Written Testimony of Earle Drack Before the PA House Transportation Committee

Rep. John Taylor, Chairman, Rep. William F. Keller, Minority Chairman

Public Hearing on Local and Regional Police Potential Use of Radar as a Speed Timing Device

April 4, 2018, 10:00 AM

Room 140, Main Capitol

Harrisburg, PA

Good afternoon Chairman Taylor, Minority Chairman Keller, and members of the State House Transportation Committee. My name is Earle Drack and I appreciate this opportunity to participate in today's hearing and testify on behalf of Pennsylvania's citizens and motorists.

While today's hearing is nominally focused on consideration of new legislation authorizing the use of radar as a speed timing device for local police, the fact that I was invited to testify suggests that the Committee is also interested in better understanding the speed measurement devices currently used by local police in PA.

My testimony will thus center on a specific non-radar device called the ENRADD EJU-91 wireless device, a beam-break-type device that spaces two infrared beams 3 feet apart and measures the time between beam breaks when a target car passes and then uses the simple formula

Speed = distance / time

to compute speed, while assuming the distance traveled was indeed 3'. This device is now widely used by local police across Pennsylvania.

I will discuss problems with this device that are likely leading to unfair citations for motorists, including many of your constituents, and likely in large numbers. My testimony will briefly cover the following topics:

- **ENRADD EJU-91 wireless Approval Issues**
- **ENRADD EJU-91 wireless Accuracy Issues**
- **ENRADD EJU-91 wireless Calibration Issues**
- **Need for removal of the ENRADD EJU-91 wireless device from PennDOT's list of approved speed measurement devices**

Background

I was invited to testify today based on my previous testimony related to speed timing devices and issues before both the Pennsylvania Senate and House Transportation Committees, and I accepted that invitation as a concerned citizen who simply wishes to ensure that Pennsylvanians are not forced to choose between fairness and safety. I am sure everyone attending today's hearing agrees that we should and can have both, and that it is the responsibility of this Committee to help ensure that outcome.

ENRADD Approval Issues:

As you may be aware, all non-radar devices must currently be approved by PennDOT before they can be used as the basis for a citation, and PennDOT has a written procedure for such approval (see attached Figure 1 for the procedure in place at the time the wireless ENRADD EJU-91 was approved in August of 2003).

When I first was able to see this procedure the problem was clear – instead of PennDOT performing its own critical and objective technical analysis and testing of a device, they allow the device manufacturer to specify what testing is (and is not) done. While PennDOT does choose an independent lab to perform the testing, that lab does only what testing the manufacturer tells it to do. And while PennDOT is required by its own written approval process to review the testing that was done and issue an approval/denial report, in this case that step was not performed, and it is not clear whether PennDOT even has someone qualified to do such a technical review and analysis. What's more, PennDOT says it has no record of a written instruction that the wireless ENRADD be included in the PA Bulletin list of approved devices. **It is therefore unclear, even now, on what basis and on whose authority the wireless ENRADD EJU-91 was approved and how it came to show up on that list.**

In the case of the wireless ENRADD EJU-91, only laboratory tests were specified by the manufacturer, and those tests could not (and thus did not) reveal certain significant design flaws. Let me reiterate that; based on the information I was provided under the Open Records law, **the wireless ENRADD EJU-91 was never even road tested prior to approval!**

Please note that this approval is very significant, because in Pennsylvania if a device is approved and has been calibrated in accordance with the PA Code, that is prima facie evidence of accuracy and the burden

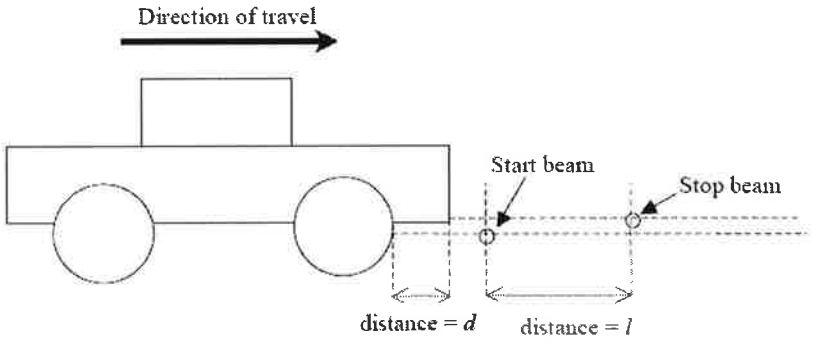
of proof shifts to the defendant. So while it may be tempting to say, "Well, no device is perfect, that's why you are allowed to challenge it in court", I'd like to respectfully point out that as a practical matter only folks with a technical background and the stubbornness to track down information which is not easily available have any chance to successfully challenge an ENRADD citation. It is much more likely that people will just plead guilty or will show up in court unprepared and be found guilty.

ENRADD Accuracy Issues

There are several obvious accuracy issues with the ENRADD device, and I would be happy to discuss them all off line. In the interest of brevity I will simply focus now on one such issue.

For a beam-break device like ENRADD, the accuracy is dependent on the distance traveled between the beam breaks to be known accurately. In the case of ENRADD, that distance is assumed to be 3' since that is the beam separation on the roadside set by the mechanical support.

It is easy to see however, that if beams are triggered by two different points on the car, say by the tires for the start beam and the bumper for the stop beam, then the distance traveled is not 3' but less, resulting in an artificially high speed reading. See below:



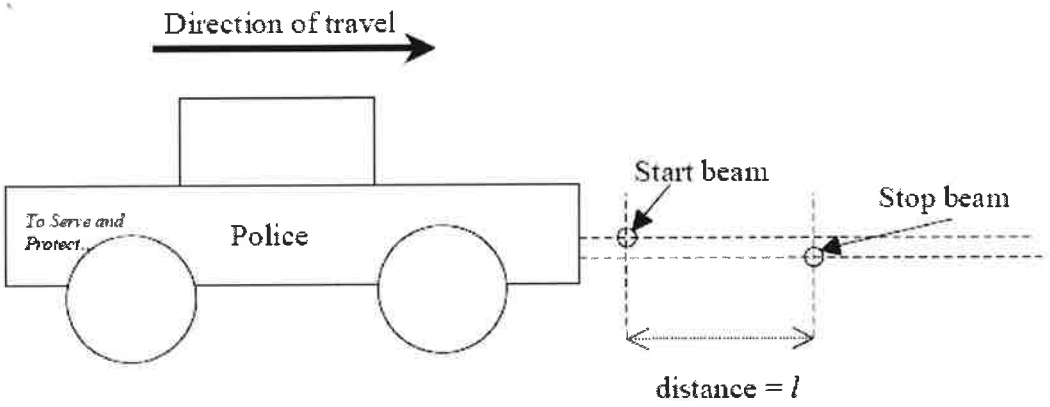
This could result in a citation for an innocent motorist, since the speed reported will be inaccurate by a factor of:

Speed reported = true speed * $l / (l - d)$

For the case where l = 36" and d = 10", the error factor will be 36/26 = 1.385. That means a 38.5% error, which would make a car traveling at 45 mph give a reading of 62 mph.

Also, it has been implied that a test-drive of the police vehicle through the ENRADD is a good way to ensure proper alignment and thus avoid bad tickets. Note, however, that if the beams are set to a height that corresponds to the center of the police vehicle bumper, the device could read correctly *for that vehicle* even if there are several inches of height difference between beams.

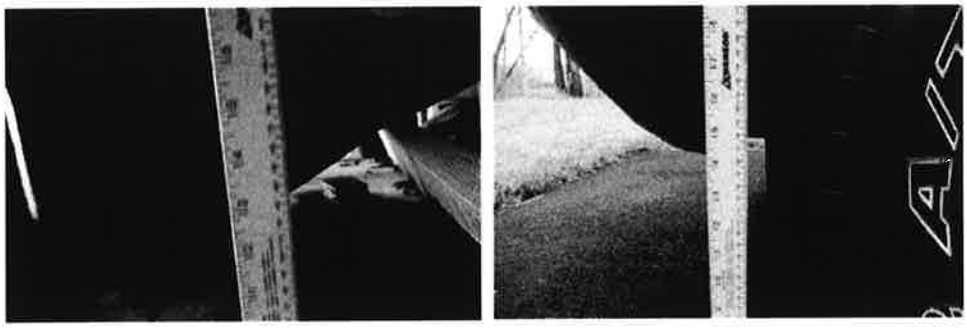
See diagram below, in which the reading will be correct for the police vehicle but may have large errors for vehicles with different bumper heights/profiles like SUV's or pickups.



Also, even if it were possible to align the beams at the exact same height with respect to the roadway (for all points on the roadway), similar errors could still result from any bounce, road unevenness, or other slight changes to vehicle height between the start and stop beams such as a slight dip in the front if brakes are applied. What's more, all roads are designed with a "crown" for water runoff, so a straight infrared beam will be at many different heights depending where on the road surface you measure.

The manufacturer is aware of this problem, going so far as to tell officers via the training manual to "avoid triggering in the middle range… you may trigger off different points on the car" (see attached Figure 2, which shows Step 1 of the ENRADD EJU-91 wireless setup from the manual). The problem, of course, is that what is "middle range" for one vehicle is not "middle range" for another. For example, a video link at the manufacturer's website at one time showed an officer stating he sets the beam height at about 14" to place them at "mid-bumper", and 14" is within the range specified in the ENRADD manual as avoiding this "middle range". As can be seen in the following photos, however, 14" is near the lower bumper edge, right where it is most likely to cause error, for two different SUV's. Moreover, as seen in Figure 3, a later setup step (Step 4) has the operator moving the sensors up or down to achieve

alignment with the opposite beam transmitter, apparently negating any matching of beam height achieved in Step 1.



It is also not clear how the manufacturer came to the conclusion that avoiding the 6"-12" range of beam heights will result in accurate readings for all vehicles, nor is it clear how the +/-1mph accuracy specification for the device listed in the manual (see Figure 4) could be achieved for all vehicles under real-world conditions, and thus how the claim can be made. If that accuracy has not been demonstrated under real-world conditions, why does PennDOT accept it at a fact?

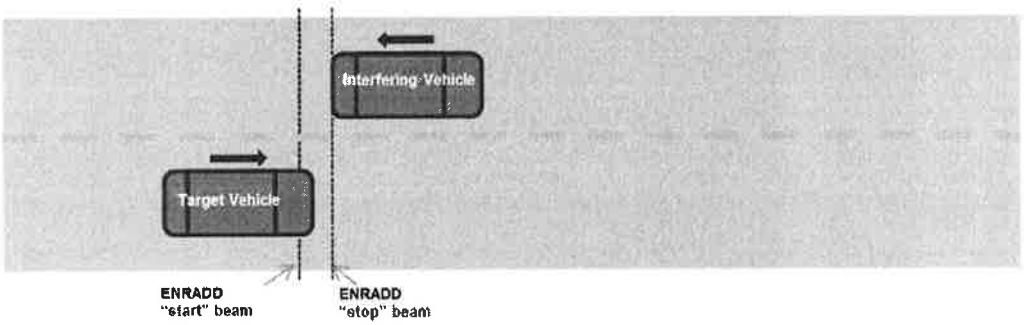
Roads are not flat like laboratory floors, and a thorough road test regimen would likely have caught this design problem in the approval process.

This is not just my theory; it was reported on in a WTAE Team 4 Investigative Report aired on local Pittsburgh television (http://www.thepittsburghchannel.com/news/22910814/detail.html), and the expert they consulted agreed with this analysis. A similar story was also recently published by PennLive (http://www.pennlive.com/news/2018/02/were_you_wrongly_ticketed_for.html).

In addition, the device manual states (see Figure 5):

"Any vehicles passing through the detection zone in a direction opposite to the lane setting will be ignored if the speed is greater than 20mph. This function is known as opposite lane rejection."

While this may be the case if the opposite lane vehicle enters the measurement interval before the target vehicle, the ENRADD EJU-91 wireless will indeed give an erroneously fast reading if the target vehicle breaks the start beam and the interfering vehicle breaks the stop beam, as shown below.



This error mode is not mentioned in the manual nor was it tested for prior to device approval. Again, it remains a mystery as to how the device can have an accuracy of +/-1 mph in all cases given that this error mechanism is not mitigated in the device design or on the operation/training procedures.

With respect to accuracy issues, I remain convinced that local police are interested in both safety and fairness, and that they assume (as most people did) that the device was accurate based on its approval by PennDOT. I am pro law enforcement, and believe it should be based on accurate technology and enforced evenly fairly. It should also be noted that since the error could be on the low side as well, some speeders are likely not being cited by virtue of the accuracy problems with ENRADD.

ENRADD Calibration Issues

As stated earlier, the wireless ENRADD EJU-91 uses 3' beam spacing and has used this spacing since 2003. The PA Code, however, is very clear that all ENRADD EJU-91 devices must be calibrated assuming a 5' spacing (see attached Fig. 6). If the calibrations currently being done assume a 3' spacing, then this violation of the PA Code would presumably invalidate all such ENRADD calibrations and render the citations on which they were based invalid. **It is not clear why this provision of the PA Code is being ignored, especially since a 5' spacing would make the device less sensitive to the type of error described earlier.**

Recommendation

Based on the foregoing, I respectfully recommend that this Committee, in its oversight role for PennDOT, see that the wireless ENRADD EJU-91 approval is suspended immediately pending a thorough evaluation of the problems with the device. Note that even if radar is eventually allowed for local police, the immediate suspension of the ENRADD approval is necessary to stop unfair citations from being written. Note also that if the standards for non-radar device approval require that they be accurate in order to be approved, there is no reason why accurate non-radar devices cannot be used effectively and fairly.

Thank you.

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Approval Procedure for Speed-timing Devices

Non-Radar Devices:

Any manufacturer wanting to market a non-radar speed-timing device for use in Pennsylvania, must submit that request in writing to the Bureau of Motor Vehicles. The manufacturer is responsible to provide to the Department of Transportation a list of not less than 3 certified laboratories approved to test and verify that the device performs as specified. The Department will choose which laboratory will conduct the testing. The test must be paid for by the manufacturer and the results submitted by the laboratory directly to the Department of Transportation, Vehicle Inspection Division for review. Once the results have been verified, the Vehicle Inspection Division will issue a report to the manufacturer that either approves or disapproves the device. If the device is approved for use by the Commonwealth, the Bureau of Motor Vehicles will send notification to be published in the Pennsylvania Bulletin that the device has been approved and is now on the list of approved speed-timing devices to be used in the Commonwealth of Pennsylvania.

Please note the following requirements:

- Letter requesting the approval must be on the manufacturer's letterhead.
- Contact person for the manufacturer must be identified by name, address, telephone number and position.
- All laboratories on the list that perform the testing must be made available for inspection by the Commonwealth and its agents, if needed.
- Final approval will always depend upon verification from PENNDOT.

Radar Devices:

In order for a radar device to be approved for use in the Commonwealth of Pennsylvania, it must be on the list of approved devices published by the International Association of Chiefs of Police (IACP), the National Highway Traffic Safety Administration (NHTSA) or any other entity PENNDOT deems appropriate. Manufacturers seeking approval must submit a request in writing to the Bureau of Motor Vehicles with proof that the device has been published on an approved list acceptable to PENNDOT. The Bureau will forward this request to the Pennsylvania State Police (PSP). PSP will evaluate the device(s) and forward their recommendation for approval/disapproval to the Bureau. Upon receipt of a request for approval, the Bureau will send notification to be published in the Pennsylvania Bulletin that the device has been approved and is now on the list of approved speed-timing devices to be used in the Commonwealth of Pennsylvania.

Please note the following requirements:

- Letter requesting approval must be on the manufacturer's letterhead
- Contact person for the manufacturer must be identified by name, address, telephone number and position.

Please send all correspondence relating to this procedure to:

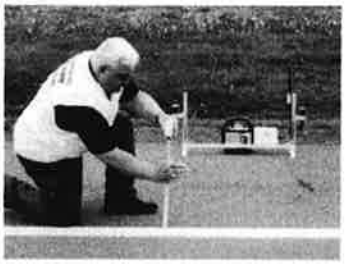
The Bureau of Motor Vehicles
Vehicle Inspection Division
P.O. Box 68697
Harrisburg, PA 17106

Figure 1

ENRADD EJU-91 WIRELESS SYSTEM
YIS/Cowden Group, Inc. 717-854-7804

SETUP con't

1) Start the set up by setting the sensors (not necessarily the entire bar) level and 13 to 16 off the ground to trigger off the bulk of the target vehicle (use your level and tape measure). If this is not feasible, lower the sensors to 4-5 inches to trigger off the tires (use your level and tape measure). **Avoid triggering in the middle range (6 to 12 inches).** You may trigger off two different points of the car, i.e. spoiler and tire, instead of just the tire or body. We recommend you set up in your parking area first to be sure everything is working before you go to your detail area. In the pictures below, see how to check the height of your IR beam at the fog line. Have the alignment switch set to the side you are checking. Bring your hand up the tape until you hear the tone. You now know the height of the IR beam from the roadway. **CHECK FOR SAME HEIGHT OF ALL 4 SENSORS.**



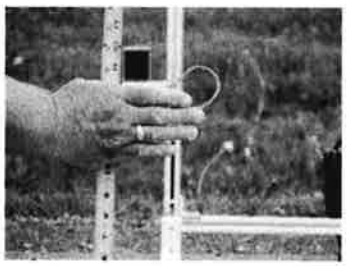


Figure 2

ENRADD EJU-91 WIRELESS SYSTEM
YIS/Cowden Group, Inc. 717-854-7804

SETUP con't

2) Set up the receiver sensor as follows
   a) Plug in the batteries
   b) Adjust the sensors and using the alignment switch move the sensors until they are aligned (see below) IF THE ALIGNMENT BUZZER TONES IN QUICK CONTINUOUS BEEPS, THEN YOU NEED TO REPLACE THE BATTERY WITH A FULLY CHARGED BATTERY.
   c) Raise the transceiver Antenna post if needed

3) The alignment switch is located on the RECEIVER CONTROL BOX. It is a 3-position switch that controls the audible alignment alarm. The center position is OFF. The left position controls the high side and the right position controls low side (see features).

4) Move the switch to the left position. Find your "sweet spot" by moving your sensor up and down the rail and tilt up and down hearing the alarm as you zero in on the "sweet spot". When centered and no alarm tone, you're ready to flip the alignment switch to the right side and repeat the process. An experienced operator will do this in a few short seconds. **If it takes you longer than 2 minutes, go to the troubleshooting section to find out why.**

5) Move the switch to the left position for 5 to 10 seconds and then the right for 5 to 10 seconds to verify there is no alarm in either position. Then place the switch back to center.

Figure 3

ENRADD EJU-91 WIRELESS SYSTEM

YIS/Cowden Group, Inc. 717-854-7804

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ENRADD EJU-91

SPECIFICATIONS

Power 12 VDC 300ma Fuse Replacement 2 amp only Accuracy +/- 1 MPH
Display LCD with Backlight Dimensions H- 3.0", W- 5.25", D- 2.0"
Range 10 MPH — 120 MPH Opposite Lane Rejection > 20 MPH
Start Pulse / No Stop Pulse 7 MPH Code Self Test 40 MPH

Figure 4

MONITORING TRAFFIC

This ENRADD System is designed to monitor only one lane of traffic at a time, **however it is possible to quickly switch directions using the lane switch.** The lane switch determines the direction of traffic to be monitored. Vehicles traveling through the detection zone from the Low Frequency side to the High Frequency side are detected as Lane 1 vehicles. Vehicles traveling through the detection zone from the High Frequency side to the Low Frequency side are detected as Lane 2 vehicles. Any vehicles passing through the detection zone in a direction opposite to the lane setting will be ignored if the speed is greater than 20mph. This function is known as opposite lane rejection.

Figure 5

(e) *Enradd, Model EJU-91*—Manufactured by Y.I.S., Incorporated, 1049 Hartley Street, P. O. Box 3044, York, Pennsylvania 17404.

(1) *Required equipment.* The following equipment or an equivalent substitute is required for calibration:

(i) Two pulse generators.

(ii) Dual channel oscilloscope or frequency counter with interval capability.

(iii) Power supply, + 5 volts.

(2) *Calibration procedure.* (See Appendix A, Figure 8 for interconnection diagram). Calibration procedures shall be as follows:

(i) A single circuit to generate the signals that simulate the front wheels of a vehicle crossing the road sensor shall be set up as set forth in Appendix A, Figure 7.

(ii) The elapsed time between the pulse on Outputs 1 and 2 is measured by the Enradd using the formula V x T = 3408. 3408 is the proper constant for a 5-foot timing strip spacing.

V = velocity in mph

T = time in ms

(iii) The elapsed interval time is computed by:

(A) Calculation of the equation:

$$V = \frac{3408}{T}$$

(B) Comparison of the readout on the oscilloscope/frequency counter to the readout on the Enradd.

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Figure 6