

Deploying Houston Radars with “True Average Speed” for Traffic Monitoring

Abstract

Houston Radar has released a firmware update that has enhanced our radars with a True Average Speed calculation and output.

The radar internally calculates and periodically updates a vehicle count weighted average traffic speed on the road over a user-determined time period taking into account all incoming lanes of traffic and speeds of all vehicles.

Additionally, it also accumulates real-time traffic volume binned by speed in 1mph or 1kph bin widths.

This feature provides sub-mph/kph accurate speed information as the vehicle speeds are measured by a direct Doppler shift rather than inferred indirectly. Additionally, setup and deployment are extremely easy, with the radar simply pointed upstream into traffic without any accurate sighting or extensive field setup requirements.

In many situations where lane-by-lane traffic counts and occupancy are not required this provides a great alternative to side-firing radars at significantly lower price points (<5x the cost), power usage (<20x the power usage) and ease of setup.

Our customers are successfully using this feature for Slow traffic ahead and Travel time to destination applications.

Background

Monitoring traffic speed has been a critical part of managing traffic on the road. Many different solutions exist in the marketplace. However, the recent trend is towards non-intrusive microwave radar based solutions for obvious reasons of ease of deployment, service and installed cost over the lifetime of the installation.

Traditionally, side-firing radars have filled this need from a couple of suppliers. These side-firing radars are mounted on the side of the road and look across the carriageway and are able to count vehicles on a lane-by-lane basis and also provide average speed and occupancy to varying degrees of accuracy.

However, these side-firing radars suffer from several drawbacks:

1. Complicated and extensive setup procedures in the field that requires deployment only by factory trained personnel.
2. Strict height and setback requirements that make them unsuitable in many locations.



3. Poor speed accuracy measurement as the vehicle speeds are inferred by "time of distance traveled" measurements rather than direct speed measurements
4. High purchase cost of the equipment that runs in the >\$4000 range and high deployment cost due to their high power usage (>7Watts for one solution!) resulting in a deployed cost per point in the >\$12K to \$15K range.

As a result, these units are reserved for high-end, multi-lane permanent installations and are not suitable for deployment in one/two lane or mobile non-permanent environments. There exists a need in the market for a simple, easier to deploy, non-intrusive device that is able to provide a true average traffic speed and volume counts at a low installed price point (<5x the side-fired solutions) for many locations where a traditional side-fired radar may be too expensive or impractical.



The Houston Radar "True Average Speed" Solution

Our DR series of radars (DR500S and DR1500) have been capable of internally capturing vehicle count and speed statistics on the road based on our highly successful "Advanced In-Radar" traffic statistics feature. Based on customer requests, we have leveraged this field proven feature and added a real-time count weighted average speed calculation (a True Average Speed) that is also available on the serial port output in addition to be read out remotely using our binary communication protocol.

This real time true average speed is internally updated for each vehicle detected over a user configured time period and then sent out over the serial port which may be captured locally or sent to a remote location via a cellular enabled data modem connected to the radar.

Additionally, our Windows based traffic statistics analyzer now features native TCP/IP connectivity to such data modems to allow the user to capture this speed from remote radars as well as retrieve the real-time histograms.

This feature can now be used for point A to point B travel time calculations, queue time measurement or "Slow traffic ahead" warning systems in many locations on the road where such measurements were not feasible with traditional side-firing radars.

For More Information about this feature or our products contact us at:

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Frequently Asked Questions (FAQ's):

Q. What is the difference between simple Doppler speed output available from any Doppler radar and "True Average Speed" in Houston Radar?

A. The Doppler speed available from a Doppler radar is simply a speed value of a single highest speed target or target with the strongest return signal. This speed will vary widely as vehicles are detected and their speed measured.

In True Average Speed mode, our radars internally track individual targets on the road simultaneously, accumulate vehicle counts over a user specified time period (e.g. 30 seconds) and then update the average speed taking into account all the traffic on the road. This gives a much more accurate picture of the traffic pattern on the road.

Q. Are there strict mounting requirements to use this feature?

A. No. Simply mount the radar at least 6 to 15 feet above or away from the road, pointing up-stream into traffic and it will track and measure the vehicle speeds on all incoming lanes. We recommend that you use this feature to monitor no more than 3 lanes of incoming traffic.

Q. How accurate is the speed measurement?

A. Since the speed is measured via the Doppler shift, the accuracy is significantly better than 1mph or 1kph. Additionally, the radar is able to know when a vehicle passes it and takes into account the cosine error generated just as the vehicle is passing the radar automatically mitigating the error introduced due to the cosine effect.

Q. Is the True Average Speed available even if I require the raw Doppler speed (e.g. for local traffic calming display purposes)?

A. Yes. You may chose to output the raw Doppler speeds over one serial port and poll for real-time histograms or the True Average Speed value over the second serial port using our binary protocol and thus have access to both features simultaneously. Please note, that the Advanced In-radar traffic statistics option must be purchased for the True Average Speed calculation to be enabled.

Q. Can the radar output lane-by-lane average speed or occupancy data?

A. No. The radar will provide a True Average Speed for all incoming lanes of traffic. It cannot distinguish between individual incoming lanes. Note that the radar will reject all outgoing traffic in the speed and count calculation.

Q. Can I simply average the raw Doppler speed over the serial port and achieve the same result? What's special about True Average Speed done inside the radar?

A. While you can certainly average the raw Doppler speed output from any Doppler radar, you will not achieve the same result. The in-radar True Average Speed is not calculated by averaging the raw Doppler speeds internally, rather by actually counting individual vehicles and then generating a count weighted average speed.

Thus, the simple average calculation performed outside the radar will miss a slow lane of traffic as the radar may prefer the faster lane and send its speed out. The True Average Speed calculation will count individual vehicles in all visible lanes taking into account different vehicle speeds thus giving a much more accurate picture of the traffic on the road.

Additionally, the simple average speed calculation will bias the result towards speeds associated with vehicles picked over a longer distance/time since more updates will be included from these vehicles whereas the True Average Speed actually counts individual vehicles and the range or time of the pickup does not influence the result.

Finally, the internal counting algorithm is able to reject to a high degree spurious pickups (e.g. swaying tree branches, snow flakes, rainfall etc.), whereas all these spurious pickups will be included in the simple average result.