Radar Detector Use and Speeds in Maryland and Virginia

Mark Freedman Allan F. Williams Nancy Teed Adrian K. Lund

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ABSTRACT

Radar detector use and vehicle speeds were determined at four rural interstate sites in Maryland and Virginia. Radar detectors are legal in Maryland but banned in Virginia. Receivers designed to pick up the microwave signals that emanate from radar detectors were used to indicate the presence of radar detectors in use; speeds of free-flowing vehicles were measured using nondetectable radar. In both Maryland and Virginia, tractor-semitrailer trucks were most likely to have radar detectors in use (28 percent in Maryland, 32 percent in Virginia). Four percent of passenger vehicles in Maryland and five percent in Virginia had radar detectors in use. The estimates of radar detectors in use in this survey are conservative because under certain traffic conditions it was not possible to determine whether only one or more than one vehicle had a radar detector in use. For all categories of vehicles, those with radar detectors in use were much more likely than those without to be traveling at excessive speeds; the higher the speed the more likely it was that vehicles had radar detectors in use.

Speeds of free-flowing vehicles on United States highways increased throughout the 1980s. This trend was greatly accelerated in 1987 when legislation was enacted permitting states to set 65 mph speed limits on rural interstate highways. ^{1,2} By the end of 1987, 38 states had raised their speed limits, and two more did so in 1988. This has resulted in greatly increased speeds in these states. For example, the National Highway Traffic Safety Administration, based on data from 18 states, estimated that three times as many vehicles were traveling faster than 70 mph in 1988 compared to 1986.³ Speed surveys on rural interstates in Virginia indicated that the percentage of free flowing cars exceeding 70 mph increased from 8 percent just before the speed limit was raised to 17 percent just after, and it increased further to 33 percent a year and a half later (with 75 percent exceeding the 65 mph speed limit).⁴ Studies indicate that the higher speed limits, and the higher speeds they produce, have resulted in a 20-30 percent increase in deaths on rural interstates.^{3,5}

Police traffic radar is the primary tool in speed enforcement because it helps police identify and deter speeders. However, police efforts to control excessive speeds by means of radar are hampered by the growing use of radar detectors. Radar detectors are receivers, tuned to police traffic radar microwave frequencies, that are sensitive enough to detect the radar beam before the vehicle is within the range of the police radar. The only use of a radar detector is to warn speeders of the presence of police radar in time to slow down before police can get a speed reading.

Previous research conducted in Maryland and Virginia found that 11 percent of vehicles traveling in excess of 62 mph slowed abruptly when a police radar unit was suddenly activated, which is an indication of probable radar detector use. The higher the initial speed the more likely it was that vehicles slowed abruptly.⁶

A device has been developed recently that can determine directly when a radar detector is in use. The "Interceptor VG-2," developed by Technisonic Industries of Mississaugua, Ontario consists of a microwave receiver designed to pick up the leakage of microwave signals that emanate from all radar detectors. This "radar detector detector" (RDD) device can be used in both stationary and moving modes. Laboratory and field tests conducted by the Insurance Institute for Highway Safety indicate that, when used properly under specified conditions, the RDD can accurately identify all types of radar detectors currently on the market and has a very low rate of false positive and false negative identifications.

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The purpose of the present study was to determine the frequency with which radar detectors are in use in Maryland, where their use is legal, and in Virginia, where they are illegal, and to measure speeds of vehicles with and without radar detectors.

METHODS

The study was conducted in late February and early March 1990 at four rural interstate highway sites; two were in Maryland and two were in Virginia. Sites were selected such that they afforded straight and level terrain, were at least one-half mile from an exit, had low to moderate traffic volumes, and provided ample shoulder and either a clear area or guardrail sufficient to separate the parked data collection vehicles from traffic (Table 1).

There were two data collection vehicles parked beyond the shoulder at each site; both were unmarked passenger vans. In the first van, observers took a census of vehicles by vehicle type and radar detector use. One person in this van operated a RDD unit and indicated which passing vehicles had radar detectors in use; the other counted and classified all vehicles as they passed.

Table 1
Study Site Locations

Route Direction		Mile marker	County	Location		
Maryland						
I-70	East	5.5	Washington	5 mi. East of Hancock		
I-83	North	•	Baltimore	20 mi. North of Baltimore		
Virginia						
1-81	North	163.7	Botetourt	15 mi. North of Roanoke		
I-85	North	36.9	Brunswick	35 mi. South of Petersburg		

^{*} No milepost on this section of roadway

Usually, vehicles with radar detectors could be identified with near certainty. However, it was not possible to tell with certainty how many and which vehicles had radar detectors in two situations: when a signal was detected when a group of closely spaced vehicles came by, and when a signal from a distant upstream vehicle with an especially "noisy" radar detector was continuously detected for a long period. In these situations one radar detector was counted as being in use, with the specific vehicle (or vehicles) unknown.

In the second van, located slightly upstream from the first, observers measured vehicles speeds of radar detector users and nonusers. As in prior speed measurement studies, sampling was restricted to free-flowing vehicles whose headway (time separation from the previous vehicle in the same lane) was at least five seconds.⁴ A RDD unit was used by one observer to ascertain radar detector use; a second person measured speeds with a nondetectable K-band radar unit (tuned slightly off-band by the manufacturer so that it could not be picked up by commercial radar detector units). Speeds were measured with the radar units aimed downstream at receding vehicles. Radar calibration was checked at least two times each day.

The sampling protocol in the speed measurement van required the RDD operator to tell the radar operator whether or not each passing vehicle was using a radar detector. The radar operator gave highest priority to measuring speeds of radar detector equipped vehicles, because there were fewer of them than vehicles not using radar detectors. Speeds of non-radar detector vehicles were measured at all other opportunities, with the radar operator directed to choose the next free-flowing vehicle in any lane following completion of a speed measurement. Consequently, speeds of each vehicle type were not sampled according to its proportion within the overall vehicle population. Speeds were not measured for vehicles whose radar detector use could not be determined with high certainty.

Data were collected from 9:00 a.m. to 12:00 noon and 1:00 p.m. to 4:00 p.m. for two days in late February and early March at each site. During the same four-day period (Monday-Thursday), data were collected by one four-person team with two vans at the Maryland sites while another team collected data at the Virginia sites. The weather and road surface were dry for all data collection periods.

Raw speed data were corrected for measurement error due to the observation angle and radar frequency. The observation angle correction adjusts the speed to compensate for the cosine of the angle between the observed vehicle's path and the aim of the radar beam. The radar frequency correction compensates for the 1.45 percent difference between speeds measured by standard K-band radar and the nondetectable radar. The complete correction for observed speed is:

To ensure that only free-flowing, unconstrained vehicles were analyzed, observations that had been made within two minutes before and after any event that may have influenced speed (such as the appearance of a police vehicle passing or stopping or a disabled vehicle on the roadside) were separated from the data. Mean speeds, selected percentile values, and the frequency distribution of speed were calculated for each data group. Observations were grouped by state and vehicle type, and summary statistics were calculated for each group.

Vehicles were classified into eight main types: passenger cars, sports/specialty cars, light trucks, straight trucks, tractor-semitrailer trucks, twin-trailer trucks, bobtails, and buses. Sports specialty cars were defined according to Highway Loss Data Institute criteria as two seaters, convertibles, midsize and larger cars with two or fewer designated rear seating positions, and luxury vehicles. Passenger cars were defined as cars and station wagons other than sports/specialty cars. Light trucks were defined as all pickups, small and full sized passenger and cargo vans, and utility vehicles (gross vehicle weight typically under 10,000 pounds). Straight trucks were defined as all single-unit trucks with gross vehicle weight generally over 10,000 pounds (e.g., larger step vans and dump trucks). Buses were defined as passenger carrying vehicles similar in size to straight trucks with gross vehicle weight over 10,000 pounds. Tractor-semitrailer trucks were defined as combination trucks with a tractor and one trailer; Twin-trailer trucks were defined as a combination with a tractor and two trailers; and bobtails were defined as truck tractors without any trailers.

RESULTS

Radar Detector Usage

Information on the number and percentage of vehicles passing by the observation sites that had radar detectors in use is presented in Table 2. Overall at least 11 percent of the vehicles observed in Maryland and 14 percent in Virginia had radar detectors in use, but there was variation in use rates by site. It is important to note that these figures underestimate the number of vehicles on the roads with radar detectors. In 21 percent of the cases in which radar detectors were identified, they were in groups of two or more closely spaced vehicles or masked. In these instances one radar detector was counted as being in use; to the extent that there was more than one radar detector in these groups of vehicles, the rates

Table 2
Radar Detectors in Use in Maryland and Virginia

		Number of Radar Detector Detections					
State	Number of Vehicles	In Specific Vehicles	In Vehicle Groups	Total Detections	Percent of Vehicles		
Maryland							
I-70	5,029	607	125	732	15		
1-83	9,131	586	227	813	9		
Total	14,160	1,193	352	1,545	11		
Virginia							
I-81	5,278	646	152	798	15		
I-85	2,874	289	50	339	12		
Total	8,152	935	202	1,137	14		

presented underestimate use. It is also important to note that because of the site differences and the small number of sites in the study, the reported rates may not be representative of statewide radar detector use. Nevertheless, the observations do indicate considerable use of radar detectors in both states in cars and trucks.

Table 3 shows radar detector use by vehicle type. Four percent of passenger vehicles in Maryland and 5 percent in Virginia were using radar detectors. Among all heavy trucks, 21 percent in Maryland and 27 percent in Virginia had radar detectors in use. Tractor-semitrailer trucks were most likely to have radar detectors in use, 28 percent in Maryland and 32 percent in Virginia, followed by twin-trailer trucks and bobtails. Sports/specialty cars were more likely than other cars to have radar detectors in use in Virginia, though not in Maryland. The use rates in Table 3 are underestimated, even more than those in Table 2 because none of the radar detectors identified in the groups of vehicles could be assigned to a specific vehicle type.

Table 3
Radar Detectors in Use by Vehicle Type

Vehicle Type	Maryland		Virginia		Total	
	Perce	ent (N)	Percent	(N)	Percen	t (N)
Sports/Specialty Cars	5	(1,349)	7	(810)	5	(2,159)
Other Cars	5	(6,342)	4	(3,537)	4	(9,879)
Pickups, Vans, and Utility Vehicles	4	(3,056)	5	(1,331)	4	(4,387)
All Passenger Vehicles	4	(10,747)	5	(5,678)	5	(16,425)
Straight Trucks	3	(797)	3	(303)	3	(1,100)
Tractor-Semitrailer Trucks	28	(2,446)	32	(1,945)	30	(4,391)
Twin-Trailers Trucks	12	(76)	17	(184)	16	(260)
Bobtails	9	(47)	12	(26)	10	(73)
All Heavy Trucks	21	(3,366)	27	(2,458)	24	(5,824)
Buses	2	(47)	13	(16)	5	(63)

Table 4
Speeds of Vehicles With and Without
Radar Detectors in Maryland

Vehicle Type	Speed Limit	Detector Use	N	Percent >65 mph	Percent >70 mph	Percent >75 mph
Cars (passenger, sports/ specialty)	55	yes no	166 1,109	40 22	18 6	3 1
Pickups, Vans, and Utility Vehicles	55	yes no	67 504	46 20	11 4	5 1
Tractor- Semitrailer Trucks	55	yes no	384 472	22 8	5 1	1 0

Table 5
Speeds of Vehicles With and Without
Radar Detectors in Virginia

Vehicle Type	Speed Limit	Detector Use	N	Percent >65 mph	Percent >70 mph	Percent >75 mph
Cars (passenger, sports/ specialty)	65	yes no	88 1,405	86 75	51 28	14 3
Pickups, Vans, and Utility Vehicles	65	yes no	42 393	86 67	50 21	12 4
Tractor- Semitrailer Trucks	55	yes no	297 646	35 15	7 2	1 0

Vehicle Speeds

In Tables 4 and 5, information on the speeds of free-flowing vehicles with and without radar detectors is presented. During the study period, the speed limit for all vehicles on rural interstates in Maryland was 55 mph. In Virginia, the rural interstate speed limit was 65 mph for cars and 55 mph for trucks. Table 4 shows that all categories of vehicles with radar detectors observed at the Maryland sites were generally at least twice as likely to be traveling at speeds in excess of 65 mph. For example, three times as many cars with radar detectors were exceeding 70 mph (15 mph over the speed limit) as cars without radar detectors. The higher the speed, the more likely it was that the vehicle had a radar detector in use.

The speeds of cars and light trucks observed at the Virginia sites were higher than those in Maryland, because of the higher speed limit, but there were similar relationships between radar detector use and speeds. Especially at the highest speeds, radar detector use was in evidence. For example, 14 percent of the cars with radar detectors were exceeding 75 mph compared to 3 percent of the cars without radar detectors.

DISCUSSION

Radar detectors were undercounted in this study, but the results indicate that they are in use in many vehicles, especially tractor-semitrailer trucks. Some of the radar detector use rate variation among sites may have been due to the relative volumes of closely spaced vehicles and masked groups. The site with the lowest radar detector use, Maryland I-83, had the highest rate of radar detectors identified in groups of vehicles (28 percent) compared to 17 percent on Maryland I-70, 19 percent on Virginia I-81, and 15 percent on Virginia I-85. All types of vehicles with radar detectors were much more likely than vehicles without detectors to be traveling at speeds far in excess of the speed limit; vehicles traveling at the highest speeds were especially likely to have radar detectors operating. Radar detector use clearly encourages high speed travel.

Based on data from these sites, Virginia's ban on radar detector use has little to no apparent effect in deterring usage; in fact, vehicles observed in Virginia were somewhat more likely to be using radar detectors than those observed in Maryland. The difficulties in enforcing a ban on radar detectors may partially explain these results in Virginia. The RDD technology, which was developed specifically to enable the Ontario Provincial Police to effectively enforce the ban against radar detector use, offers the police a much more effective enforcement tool.

REFERENCES

- 1. Public Law 100-17. Surface Transportation and Uniform Relocation Assistance Act of 1987 § 174, 23 U.S.CA. § 154 (West Supp. 1990).
- Public Law 100-202. Act of December 22, 1987 § 329, 23 U.S.CA. § 154 (West Supp. 1990).
- 3. National Highway Traffic Safety Administration. 1989. Report to Congress on the Effects of the 65 mph Speed Limit through 1988. Washington, DC: U.S. Department of Transportation.
- Freedman, Mark and Esterlitz, Joy. 1990. The effects of the 65 mph speed limit on speeds in three states.
 Transportation Research Record, in press.
- 5. Baum, Herbert M.; Lund, Adrian K. and Wells, JoAnn K. 1990. Motor vehicle crash fatalities in the second year of the 65 mph speed limits. *Journal of Safety Research* 21:1-8.
- Ciccone, Michael A.; Goodson, Mark; and Pollner, J. 1987. Radar detector speeds in Maryland and Virginia.
 Journal of Police Science and Administration 15:277-84.
- Technisonics Industries Limited. 1989. Operator's Manual Interceptor VG-2 Microwave Receiver. Mississauga, Ontario.

- 8. Lund, Adrian K; Schmidt, Scott; Freedman, Mark; Preuss, Anthony C. and Ciccone, Michael, A. 1990.
 Performance Under Controlled Conditions of the Interceptor VG-2 Radar Detector Detector. Arlington, VA:
 Insurance Institute for Highway Safety.
- 9. Highway Loss Data Institute. 1989. Insurance Collision Report; R-89-2; Passenger Vehicles, Vans, Pickups, and Utility Vehicles. Arlington, VA.

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