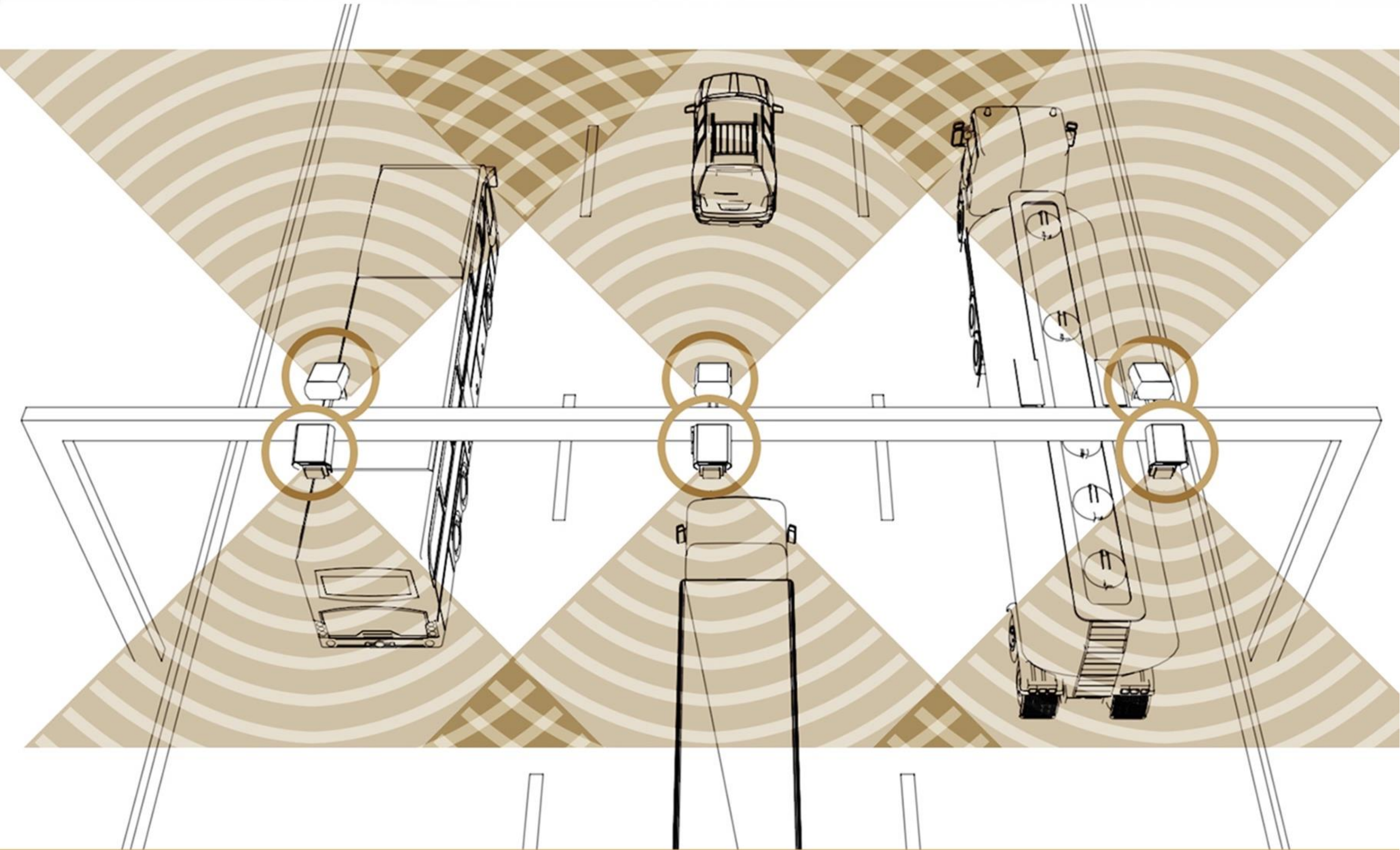
Optimizing **Speed Camera** Performance



Installation Best Practices Guide for ANPR cameras equipped with multi-lane Radar.

RELEASE DATE
05.01.2024.

Disclaimer:

This guide provides essential information for the deployment of speed camera systems provided by Adaptive Recognition. If the system is intended for issuing speeding tickets, strict adherence to these guidelines is crucial. **Failure to follow these guidelines may lead to inaccurate speed measurements and could impact the reliability of speed enforcement**. Users are responsible for ensuring compliance with local laws and regulations governing the use of speed camera systems for law enforcement purposes.

The responsibility for accurate speed measurement and proper allocation to specific vehicles rests with the System Integrator during camera and radar setup, guided by this document, the Product's Install Guide, and User Manual.

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Purpose of this Guide

This guide aims to provide clear and concise instructions for the installation of speed cameras, ensuring accurate speed measurements and optimal functionality. By following the outlined guidelines, System Integrators can be sure that the system will perform as required.

In the subsequent chapters we will list specific installation *do's* and *don'ts*, accompanied by *visual aids* and *practical examples* to facilitate a comprehensive understanding on the recommended best practices.

The guide strictly follows the guidelines of the radar manufacturer. The described limitations are all originated by using radar technology, the Vidar ANPR camera does not require these installing limitations when it is purchased without a radar!

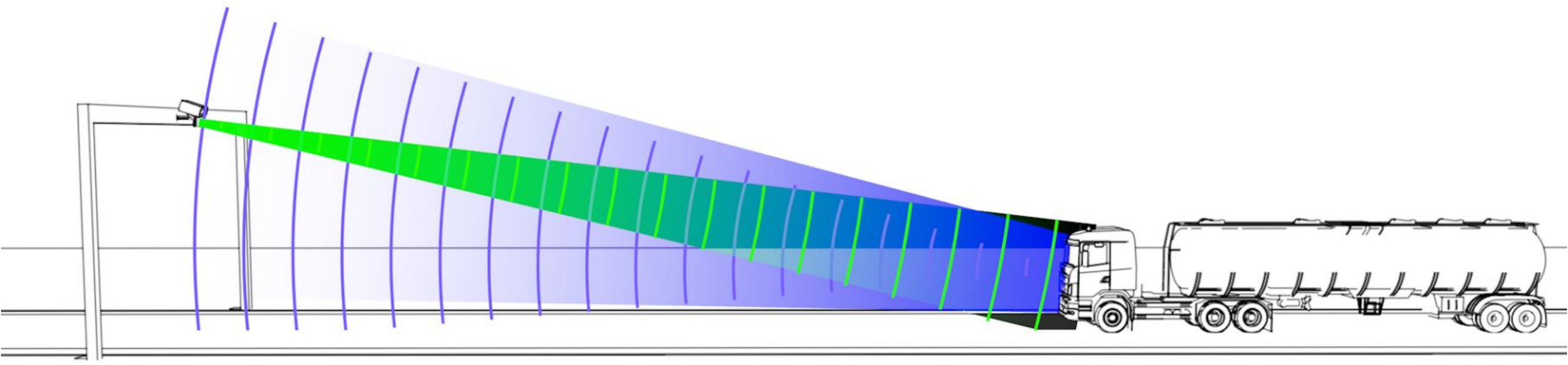
Understanding Speed Camera Technology

Speed cameras equipped with radar technology (such as Vidar Speed) play a vital role in enhancing road safety by monitoring and enforcing speed limits. It is essential to grasp the fundamental principles behind this technology to ensure the effective deployment of speed cameras.

How radar technology works

All Speed Enforcing cameras, which are equipped with radar are operating by emitting radio waves and analyzing the reflections to detect objects and calculate their speed. In the context of speed cameras, this involves emitting radar signals towards oncoming or departing vehicles, capturing the reflected signals, and using the frequency shift to determine their exact distance in a certain moment. By tracking the vehicle and capturing its precise location in time we can calculate its speed.

Since the radar analyzes the reflected signals, it is important that these signals should be as clear from noise as possible. It is crucial that radar signals reflected from vehicles do not bounce back from other terrain objects (such as larger metal sheets along the road) because these can induce a so-called ghost effect, leading to false positive events and potentially erroneous speed measurements. Both the radar and the camera actively attempt to filter out such cases, but we can only be sure that such events do not occur if we adhere to the guidelines set by the radar manufacturer, which are outlined in this guide.



General considerations for Radar Technology

The principles discussed in this guide are not specific to Vidar Speed but are applicable to radar technology in general. Understanding these considerations is crucial for optimizing the performance of any speed cameras (from any vendors) across various environments and applications.

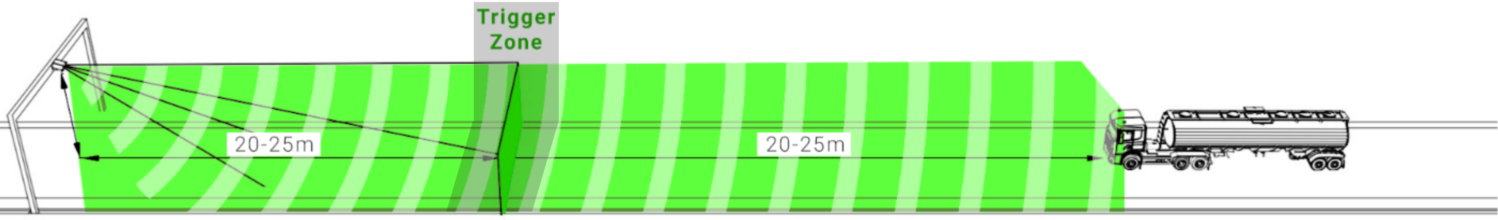
Keep in mind, that Adaptive Recognition has another Speed Enforcement solution in its portfolio, the portable S1, which operates based on LASER technology, therefor it is more forgiving on how it is installed.

Installation Best Practices – The Do's

1

Adequate Tracking Distance

One critical factor in optimizing speed camera performance is maintaining an adequate tracking distance. The radar must track vehicles for **20-25 meters [65-80 feet]** ***before*** **reaching the trigger zone** for successful detection. For optimal results, ensure a "clear field" of 50-60 meters [165-200 feet] in the monitored direction from the point of installation.



50 meters of clear, straight road section

2

Straight Road Segments

The necessity of an adequate tracking distance implies that the monitored road segment should be straight. Lane changes are not a concern in this context.

3

Clear Line of Sight

To function effectively, the radar must have an unobstructed view of the monitored road segment. Anything that would obstruct human vision, such as buildings or trees, similarly impedes the radar's ability to detect vehicles. Additionally, consider that a crossing truck on the road can also obstruct the view of approaching vehicles.

4

Proper mounting Height

Maintaining the appropriate mounting height is crucial for optimal performance. The radar's **minimum recommended installation height is 4 meters [14 feet]**. In pole-mounted installations, it is essential to have a clear view above the approaching vehicles. A lower height may result in a reduction in detection rates, particularly in more distant lanes.

5

Well-documented and measured installation

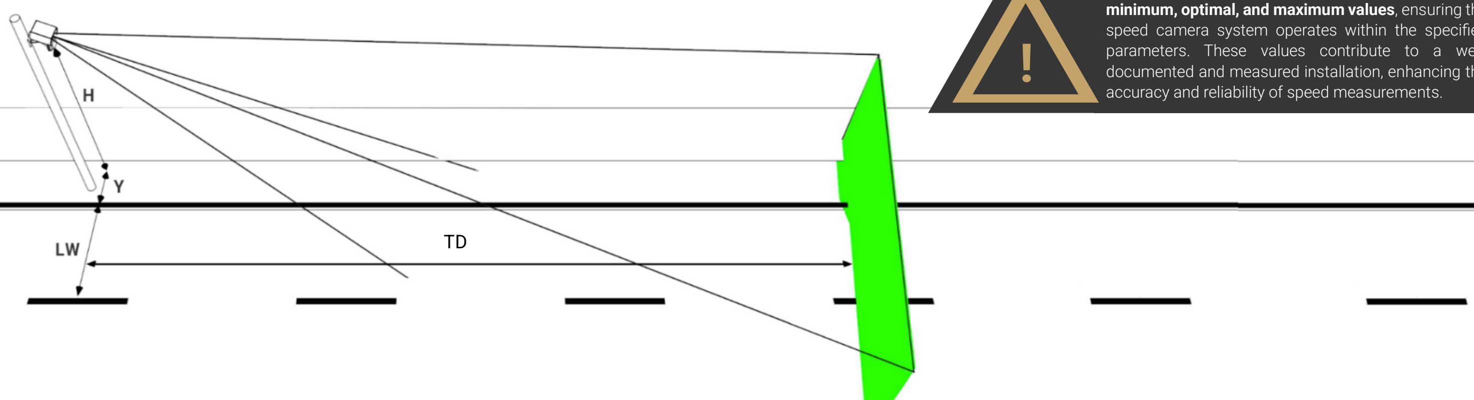
Ensuring accurate coordination between the radar's and camera's coordinate system is crucial to know when a vehicle (detected by the radar) enters the camera's field of view. Additionally, precise speed determination requires the radar to have knowledge of the exact installation parameters. Therefore, precise speed measurement requires precise installation mapping. The crucial measurements include:

- Radar installation height **relative to the monitored road segment**.
- Trigger zone distance (TD) from the camera, measured along the road.
- Camera distance from the edge of the nearest lane (Y).
- Width of a single traffic lane (LW).

!

During the installation process, it is crucial to rely on accurate measurements for optimal performance. **Avoid measuring angles** and instead focus on precise values for H (height), Y (distance from the camera to the nearest lane edge), LW (traffic lane width), and TZ (trigger zone distance along the road).

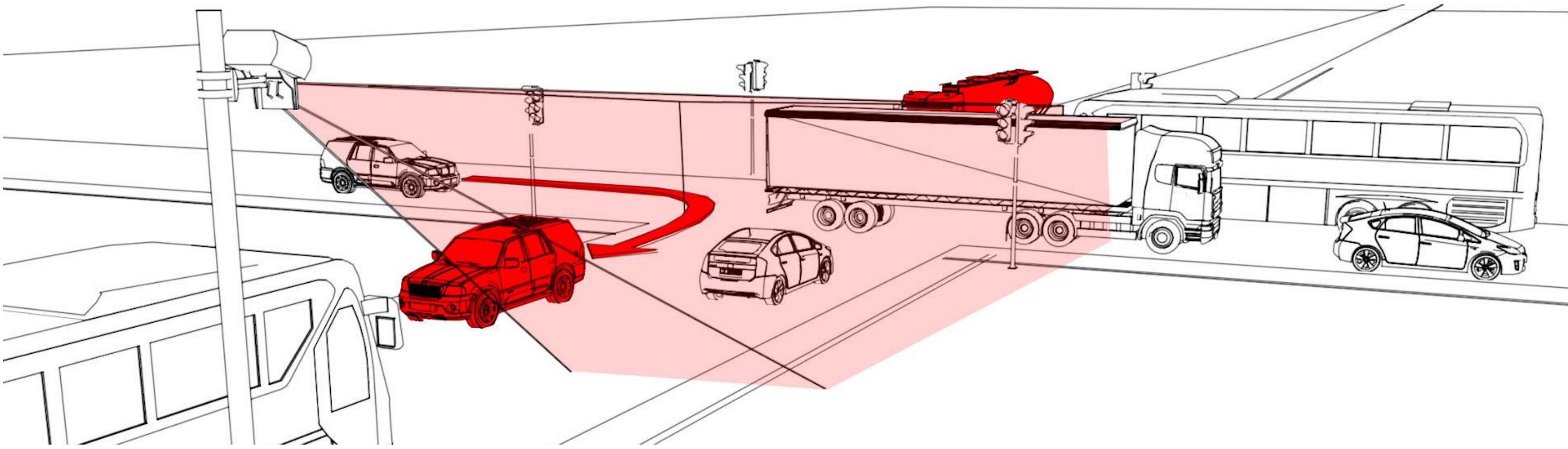
Refer to the Showcases section **for recommended minimum, optimal, and maximum values**, ensuring the speed camera system operates within the specified parameters. These values contribute to a well-documented and measured installation, enhancing the accuracy and reliability of speed measurements.



Installation Pitfalls to Avoid – The Don'ts

1 Curves and intersections

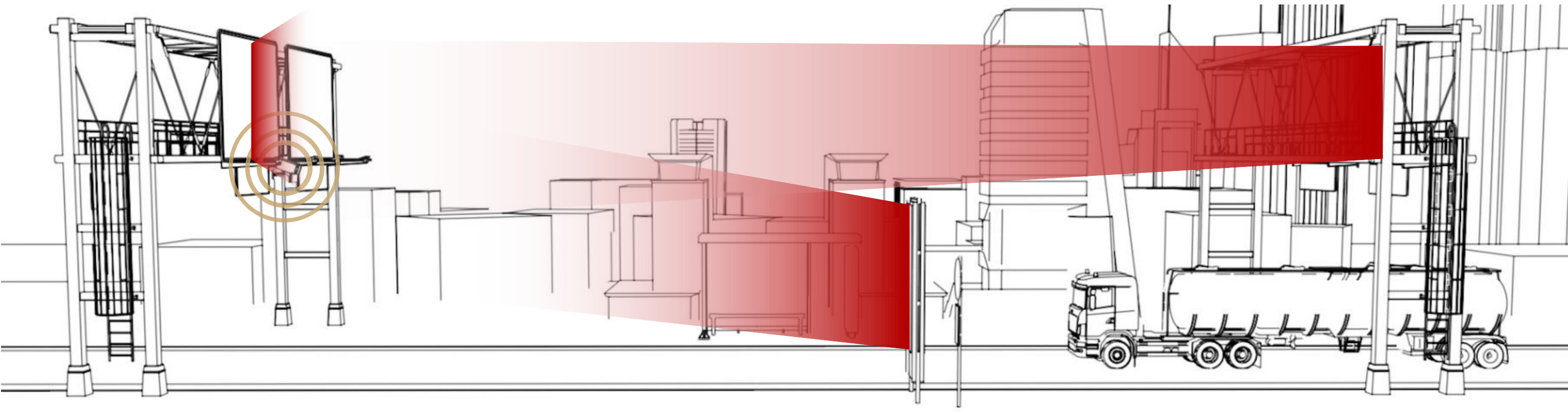
Selecting an inappropriate road segment can compromise the effectiveness of speed enforcement. Avoid curvy roads and intersections as the radar may struggle to accurately track vehicles. Opt instead for straight segments to ensure the required tracking distance before the trigger zone, enhancing detection reliability.



Note, how the radar might miss the incoming semi-truck, potentially hidden by the crossing traffic in the image below. The turning SUV enters the radar's view within the minimum tracking range, introducing the possibility of the radar failing to detect it.

2 Metallic Obstructions

Be cautious of substantial metal structures near the road, like billboards or bigger road signs as they act like a mirror, and might reflect back the reflected radar waves from vehicles generating "ghost" events. Even when positioned behind the camera, these objects can reflect the radar waves in an unwanted way. They may interfere with radar signals, potentially compromising the accuracy of speed measurements. Ensure a clear line of sight for the camera by minimizing the presence of such metallic obstructions in its vicinity.



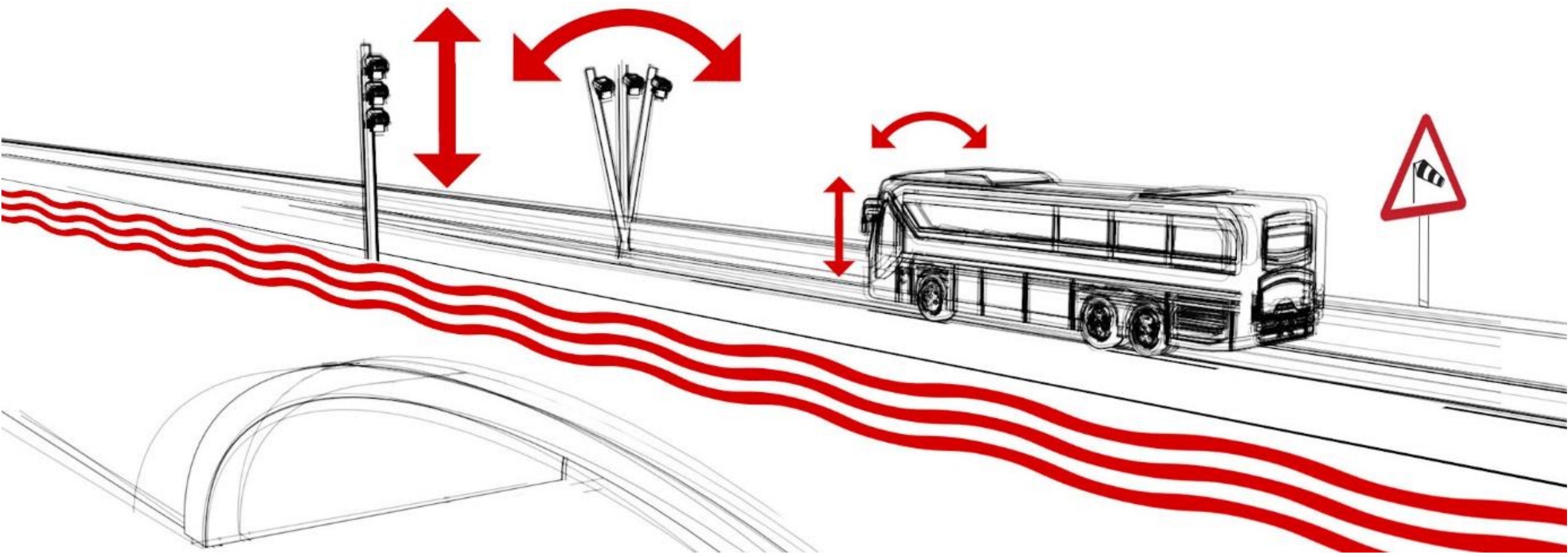
The camera (highlighted with golden circles) mounted beneath a highway road sign. The radar reflection from an approaching vehicle bounces off the sign, creating a second "virtual" image (ghost event) of the vehicle. This scenario can lead to unintended detections and potential inaccuracies.

3 Other objects which can cause interference or radar blindness

Be cautious of objects that can obstruct the radar's view or cause interference. Buildings, trees and other obstacles can create "radar blindness" zones, preventing the radar's ability to detect the vehicles accurately.

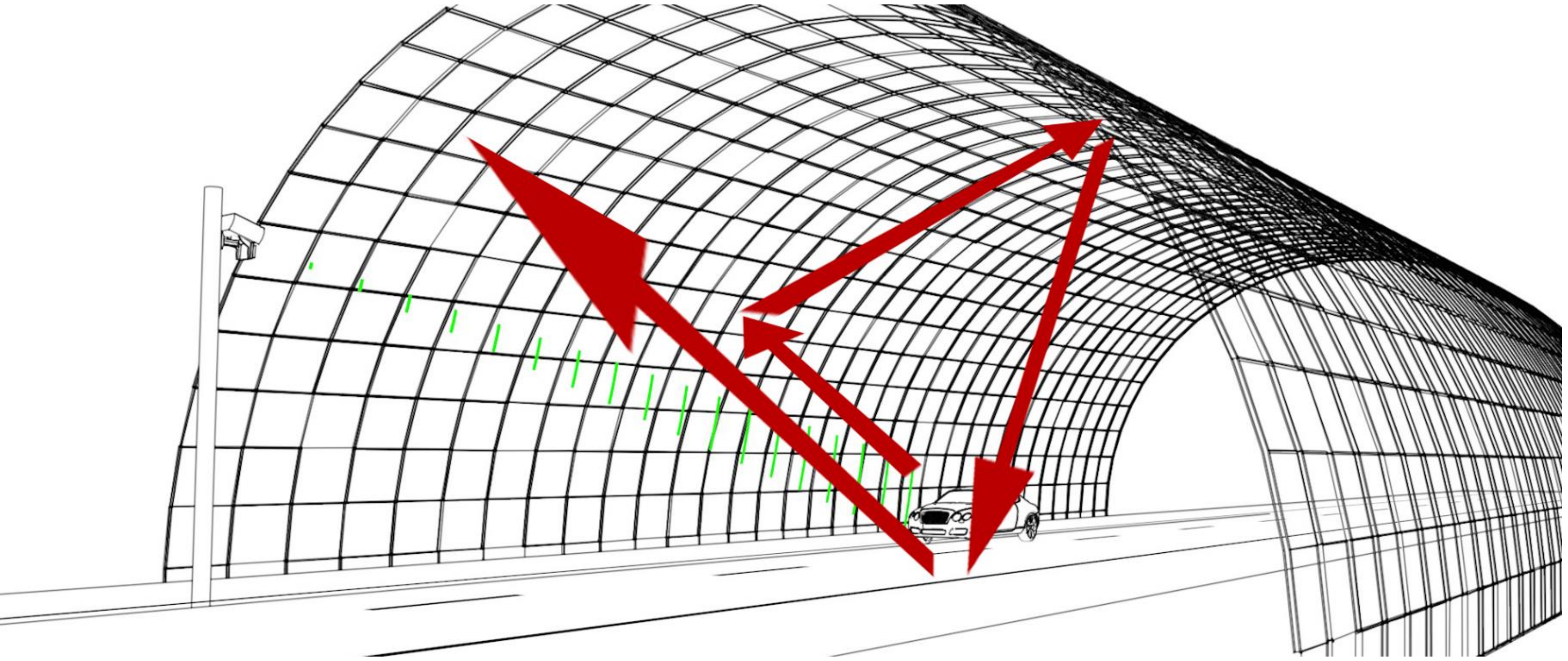
4 Sturdy installation site

Avoid locations prone to ground vibration or where the device would "swing", as this can impact the speed measurements. Choose solid and secure mounting points to minimize camera movement. The camera's gyroscope automatically flags all events as "non-certified" after any significant movement, requiring manual clearance through the camera's GUI (this feature was added to firmware V2023.11.14-1121 so make sure you have this version or newer).



5 Avoid bridges, tunnels and overhead electrical cables

The radar's manufacturer highlights further environments where it is not recommended to install the radar. You should avoid measuring speed in a tunnel, pointing the device under a bridge or where overhead electrical cables are present, since these all may cause inaccuracies in speed measurement.



By steering clear of these pitfalls, you contribute to the optimal functionality of your speed camera, minimizing the risk of inaccuracies and ensuring reliable speed enforcement. Always prioritize clear sightlines, stable installations and interference-free environments for optimal results.

Ideal Speed Camera Setup – Showcases

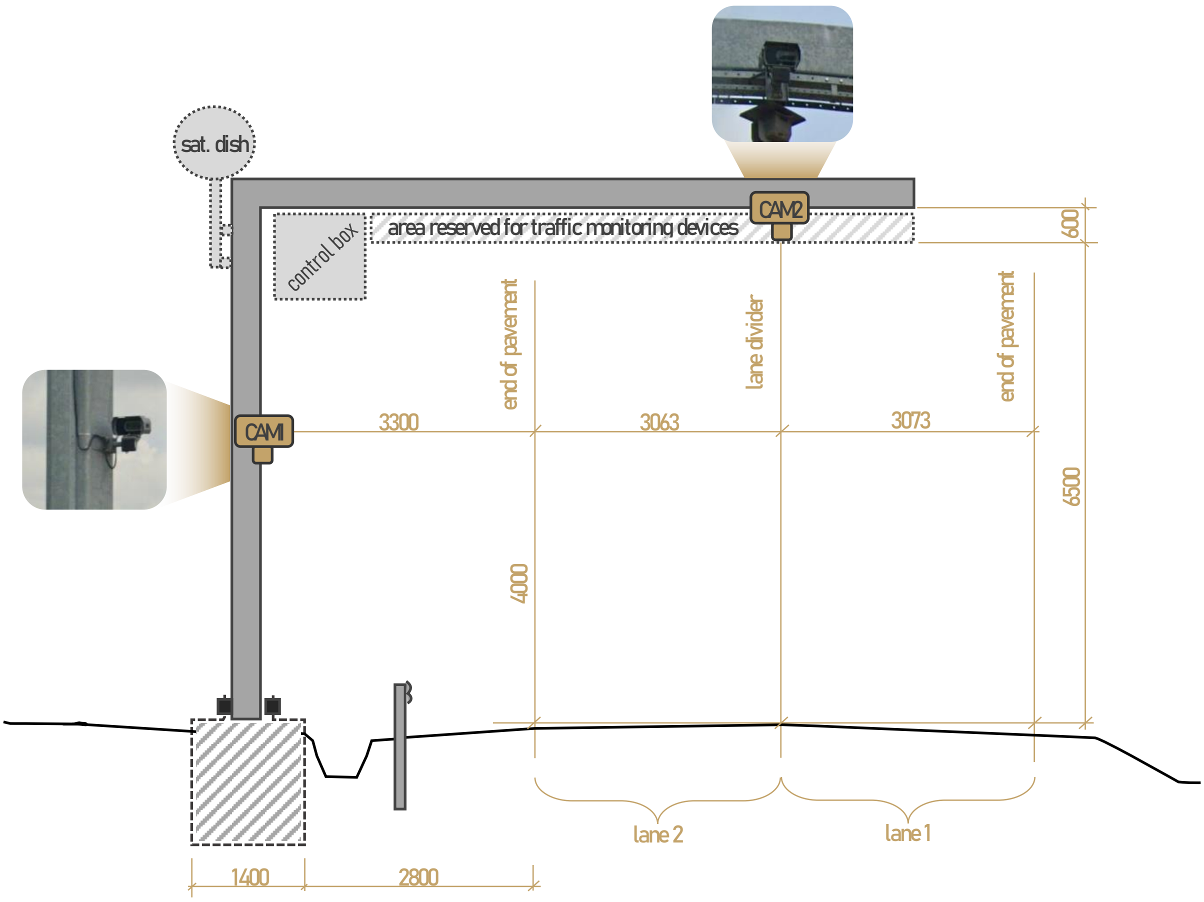
In this segment, we present our test site featuring two Vidar Speed cameras strategically installed for optimal performance. Also, at the end of this chapter, you can find the Recommended Installation Dimensions and Guidelines. We truly recommend to take a look at the table since maximum detection rate and accuracy requires the radar to be mounted optimally.

The reference site

We would like to showcase our test site, where two Vidar Speed cameras are installed. One camera is positioned overhead, mounted on the crossbar of the gantry, while the other is installed on the side, replicating a typical pole setup. Both cameras have been precisely set up following the guidelines outlined earlier, providing a useful reference for your installations.

The test site is accessible for inspection on Google Maps via the following link: 47.585435, 18.750897. These cameras are actively monitoring a 2-lane arterial road, each overseeing both lanes. The half-gantry serves as the hub for traffic monitoring devices (cameras and LIDAR sensors), housing a control box, which facilitates a PC, and the Ethernet and Power connections. An antenna is installed for seamless connectivity with the backend.

Refer to the image below for exact measurements (in millimeters) of the road-segment and the gantry structure. The "pole"-mounted camera is labeled as "CAM1", and the overhead camera is identified as "CAM2".



The gantry stands 3.3 meters (11 feet) away from the edge of the road, with each lane measuring just over 3 meters (10 feet) in width. CAM1 is mounted at a height of 4 meters (13 feet) above the road surface, while CAM2 is installed 6.5 meters (21 feet) high. Both cameras face towards the south-southwest, effectively monitoring both inbound and outbound traffic. The monitored road section is straight for roughly 160 meters (525 feet). The trigger zone is around 30 meters (100 feet) away from the gantry.

The installation site is carefully chosen to ensure an unobstructed view. No significant metal objects or landmarks are present that could impede the visibility of vehicles, enhancing the accuracy of speed measurements.

Reference Images

Here, we present actual images from our test gantry, showcasing the setup with CAM1 (pole) and CAM2 (gantry). The camera images provide perspectives from both devices' main (ANPR) and secondary (overview) sensors, offering valuable insights into the real-world application of our Speed Camera system. *Please note, that parts of these images were modified to comply Data Privacy standards (the license plates, the driver and other markings were partly blurred).*

The images above show the test gantry referenced from its two sides. On the left picture (north-northeast view) the two cameras (CAM1 and CAM2) marked with golden rings are facing you. The second image (south-southwest view) illustrates the perspective of the cameras, with the road section highlighted in gold representing the monitored segment. The red highlight marks the Trigger Zone.

*These images offer views captured by the cameras during the same event. On the left is CAM1 (pole), and on the right is CAM2 (gantry). It's important to note that **while the camera effectively monitors only the Trigger Zone, the radar covers a more extensive road segment, both before and after the Trigger Zone. Therefore, the entire segment must be straight and unobstructed.** The Trigger Zone should be around 1/3rd of the height of the image (or as close to the bottom as possible).*


The Overview images are illustrating better, where the vehicles are located when they enter the Trigger Zone. The Trigger Zone is exactly at the optimal point, 30 meters (98 feet) away from the gantry.

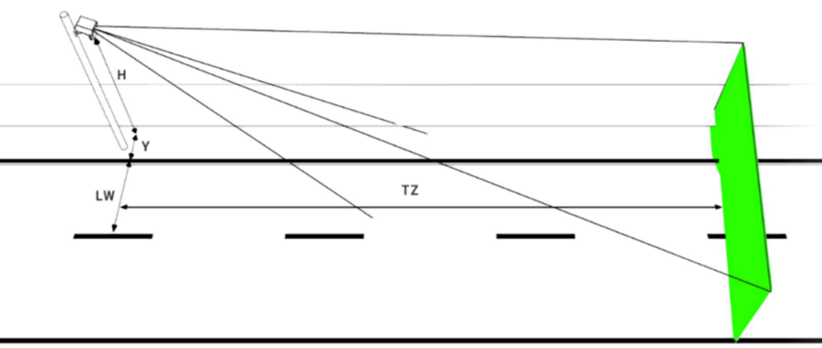
Installation dimensions and Guidelines

This following table provides recommended, minimum, and maximum values for key installation dimensions of the Vidar Speed camera, including the mounting height of the camera, the distance from the road, and trigger distance. **It is crucial to handle the minimum and maximum values thoughtfully, ensuring that extreme values for one dimension are balanced with caution in others.** Optimal performance is achieved by carefully considering the interplay of these dimensions during installation. Always strive for having an installation as close to the recommended as possible!

You can find the installation dimensions for the showcased cameras, CAM1 and CAM2 as well in the table to provide a guideline regarding the installation.

	Recommended	Minimum	Maximum	CAM1 (pole)	CAM2 (gantry)
Device placement	Overhead	-	-	Transversal	Overhead
Number of lanes covered△	-	1	2△	2	2
Lane width□ (LW)	3 – 3.5 m [10 – 11.5 feet]	-	-	3 m [10 feet]	3 m [10 feet]
Vertical offset (H)	7 m [23 feet]	4 m [13 feet]	10 m [33 feet]	4 m [13 feet]	6.9 m
Horizontal offset (Y)	0 m [0 feet] (gantry) 2 m [6.5 feet] (pole)	0 m [0 feet]	4 m [13 feet]	3 m [10 feet]	0 m [0 feet]
Elevation● (Tilt)	-13°	-20°	-6°	-7.7°	-13°
Azimuth● (Pan)	0° (gantry) 4° (pole)	0°	15°	11.3°	0°
Trigger Distance (TD)	30 m [100 feet]	15 / 25 m◇ [50 / 82 feet]◇	40 m [131 feet]	30 m [100 feet]	30 m [100 feet]

△: per camera. 4-lane version available for certain projects
□: vehicles must be in separate lanes when entering the Trigger Zone
●: calculate this value, do not measure pan or tilt when installing
◇: approaching traffic min. 15 meters, leaving traffic min. 25 meters



During the installation process, **it is crucial to rely on accurate measurements** for optimal performance. **Avoid measuring angles** and instead focus on precise values for H (height), Y (distance from the camera to the nearest lane edge), LW (traffic lane width), and TZ (trigger zone distance along the road). Remember: the speed measurment accuracy relies on the installation

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For detailed information about your hardware, the latest software updates, and user manuals, please visit our Documents Site at https://adaptiverecognition.com/doc.

Our Adaptive Recognition Hungary Technical Support System (ATSS) is tailored to deliver swift and proficient assistance, ensuring you can promptly resume your business operations.

New Users:

If you haven't accessed ATSS yet but wish to open a ticket, kindly reach out to your dedicated sales representatives, who will assist in registering you in our Support System. More details are available here.

Returning Users:

All registered ATSS customers receive a personalized access link via email. If you have received a confirmation message from ATSS, it contains the embedded link for secure entry into the support site. In case you can't locate your email, our sales representatives are ready to assist.