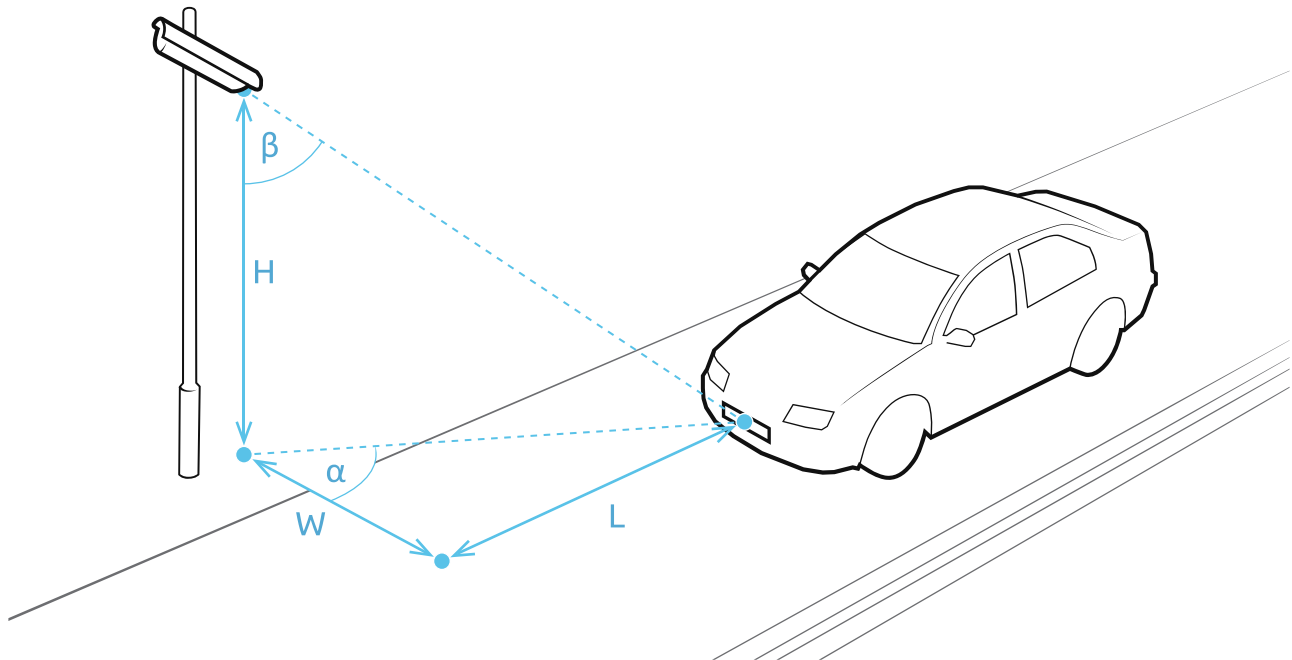


ANPR camera configuration

Version EN 4.0.3 released on Feb 16, 2025.



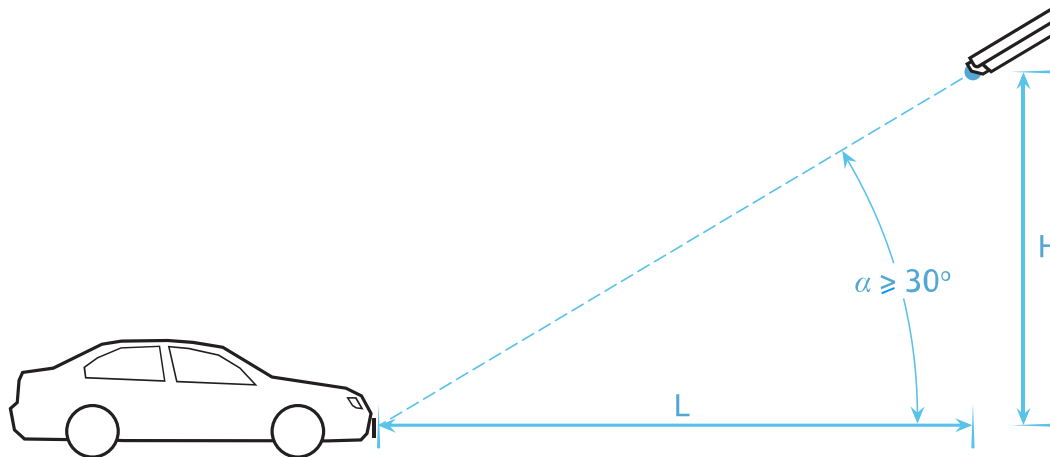
A procedure for installing and optimally setting up an ANPR camera to ensure that the results of ANPR and MMR algorithms are of the highest quality.

1. Position

When selecting a mounting point for an ANPR camera, consider the guidelines described in the following subsections.

1.1. Height

The position of the camera should be chosen so that the movement of the license plate can be observed as the vehicle passes by. Therefore, it is recommended that the camera be mounted at a height slightly above the roof of the vehicle:



Mounting height H depends on the availability of mounting structures, and in practice this means:

$$2.0 \text{ m} \leq H \leq 10.0 \text{ m}$$

Warning

Mounting the camera too low (e.g., at the level of the vehicle's roof) will cause the camera to be blinded at night by the car's headlights, and will also make it impossible to analyze the vehicle's movement (e.g., detecting direction or determining speed).

1.2. Distance

The distance L from the camera to the detection line (see point [Detection line](#)) is directly derived from the installation height H . The optimum distance L is the distance for which the angle (α) between the optical axis of the camera and the path plane is 22.5° .

For example, for the mounting height $H = 6 \text{ m}$ can be calculated:

$$L = H \cdot \cot(\alpha) = 6 \cdot \cot(22.5^\circ) \approx 6 \cdot 2.4 = 14.5 \text{ m}$$

The angle of (α) can be adjusted to the conditions of a particular measurement system, but should be within the range:

$$15^\circ \leq \alpha \leq 30^\circ$$

Warning

If the angle (α) is too small ($< 15^\circ$), overshadowing of vehicles driving behind one another may occur. If the angle (α) is too large ($> 30^\circ$), the geometry of the license plate will be disturbed – and at night, the light from the infrared illuminator will not reflect properly, impairing vehicle detection.

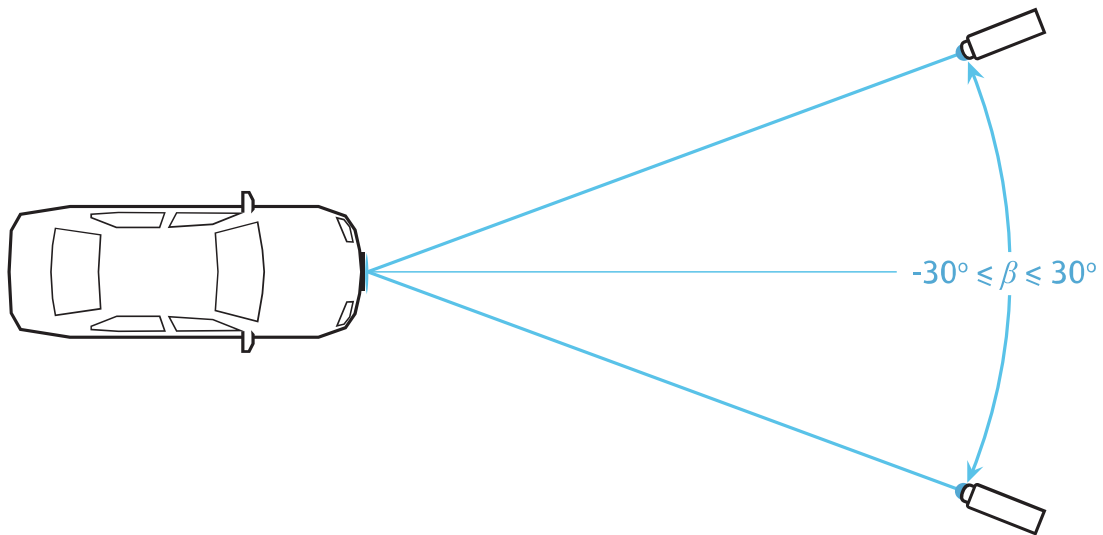
The following table indicates the optimal distance L_{opt} with respect to the camera mounting height. For the indicated height, the minimum and maximum distance L resulting from angle constraints are also indicated:

Height <i>H</i>	Distance min. <i>L_{min}</i>	Distance opt. <i>L_{opt}</i>	Distance max. <i>L_{max}</i>
2.0 m (6.6 ft)	3.5 m (11.5 ft)	4.8 m (15.7 ft)	7.5 m (24.6 ft)
2.5 m (8.2 ft)	4.3 m (14.1 ft)	6.0 m (19.7 ft)	9.3 m (30.5 ft)
3.0 m (9.8 ft)	5.2 m (17.1 ft)	7.2 m (23.6 ft)	11.2 m (36.7 ft)
3.5 m (11.5 ft)	6.1 m (20.0 ft)	8.4 m (27.6 ft)	13.1 m (43.0 ft)
4.0 m (13.1 ft)	6.9 m (22.6 ft)	9.7 m (31.8 ft)	14.9 m (48.9 ft)
4.5 m (14.8 ft)	7.8 m (25.6 ft)	10.9 m (35.7 ft)	16.8 m (55.1 ft)
5.0 m (16.4 ft)	8.7 m (28.5 ft)	12.1 m (39.7 ft)	18.7 m (61.4 ft)
5.5 m (18.0 ft)	9.6 m (31.5 ft)	13.3 m (43.6 ft)	20.6 m (67.6 ft)
6.0 m (19.7 ft)	10.4 m (34.1 ft)	14.5 m (47.6 ft)	22.4 m (73.5 ft)
6.5 m (21.3 ft)	11.3 m (37.1 ft)	15.7 m (51.5 ft)	24.3 m (79.7 ft)
7.0 m (23.0 ft)	12.2 m (40.0 ft)	16.9 m (55.5 ft)	26.2 m (86.0 ft)
7.5 m (24.6 ft)	13.1 m (43.0 ft)	18.1 m (59.4 ft)	28.1 m (92.2 ft)
8.0 m (26.2 ft)	13.9 m (45.6 ft)	19.3 m (63.4 ft)	29.9 m (98.1 ft)
8.5 m (27.9 ft)	14.8 m (48.6 ft)	20.5 m (67.3 ft)	31.8 m (104.3 ft)
9.0 m (29.5 ft)	15.7 m (51.5 ft)	21.7 m (71.2 ft)	33.7 m (110.6 ft)
9.5 m (31.1 ft)	16.6 m (54.5 ft)	22.9 m (75.2 ft)	35.5 m (116.5 ft)
10.0 m (32.8 ft)	17.4 m (57.1 ft)	24.1 m (79.1 ft)	37.4 m (122.7 ft)

To ensure reliable recognition, the focal length of the camera lens should be sufficient to achieve the required number of pixels for the character (see [Character size](#)).

1.3. Angle

The ANPR camera can be mounted in the lane or at the edge of the lane:



It is important that the horizontal angle β between the optical axis of the camera and the axis of the road is not greater than 30° :

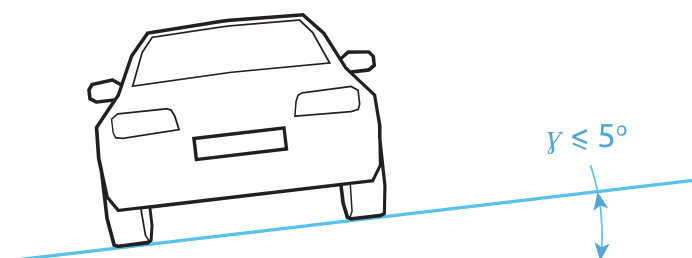
$$-30^\circ \leq \beta \leq +30^\circ$$

⚠ Warning

If the β is outside the indicated range, the image distortion may result in poor detection quality (the characters on the license plate will be too narrow), and the IR illumination will not be adequate (too little reflected light).

1.4. Tilt

When setting up the ANPR camera, pay attention to proper leveling - the longer edge of the license plate should be parallel to the horizontal edge of the camera's field of view:



It is recommended that the angle of the γ be within the range of $\pm 5^\circ$, but it must be within the range:

$$-30^\circ \leq \gamma \leq +30^\circ$$

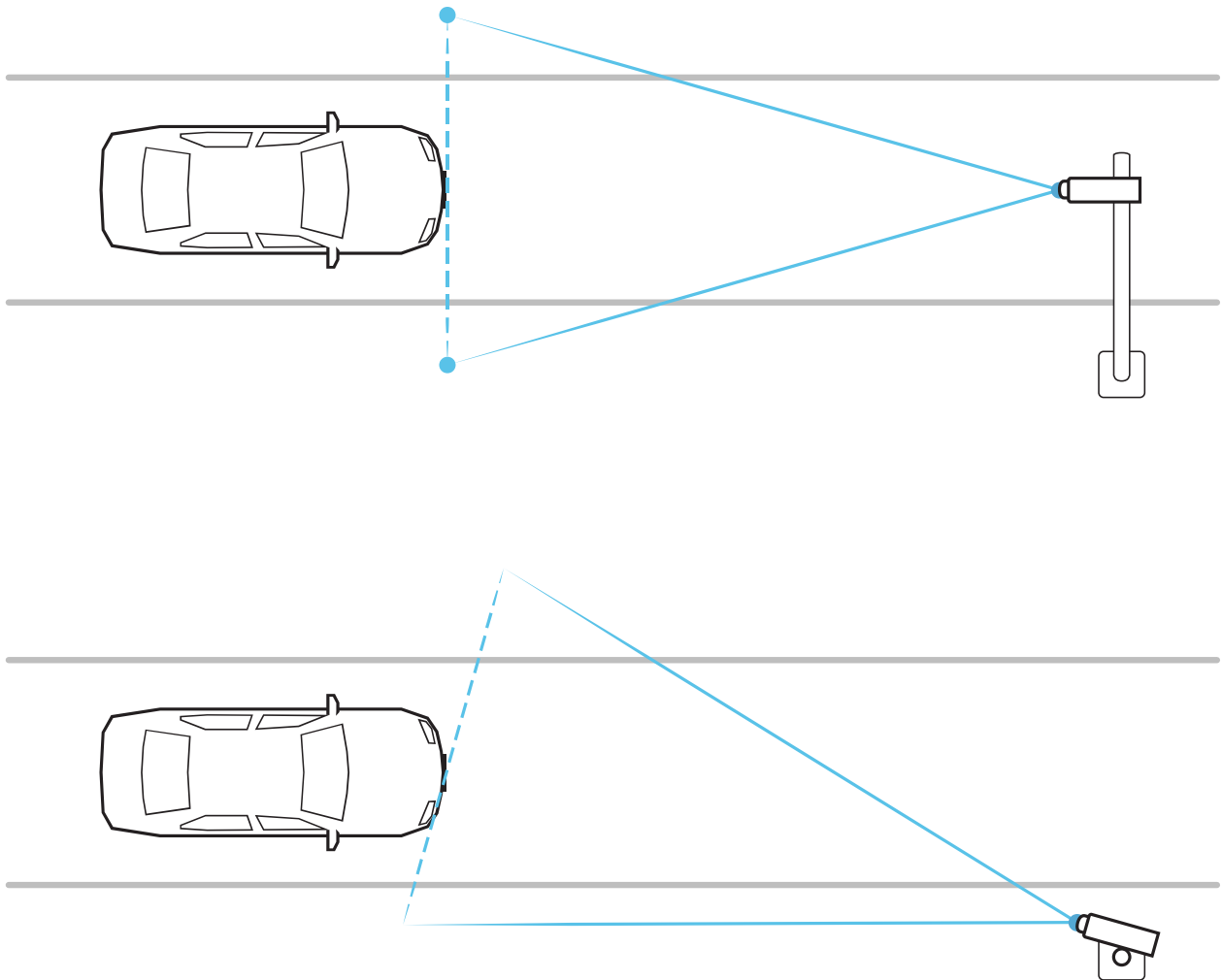
To achieve this, you may need to use special camera mounting brackets or camera leveling pads.

2. Lanes

Considering the number of lanes to be covered by vehicle detection, the position of the ANPR camera relative to the lane should be in accordance with the following recommendations.

2.1. 1 lane

An ANPR camera covering a single lane can be installed either within the lane or at its edge:



Make sure that the front of the vehicle is visible long enough in the field of view of the cameras - this means that the FoV should be mainly wider than the lane (about 2 times).

2.2. 2 lanes

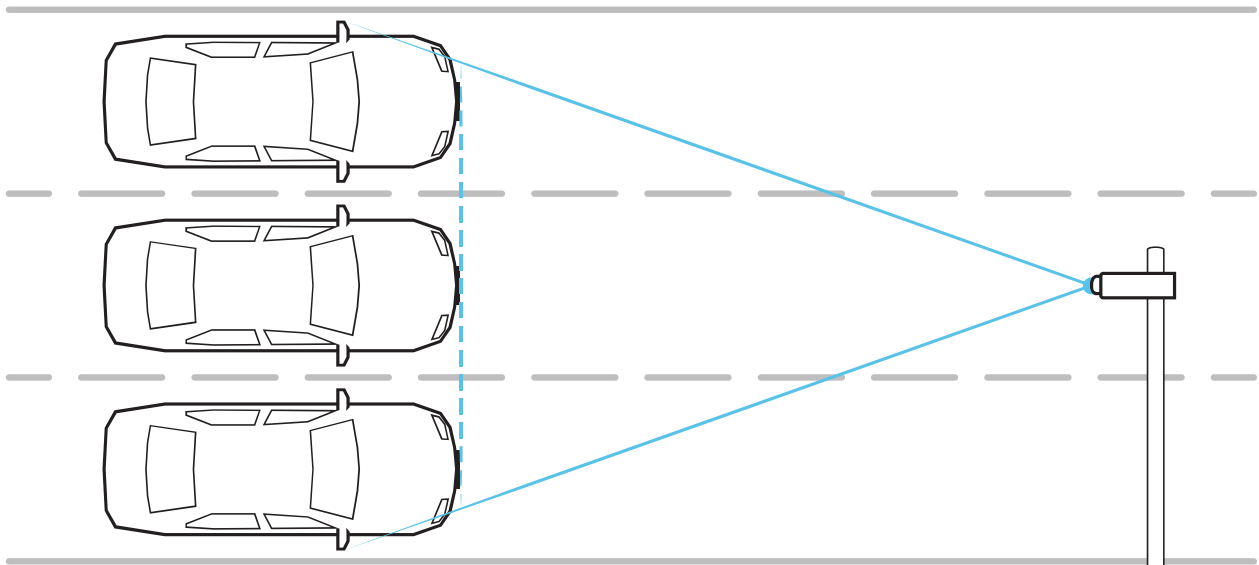
To detect two lanes, the ANPR camera should be installed on the line separating the lanes:

⚠ Warning

It is not recommended to install the camera at the edge of the road due to the high probability of shadowing vehicles (no visibility of the license plate). If technically there is no other possibility, it is better to install the camera at the edge of the faster lane, where fewer trucks drive.

2.3. 3 lanes

For three lanes, the ANPR camera should be installed over the middle lane:



⚠ Warning

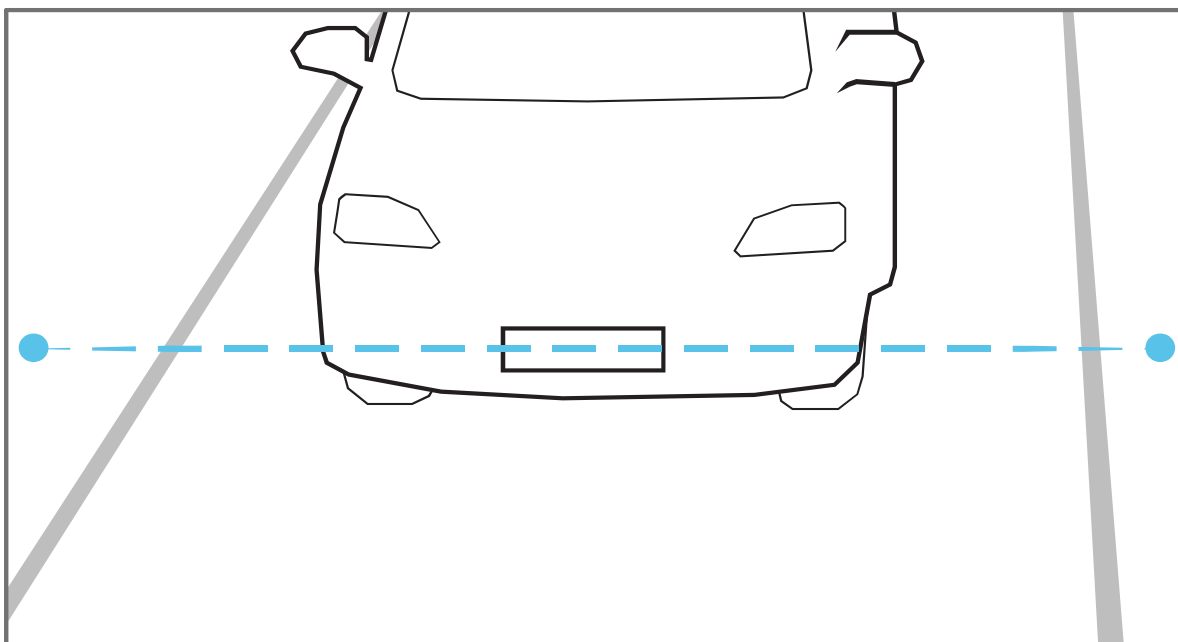
For three lanes, it is important to keep in mind the restrictions on the minimum height of license plate characters. In such a case, there is a risk that such a requirement will not be met, making the vehicle detection quality and the license plate recognition quality lower than expected.

3. Field of view

When adjusting the Field-of-View (FoV) of an ANPR camera - that is, changing the lens focal length and focus - follow the following recommendations:

3.1. Detection line

A detection line is a virtual horizontal line in the field of view (FoV) that indicates where the expected license plate detection should occur. Most often it is the line in the middle of the height of the FoV:

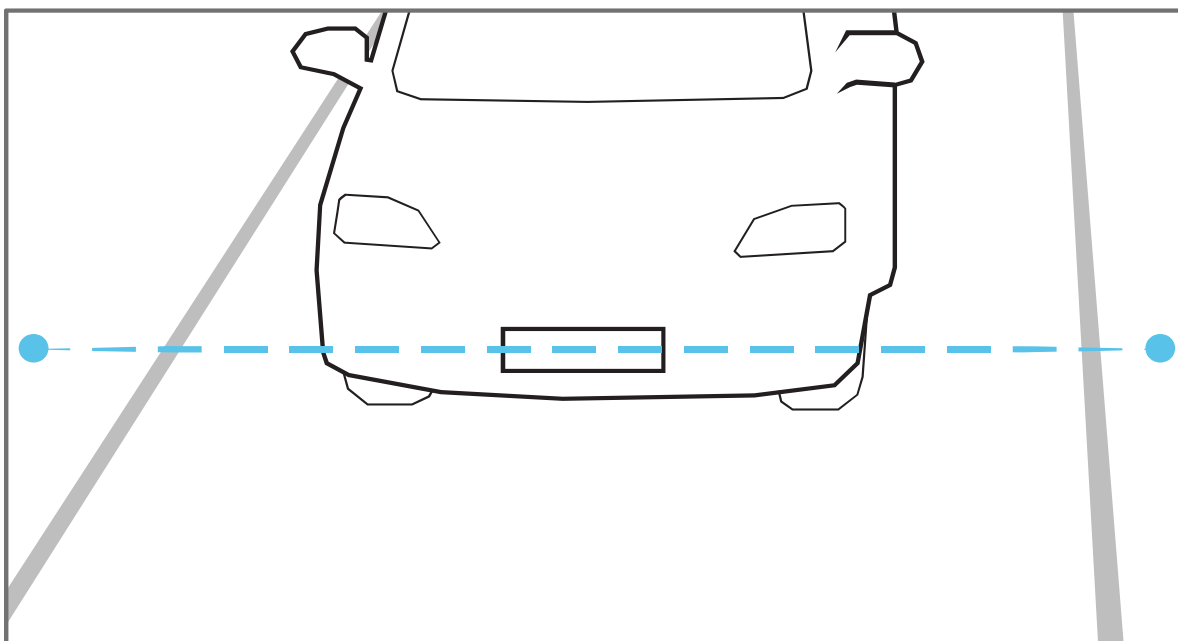


The requirements listed in the following subsections apply to the parameters of the license plate located on the detection line.

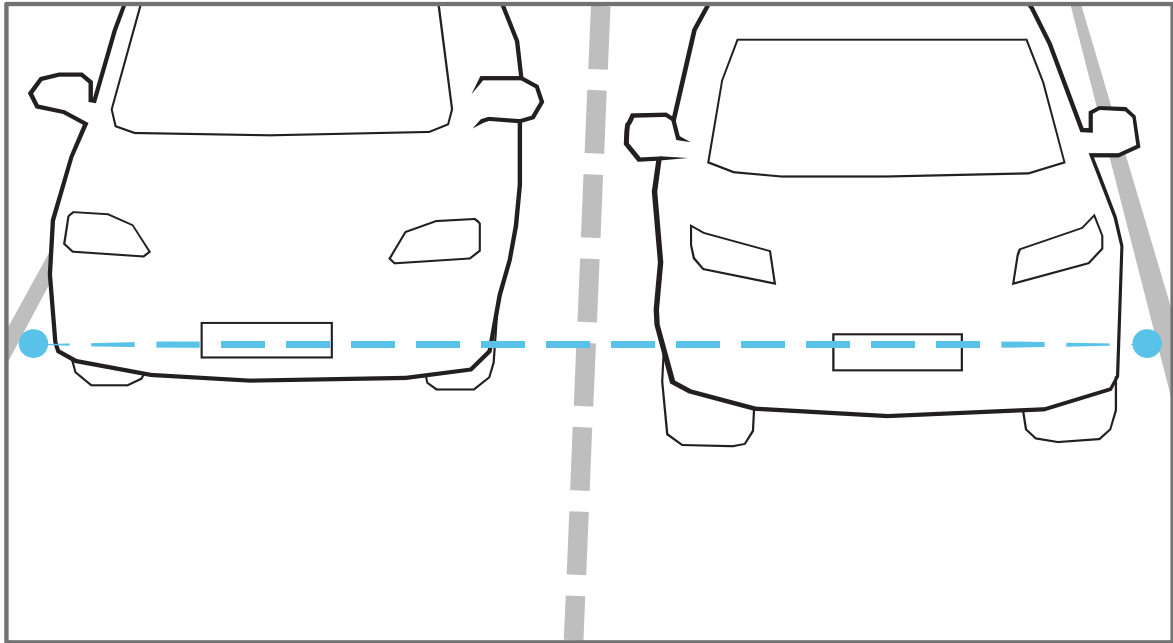
3.2. FoV width

The FoV width setting depends on the number of covered lanes (see section [Lanes](#)). Most often, the optimal width is 6 m at the height of the detection line.

For one lane, the width of the FOV should overlap about 25% with adjacent lanes:



For two lanes, the width of the FOV will cover exactly two lanes:



3.3. FoV height

Setting the height of the FoV depends on two factors:

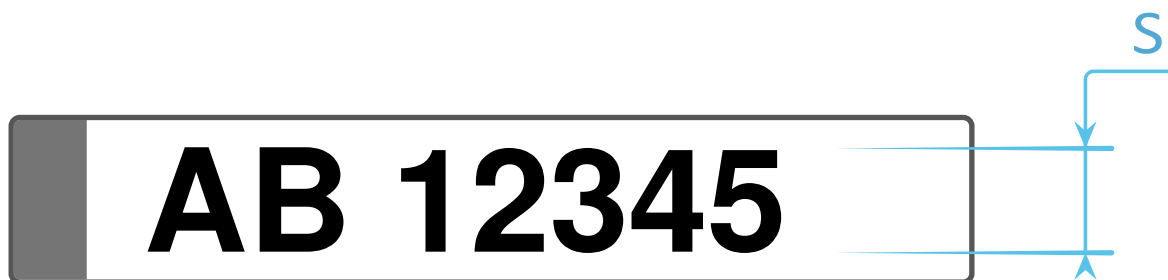
- minimum character height (described in the next section),
- maximum vehicle speed (combined with the number of frames per second - FPS).

The ANPR engine requires that for a given vehicle passage in the field of view, the license plate must be visible (recognized) at least twice. This means that the FoV at altitude must cover a sufficiently large stretch of road for the license plate to be visible (legible) twice at maximum speed. At the same time, other requirements should be met.

In this case, the user can modify the zoom, angle (α) and FPS of the camera.

3.4. Character size

The recommended height of the license plate characters on the detection line is  pixels.



Warning

The height requirement refers to the image processed by the ANPR engine, not the native camera image. Currently, the image is resampled to 1024x576 pixels, even if the camera's native resolution is 8 megapixels.

A character height of 16 pixels in the processed image is considered the optimal pixel density. The engine can still recognize arrays with smaller character heights (up to 10-12 pixels per character). However, the engine will not reject results based solely on the pixel size of the character.

4. Parameters

Internal camera settings also affect the quality of recognition - in particular, consider:

4.1. LPR mode

It is recommended that the cameras operate in LPR mode 24 hours a day:

Scene Mode

Current mode	LPR ▼
Mode ID	LPR
Copy mode to	-- ▼

Restore Mode Defaults

4.2. Frames per second

It is recommended to use the following settings:

25 fps - HDR X	✓
30 fps - HDR X	
50 fps	
60 fps	

- **25 fps - HDR X**- For access control and parking lot applications,
- **30 fps - HDR X** - For monitoring urban traffic.

For vehicle detection on highways, it may be advisable to live **50 fps** settings, however - this depends on the geometry of the measurement point and may cause problems due to the camera's limited ability to compensate for different lighting conditions.

4.3. Exposure time

It is recommended that the exposure time meet the following requirements:

- **< 1000 ms** – for access control systems and parking lot applications,
- **< 600 ms** – for other applications.

Exposure

☒

Automatic exposure

☐

Fixed exposure

Maximum shutter [s]

1/1750

▼

Default shutter [s]

Not available

▼

Fixed shutter [s]

1/500

▼

P iris

Mode

Manual

▼

F-stop

◀▶

2.10

Iris priority - open vs. close

◀▶

0

Day/night

Auto

▼

Day-to-night switchover

◀▶

-5

Warning

It is recommended that the ANPR camera automatically adjust the exposure time according to the lighting conditions.

4.4. Illumination

The recommended illumination settings depend on how far the camera is from the vehicle L . If the L is relatively small, it may be necessary to reduce the intensity level to prevent overexposure of the license plate at night.

Illuminator (LPR)

i

Illuminator module: Long range IR, 850 nm, tele beam

Illuminator function

Auto

▼

Intensity level

◀▶

30

References

Changelog

4.0.3 2025-02-16

- Correction of graphics
- Adding a table for height conversions

4.0.2 2024-11-10

- Document initiation

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See also

This document is available online at <https://docs.neurocar.pl/pro/ncar-anprcam-setup/>.

