor Vehicles for identification. About 1 percent of the lane users were constant violators. Letters were then sent to the registered owners of the vehicles informing them of the Vehicle Code violation and indicating that the driver of the vehicle could be apprehended and cited by the California Highway Patrol. Further observations indicated that the response of the owners to the letter was very good. Only about one violator in ten was observed in the lane after receiving the letter. While the warning letters did discourage future violations from most of these individuals, they did little or nothing to reduce the overall violation rate. Apparently new violators moved into the HOV lane to replace the removed violators and more direct means of enforcement were considered necessary.

### 3.2.4 Southeast Expressway (Boston) Concurrent-Flow HOV Lane

Miller and Deuser (3) made the following report on the enforcement efforts of the Southeast Expressway Concurrent-Flow HOV Lane located in Boston. The project reserved the median northbound (inbound) lane for the exclusive use of buses and carpools of three or more persons. The HOV lane operated from 6:30 to 9:30 am and at all other times the HOV lane was open to general traffic. The length of the HOV lane was eight miles and there was no priority treatment for southbound (outbound) traffic in the afternoon peak period. The HOV lane was implemented on May 4, 1977, on a voluntary, unenforced basis

and operated under that strategy until the HOV lane restrictions were enforced beginning October 18, 1977. As a result of this announced change in enforcement strategy, travel times in the general travel lanes increased and varied from day to day. On November 2, 1977, the project was terminated because of the public outcry and concern by the public officials regarding the deteriorated travel conditions in the general travel lanes brought on by the enforcement of the HOV lane.

Enforcement occurred by mailing citations to the registered owners of vehicle violating the HOV lane. About five police officers in vehicles were assigned over the three-hour period per day. Massachusetts General Laws make it possible for a police officer, who upon observing a moving violation and being unable to give the original citation to the violator at the time of the offense, to mail the citation to the registered owner of the vehicle. Massachusetts law further provides that the registered owner of a vehicle shall be prima facie evidence that the owner was the operator at the time of the violation. This mailing procedure was used because police could not apprehend the HOV violator safely at the time of the violation because of the requirement to weave across several lanes of congested traffic. During the 12 operating days of this enforcement program, a total of 1,583 citations were mailed for an average of 132 citations per day (44 citations per hour). There was no accounting of these citations, because once the HOV project was terminated, the court system decided (not on a legal basis) not to hold the persons responsible for the HOV citation.

### **3.3 RED-LIGHT VIOLATIONS ENFORCEMENT**

#### **3.3.1 Pasadena, California**

Pasadena, California in 1989 participated in a demonstration project with Multanova to test a Multafot automated red-light surveillance system. Operational problems were experienced at the initial test intersection. About 95 percent of the photographs taken were of nonviolating vehicles, partly because of the location at which the vehicle sensors were initially installed and a tendency of many drivers to encroach or creep past the stop bar and into the crosswalk area during the red phase. The system was relocated to another intersection for further evaluation. (1)

### 3.3.2 New York City

Two demonstrations of red-light violation detection equipment have taken place in New York City. The first demonstration was conducted from June 1985 through March 1986 using a Traffiphot unit. During the 44 days of full operation, approximately 4,000 red-light offenses (an average of 90 violations per day) were clearly detected and recorded on film. No citations were issued during the demonstration.

The second demonstration took place January 1988 through early 1989 and involved three intersections and used the following equipment: Traffiphot, Multifot, and a system made by Alex Jacknau Filmaufrahme. Photographs of red-light violations were obtained from the first two intersections (40 and 56 percent of the photographs taken recorded a readable red-light violation, respectively). No usable film was obtained from the equipment made by Alex Jacknau Filmanufrahme. Summonses were not issued for the detected violations.

While both studies were being performed in New York, there was no legislative approval to issue tickets based on photographic evidence. However, during the second study, the New York Legislature passed a bill that allowed photographs as evidence and summonses to be mailed to the registered owner. New York City DOT now has plans for installing red-light violation detection equipment at 25 intersections in the city. Citations for red-light violations will be issued through the mail to the registered owners of the vehicles identified. It is anticipated that the program will start in January 1990. (1)

### 3.3.3 Nottinghamshire County Council, United Kingdom

Casings to hold a signal-activated camera were installed in December 1987 at two Nottinghamshire County sites selected based on reported accidents which involved signal violations. The camera was supplied by the Dutch company Gatsometer BV. The proportion of drivers committing red-light violations, of those who had the opportunity to do so, was similar both before and three months after the introduction of the camera. However, the number of violations 0.8 seconds or more after the onset of the red sequence of the traffic signal was reduced. This reduction was greatest during the period of extensive publicity just after the camera was officially switched on. The more recent observations

have indicated that the violation rate is returning towards that observed prior to the introduction of the camera. (6)

#### 4.0 LEGAL ISSUES

Glater (7) in 1973 and Blackburn, et al. (2) in 1984 examined legal issues regarding the use of automated speed enforcement devices in the United States, especially when they involve photography. Glater reviewed the legal basis for certain potential challenges to the use of ORBIS while Blackburn, et al. provided a summary of U.S. research into legal issues. Issues reviewed included individual's right to privacy, equal protection, admissibility of photographic testimony into evidence, and vicarious liability.

Blackburn, et al (1) concluded that most legal concerns do not present formidable legal barriers except vicarious liability as it applies to speed-law statutes. This concerned the legal issues that might be encountered with the imposition of criminal or civil liabilities on the owners of vehicles observed in violation of speed laws, in the absence of information about the identity of the actual drivers. A suggested solution to this legal issue was the creation of civil vicarious liability statutes for traffic offenses, including speeding violations. The civil statutes designed to impose vicarious liability on the owners of vehicles observed in violation of speed laws would eliminate many of the objections imposed by criminal statutes.

Glater (7) concluded that ORBIS is not an invasion of privacy as defined by Supreme Court's decisions, because it does not interfere with an especially fundamental right or zone of privacy and it does not constitute an unreasonable invasion. The photograph taken by ORBIS is not an unreasonable search because it does not invade an area which may reasonably be expected to be free from public view. ORBIS does not interfere with the rights of association guaranteed by the First Amendment because the photographs do not present a "specific present objective harm". ORBIS does not contradict state statutes pertaining to the right of privacy because most of these statutes are for preventing the unauthorized use of a person's name or likeness for advertising or business purposes.

Defendants may cite the inability of ORBIS to photograph every speeder as denying equal protection of the law. ORBIS' limitations (e.g. can monitor only one lane of traffic

at a time), however, do not result in the intentional discrimination prohibited by the Fourteenth Amendment's Equal Protection Clause.

Defendants may claim that the photographs taken by Orbis are not admissible evidence. To be admissible, the prosecution would have to show that "the photograph is relevant and material to issues raised at trial and must show that the photograph is an accurate, authentic representation of the scene it contains". The ORBIS photograph is obviously relevant, and all of the people handling the film can testify to its accuracy to the extent that no tampering occurred. Normally, however, human testimony is needed to confirm the authenticity of a photograph by claiming personal perception of what the photograph purports to portray. To overcome this obstacle, the prosecution must describe the techniques used to insure the photograph's authenticity and the official who loaded the film should testify as to the familiarity of the background. Since this does not always work, officials may need to encourage the legislature to pass statues authorizing the admission of ORBIS photographs in speeding prosecutions.

Six legal issues concerning innovative enforcement techniques for HOV lanes identified by Miller and Deuser (5) are:

- Can photographic evidence be made to be admissible in traffic court through legislative action?
- If instrumentation is used to the enforcement operations, what type and amount of instrument certification would be required?
- Can the minimum number of occupants required for the utilization of an HOV lane be related to their visibility without being successfully challenged on the basis of age discrimination (i.e. small children) or other grounds?
- Can citations be mailed out to the owner of a vehicle for a moving violation without the driver's identification being confirmed?
- Can a non-witnessing officer cite a violator of an HOV facility?
- Do the legislative requirements for effective HOV lane enforcement require the allocation of powers to the enforcement agency which can then be abused? What can be done to minimize this possibility?

## 5.0 PUBLIC ACCEPTANCE

The Insurance Institute for Highway Safety (8) sponsored a telephone survey in 1989 among residents of two communities (Paradise Valley, Arizona and Pasadena, California) where photo radar is currently being used and residents of nearby communities. Considerable awareness that photo radar was being used was found, especially in Paradise Valley where 72 percent mentioned it spontaneously. In all areas combined, 58 percent either approved or strongly approved its use; residents of Paradise Valley and Pasadena were more likely to approve than residents of nearby communities. Two-thirds of those who approved of photo radar thought its use should be increased. Almost half of the respondents who knew about photo radar being used said it had made them drive slower. Possibility of errors and the wrong person getting a ticket was the most popular reason for disapproval. However, the authors observed that virtually the only source of this error occurs when the owner of the vehicle was not the driver. The owner still receives the ticket, but the photographic evidence allows the owner to show that he or she was not the driver. The second most popular reason for disapproval was that it is "sneaky" and gives police an "unfair advantage" but the authors observed that signs are used widely in both cities to warn drivers that photo radar is in use. The authors also noted that photo radar does eliminate interaction at the scene between police and driver that would allow the driver to explain mitigating circumstances, but concluded that it is objective, accurate, and nondiscriminatory.

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