LPR and Traffic Analytics cameras installation guide

Technical Manual

www.neurallabs.net

Purpose

This document is addressed to clients and installers, and its purpose is to explain the hardware and installation requirements for the proper license plate reading and traffic analytics performance developed by Neural Labs.

LPR installation guide

In order to obtain the maximum recognition rate, LPR cameras must be installed properly to capture license plate images that meet the required quality.

There are three aspects that must be taken into account when installing LPR cameras: minimum size of the plate, scene lighting and camera angle. In this section we explain how the cameras must be installed and which are the most common mistakes.

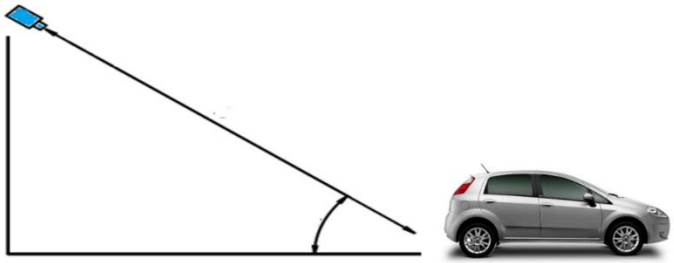
Installation Requirements

License plate size

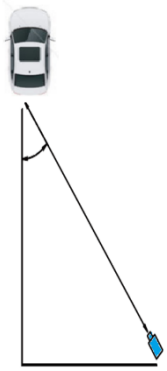
Inside of the image, the plates must be formed by characters, whose average height must be 20 to 70 pixels, being 25 pixels a good reference value. While VPAR recognition engine is able to recognise 10 pixel height letters, in many countries there are certain characters highly confusing when in such sizes. In addition, camera sensitivity affects too. For countries where different character sizes are found, this fact must be taken into account in order to include the smaller characters in the detection range.

Camera Positioning

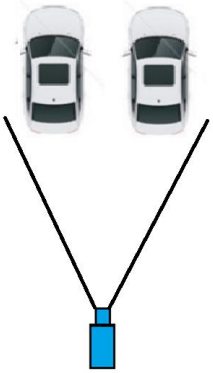
Recommended vertical angles are approximately 20º. The maximum recommended value is 35º.



Recommended horizontal angles are approximately 20º. The maximum recommended value is 35º.



In case of installation in gates up to 2 lanes, camera should be as centered as possible between the two lanes (recommended position).



The angle between the plates and the X axis of the scene must be inferior to 25º.

Recommended Parametrization

It should be mentioned that the following recommendations and specifications, are general and may vary depending on the brand and model of the selected camera and the country they are to be installed.

Free Flow (> 30 Km/H)

Mounted on a Pole

Common scenario: up to 2 lanes

Sensor size: 1 MP per lane (highway).

Height of camera on pole: 4 - 6 meters

Shutter setting (Shutter speed):

30 - 80 km/h: min. 1/500

80 - 120 km/h: min. 1/1000

> 120 km/h: min. 1/2000

Processing time of image **without** a plate: 15 ms on average.

Processing time of image **with** a plate: 50 ms on average.

Mounted on a Tripod

Common scenario: Up to 2 lanes

Sensor size: 1 MP per lane (highway).

Height of camera on pole: 1 - 2 meters

Shutter setting (Shutter speed):

30 - 80 km/h: min. 1/500

80 - 120 km/h: min. 1/1000

> 120 km/h: min. 1/2000

Processing time of image **without** a plate: 15 ms on average.

Processing time of image **with** a plate: 50 on average.

Parking

Common Scenario

Common scenario: 1 lane

Sensor size: VGA o 1 MP

Height of camera on pole: 1 - 1.5 metros

Distance from camera to the plate: 3 - 5 metros.

Shutter setting (Shutter speed): 1/250 - 1/500, depending on the lighting.

Processing time of image **without** a plate: 10 ms on average.

Processing time of image **with** a plate: 30 ms on average.

Examples

Here are some examples of suitable images in different scenarios from several countries.

Parking / Chile / Indoors / Hikvision camera

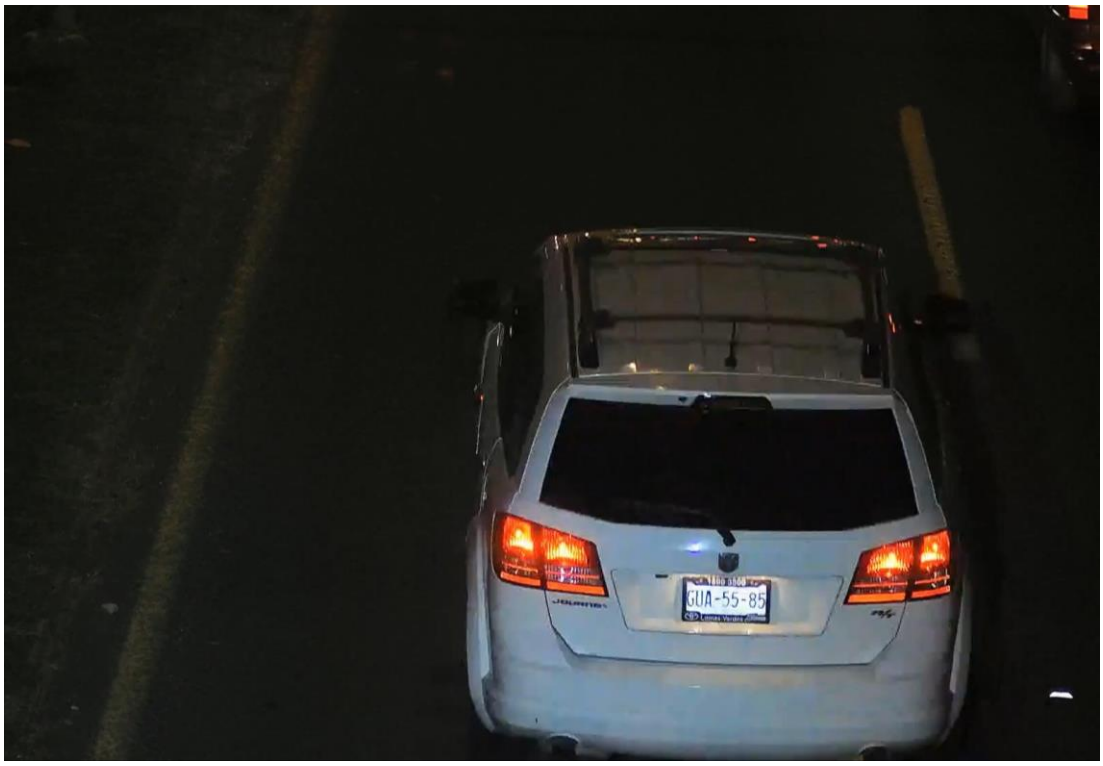
Parking / Chile / Indoors / Hikvision camera / Closed angle.

Road / Chile / Bosch camera / Daylight

Road / Chile / Bosch camera / Night

Highway/ Argentina / IndigoVision camera / Daylight

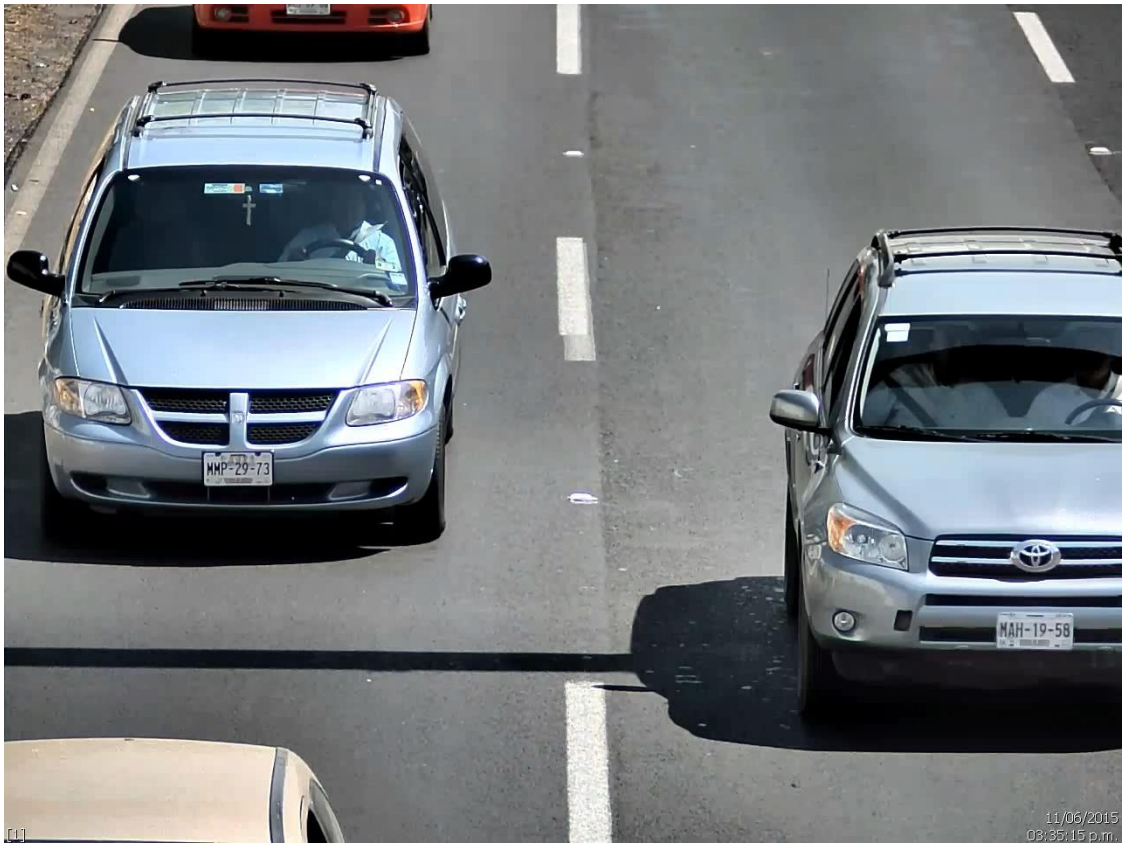
Highway / México / Dahua camera / Night / White light



Highway / México / Dahua camera / Daylight / White light

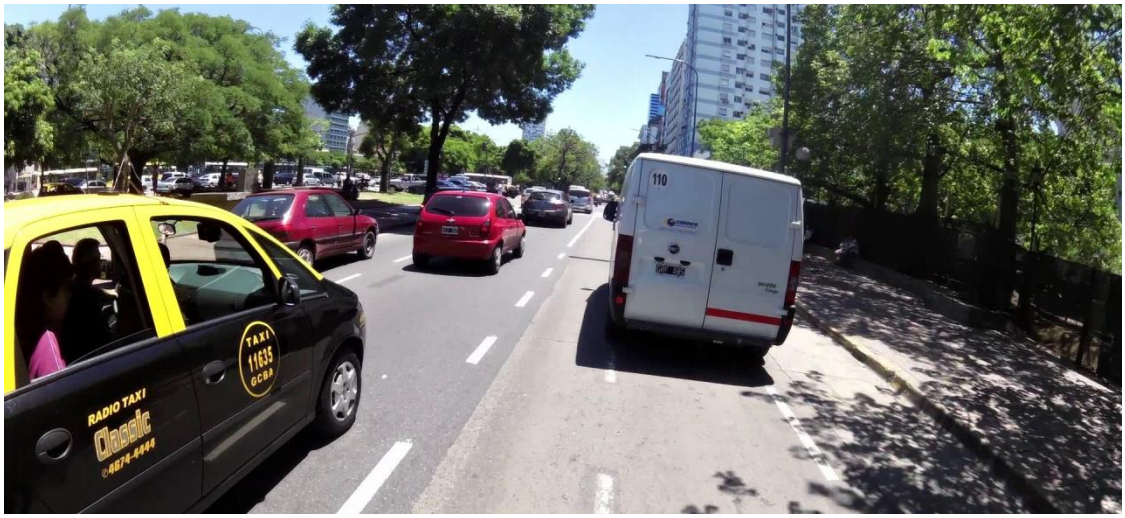
Urban / Argentina / PTZ Bosch camera / Daylight

Highway / México / Two lanes / Dahua camera / Daylight

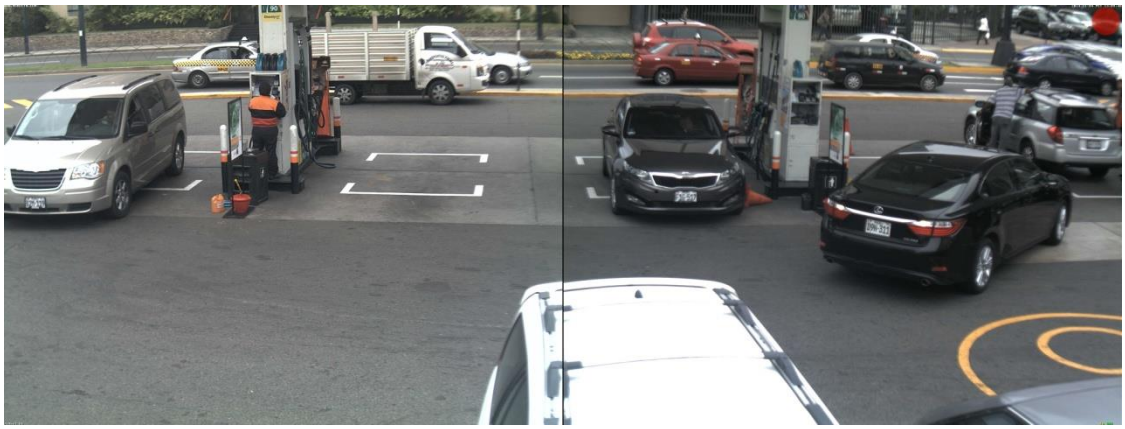


Urban / Peru / On board LPR camera / Daylight

Urban / Argentina / GoPro camera / On board



Gas station / Peru / Mobotix camera

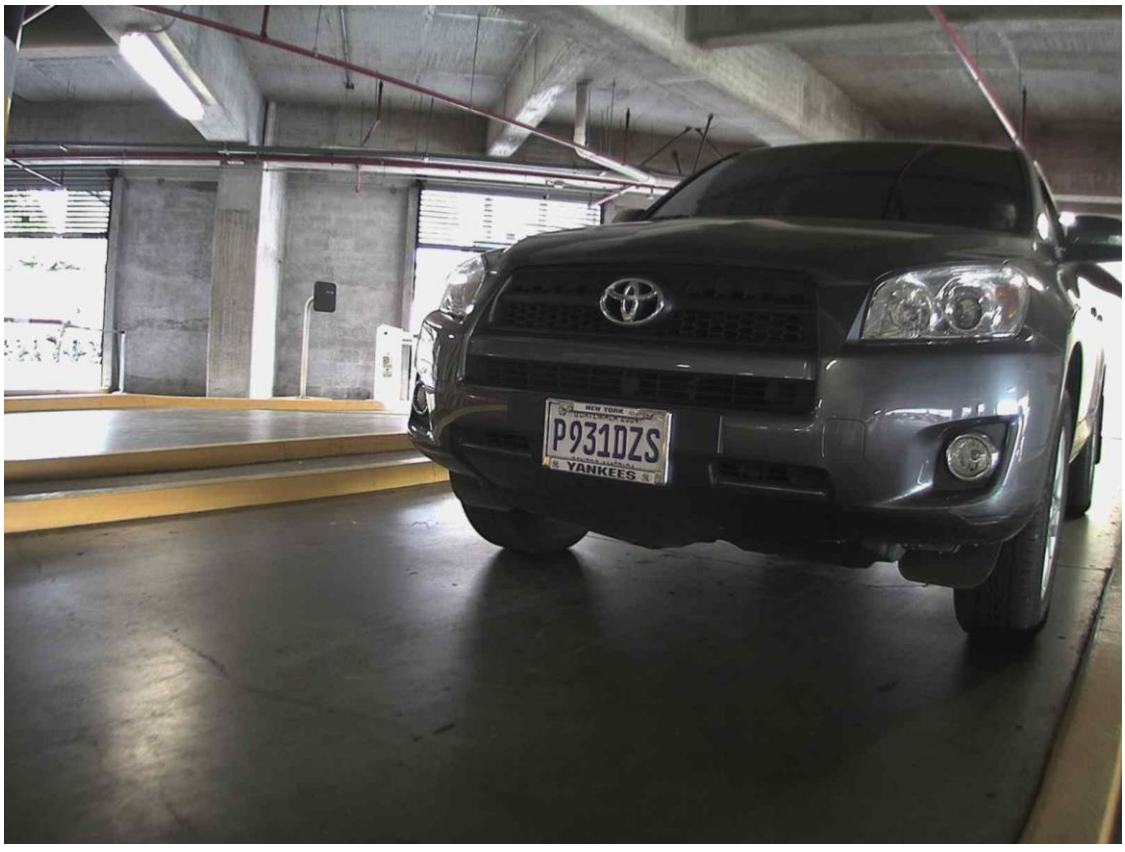


Urban / Peru / On board LPR camera / Night

Public measured parking / Argentina / Hikvision camera / Daylight

Urban / Brasil / On board LPR camera

Parking / Guatemala / Axis camera

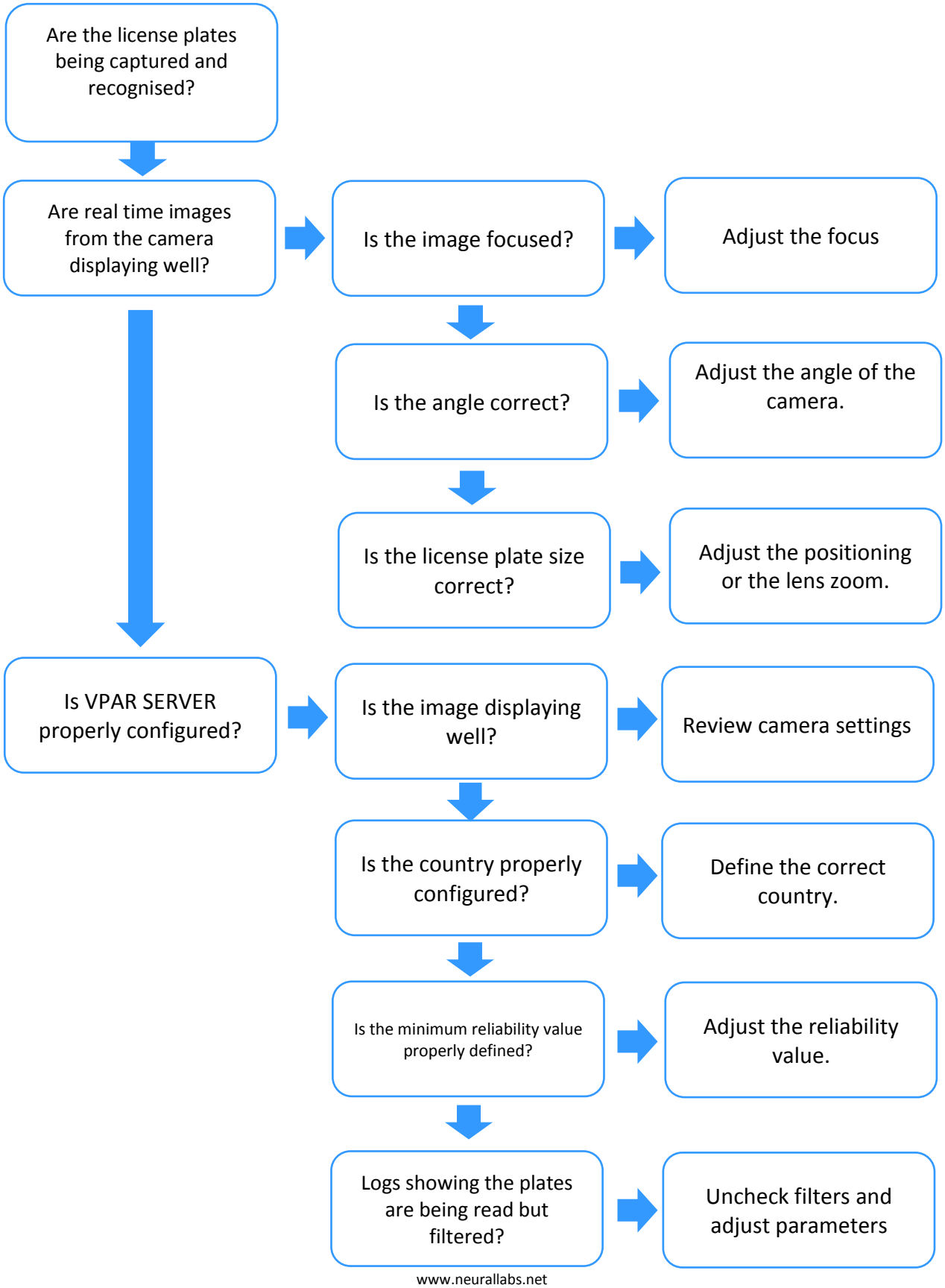


Parking / USA / Axis camera / Black and white

Parking / USA / Axis camera / Color image

FAQ

To solve common issues, we recommend to use the following diagram as a reference.



Installation Guide for Traffic Analytics

The video analytics Neural Labs has developed, have as main purpose to provide additional data of the vehicle that is being analysed, so the client can have more complete information.

Camera calibration

For the proper functioning of traffic analytics, cameras need a previous calibration. The steps to calibrate the cameras are explained in the VPAR SERVER user manual. Please check the requirements for this procedure.

2D Calibration

This calibration is used when precise information on the position and size of the vehicle isn't needed.

No special camera is needed. To perform the 2D calibration in VPAR SERVER, just mark 4 points to obtain an idea of the image perspective.

3D Calibration

This calibration is used for all the analytics that require an approximation in three dimensions. It can only be done with cameras that have been approved by Neural Labs, which are the models appearing on VPAR SERVER at the moment of calibration.

Fixed or varifocal lenses can be used. In both cases, focal distance shouldn't be inferior to **20mm.**

Cameras must be installed at a **minimum height of 4 meters above the ground.**

You can work with the different resolutions admitted by the camera, but always respecting the sensor's aspect ratio. Here's an example:

IDS UEYE 5240CP camera

- 2/3 sensor. Size: 6.784 x 5.427 mm
- Sensor Aspect Ratio: 1.25
- Maximum resolution: 1280 x 1024 pixels
- Image Aspect Ratio at maximum resolution: 1.25
- All image resizing must maintain this aspect ratio.

Right Aspect Ratio

Wrong Aspect Ratio

To perform 3D calibration, it is necessary to have real measurements of the installation (a calibration pattern is the suitable tool). This is specified on VPAR SERVER at the moment of calibrating the camera, depending on the type of lens (fixed or varifocal).

Once the camera is calibrated, it is very important not to change the camera position or its orientation, since it would be necessary to calibrate again.

Another important consideration is, for many analytics it is necessary to process two images per vehicle. For this reason, camera selection, lens and configuration of the installation must be done making sure the frame-rate is enough to capture the vehicle in at least two different positions, as the vehicle moves.

Calibration	Camera	Lens	Height	Installation	To consider
2D	-	-	-	-	-
3D	Approved	> 20 mm	> 4 m	Calibration pattern	Keep aspect ratio

Video Analytics

Direction Detection

2D calibration is needed for this analytic. At least two frames per vehicle will be needed.

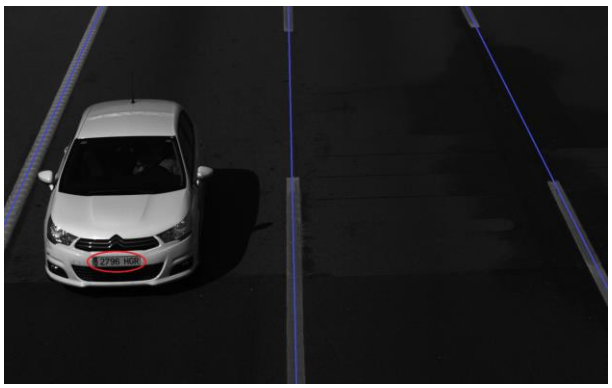
Speed Calculation

This analytic requires 3D calibration. At least two frames per vehicle will be needed. In case we want a more accurate speed measurement, it will be necessary to work with cameras that can provide the exact time (timestamp) of each captured frame. When this analytic is activated, the Direction detection analytic will activate automatically, with a more accurate calculation, using 3D approximations.

To determine speed and direction, 2 frames are be needed.

Lane Detection

For this analytic, both types of calibration can be used. For frontal installations, with no image perspective, 2D calibration will be enough, but if we need to work with side image perspective, it is recommended to use 3D calibration. It is necessary just one frame to use this analytic.



2D calibration is enough

3D calibration is needed

Vehicle classification

For this analytic it is necessary to use 3D calibration, since it classifies by detecting the size of vehicles. At least two frames per vehicle are necessary. Vehicles must be moving also.

To determine the type of vehicle, 2 frames are necessary. Also, vehicles must be moving.

Classification can be performed only if the front or back of the vehicle is fully displayed in the image.

Full vehicle must be displayed

Vehicle musn’t appear cropped

It is important to keep in mind, that for the optimal functioning of vehicle classification, lane detection must be activated also.

The following table shows a summary of the requirements for each video analytic.

Video analytic	Calibration	Frames needed	To consider
Direction detection	2D	2	-
Speed Calculation	3D	2	Use Timestamp for precise calculation
Lane Detection	2D / 3D	1	-
Vehicle classification	3D	2	Front or back of vehicle must be fully captured. Lane detection must be activated also.