

Eagle Eye Application Note - AN033

Camera Installation Considerations for LPR/ANPR

2022-05-31 Revision 1.1

Target Audience

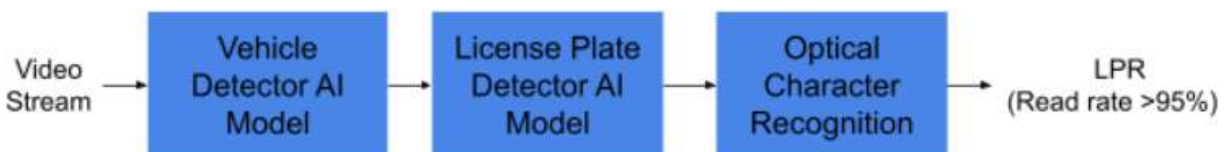
This Application Note is intended for installers and technicians that will be performing LPR camera installations in conjunction with the Eagle Eye Cloud VMS and is intended to share best practices in regards to camera specifications and placement.

LPR Overview

License Plate Recognition (LPR) or Automatic Number Plate Recognition is a technique by which the vehicle's license plate data is extracted using camera and vision technology. Camera placement plays a key role in getting a high accuracy read and this Application Note outlines best practices for installation and configuration.

Theory of Operation

License plate recognition systems work directly on the camera stream and the system does not use an external sensor to detect vehicles. Instead, the detection of vehicles and license plates, and license plate reads, are all done by AI models that run on a pipeline. The following chart provides a high-level overview of the LPR engine.



Vehicle Detection

The detection of vehicles is done by an AI model as opposed to using an inductive loop, which is the common mode of operation for traditional LPR systems.

License Plate Detection

Traditional LPR systems simply read all the characters that are seen on one image captured when the inductive loop determines the presence of a vehicle. This results in errors if the vehicle has other characters written on its body. Eagle Eye Networks uses an advanced AI model that is trained with millions of images to accurately identify the license plate and read only those characters, avoiding other characters present on the vehicle.

Camera Specification and Preferred Settings

The table below provides the minimum recommended specifications for cameras in each use case.

Specification	Gate LPR 10MPH (20 km/h)	Street LPR 30MPH (50 km/h)	Highway LPR 70MPH (110 km/h)
Resolution	1920 x 1080	1920 x 1080	1920 x 1080
FPS	25	30	60
Lens*	2.8mm - 12mm	2.8mm - 12mm or 5mm - 50 mm	5mm - 50mm
Exposure & Gain	Manually Controlled	Manually Controlled	Manually Controlled
Image Enhancement	HLC, BLC	HLC, BLC	HLC, BLC
IR	50 meters	100 meters	External IR

Table 1: Use Case Camera Specifications

* Choice of lens will depend on installation.

The table below covers camera specifications that will help to get optimal readings for license plates for each use case.

Specification	Gate LPR 10MPH (20 km/h)	Street LPR 30MPH (50 km/h)	Highway LPR 70MPH (110 km/h)
Day and Night Settings	Switching from day mode to night mode should be Auto . If the camera supports profile mode, then two profiles can be set, one for day time and one for night. If a monochrome image is ok, then night mode can be set permanently.		
Maximum Exposure/Shutter (Mentioned are maximum exposure, if plates are saturated, you may reduce the shutter)	1/250 If motion blur is observed, this can be changed to 1/500.	1/500 - 1/1000 Depends on motion blur. Shutter can be set to 1/1000 to prevent motion blur.	1/1000 - 1/2000 Depends on motion blur. Shutter can be set to 1/2000 to prevent motion blur.
HLC	Turned on.		
Gain	Needs to be kept below 30% to minimize noise in the image. Different cameras have different settings, so you may need to adjust the Gain to have proper imaging.		
IR Power	Set to full . It's always advised to keep IR power to maximum and reduce gain.		

Table 2: Additional Camera Specifications

Camera Positioning

Camera positioning is crucial to attain high accuracy for LPR reads, as factors like resolution, angle of imaging, and perspective all affect the quality of the reads.

If law dictates having license plates on the front of vehicles, install the cameras to read front plates. Front plates provide better results, as the camera gets multiple frames to track the vehicle as it approaches the camera to get the best image possible. Also, the distance between the camera and the vehicle is always the same for front plates.

To read rear license plates, the trigger point has to be chosen based on the longest vehicle, which may not be optimal for all vehicles. Optimal camera placement varies from site to site based upon the layout and the camera-mounting location (ground, ceiling, wall, etc.).

If motorcycles are to be captured, rear license plates are preferred as many of them do not have front license plates and, if present, the size is typically much smaller than typical vehicles.

The mounting varies depending upon the application. See below for the preferred mounting suggestions to achieve optimal imaging and the best LPR reading.

Gate LPR

Gate LPR refers to LPR at the entrance of critical infrastructure, a parking entrance, a hotel or corporate office for example, with vehicle speeds being less than 10 MPH or 20 km/hr

Front License Plate Installation (Camera installed on a side pole)

The camera should be mounted at a height between 3 - 5 feet and the vehicle is imaged between 5 - 12 feet from the camera.

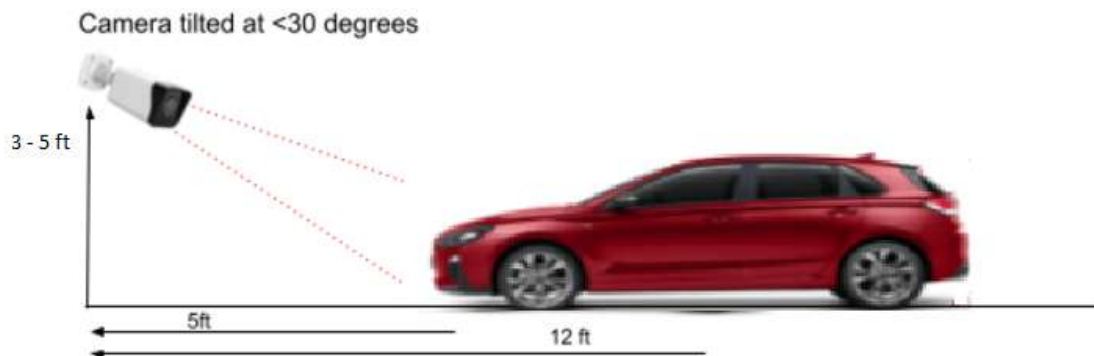


Image 1: Camera mount recommendation for front license plate installation for Gate LPR

Reference Image from the front facing camera below.



Image 2: Reference image from a front facing camera installation for Gate LPR

Rear License Plate Installation (Camera installed on ceiling)

The camera should be mounted at a height of 10 feet and the vehicle is imaged between 17 - 23 feet from the camera.

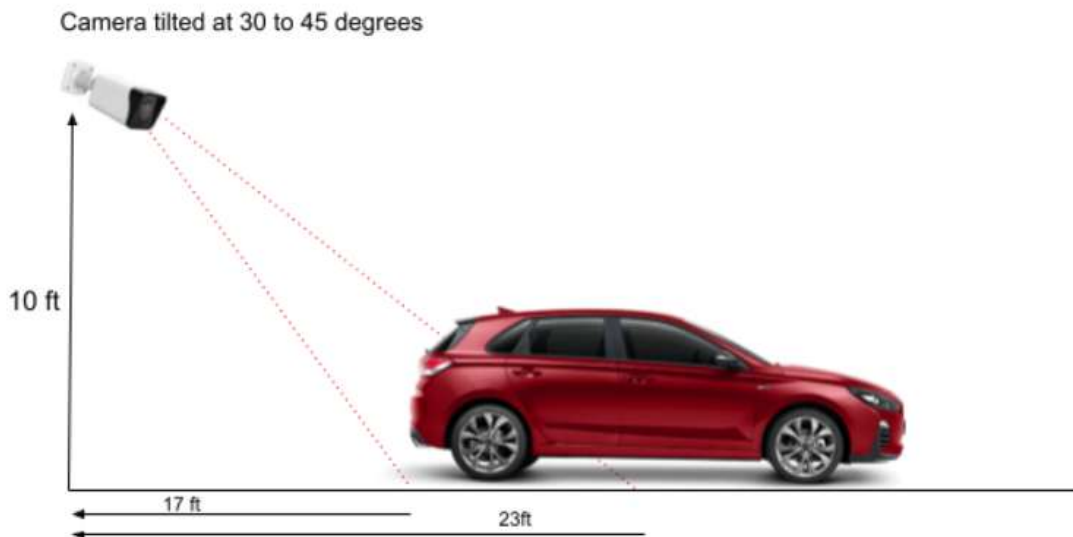


Image 3: Camera mount recommendation for rear license plate installation for Gate LPR

Reference Image from the camera below.



Image 4: Reference image for a rear facing camera installation for Gate LPR

Street LPR

Street LPR refers to LPR on open streets like in a neighborhood or on campuses for example, and vehicle speed is typically less than 30 MPH or 50 km/hr.

Front/Rear License Plate Installation

Irrespective of whether the front or rear of the vehicle plate is imaged, the camera should be mounted between 5 - 7 feet and imaged at a distance of 6 - 18 feet from the camera

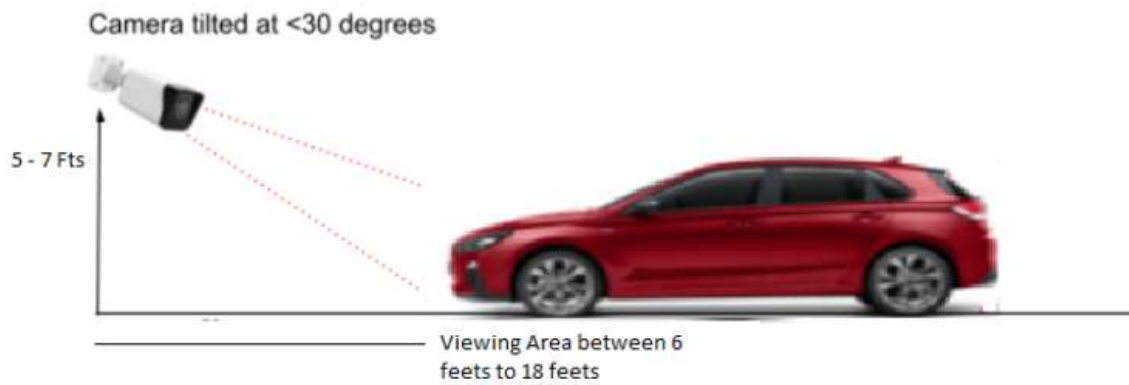


Image 5: Camera mount recommendation for a Street LPR Installation

Reference Image of a Front Installation for Street LPR below.



Image 6: Reference image from front installation for Street LPR

Reference Image of a rear installation for Street LPR below.



Image 7: Reference image from rear installation for Street LPR

Highway LPR

Highway LPR refers to LPR on highways and/or city roads with vehicle speeds less than 70 MPH or 110 km/hr

Irrespective of whether the front or rear of the vehicle plate is imaged, the camera should be mounted between 17 - 20 feet and imaged at a distance of 30 - 65 feet from the camera.

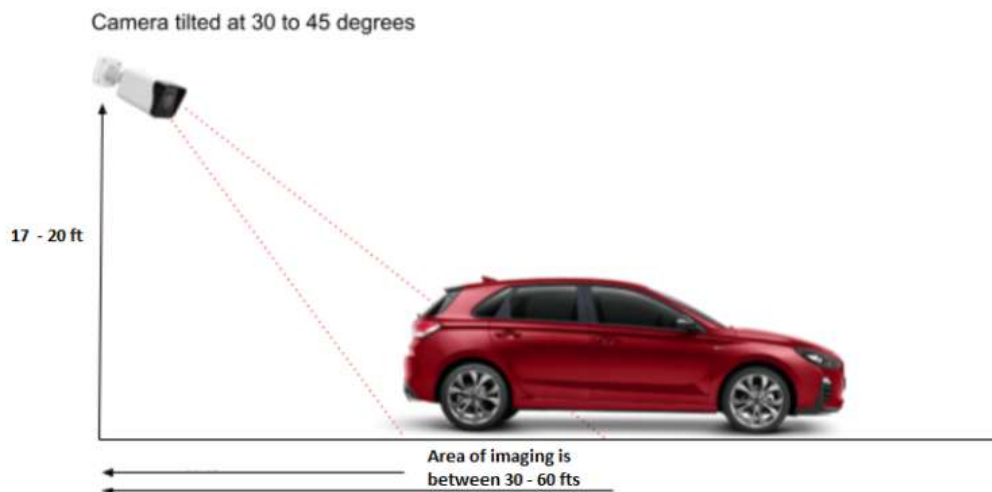


Image 8: Camera mount recommendation for Highway LPR

Front License Plate reference image for Highway LPR



Image 9: Reference image from front installation for Highway LPR

Rear License Plate reference image for Highway LPR



Image 10: Reference image from rear installation for Street LPR

After mounting cameras, it is necessary to make tilt and rotation adjustments to ensure that the license plate is centered and horizontally oriented when the vehicle is at the ideal capture distance.

To do this:

1. If possible, position a vehicle in the middle of the lane. Look at the camera view and tilt the camera such that the license plate is at the center of the camera view.
2. Rotate the camera to ensure that the license plate is horizontally-aligned with the image. It may be harder to figure out which is horizontal, so use a speed bump or gate entry barrier as a reference.

In the example below and after positioning the vehicle at the preferred area of capture and tilting the camera, the view of the camera indicates that the license plate is centered.



Image 11: Reference image to ensure that the camera is centered for optimal performance

Notes and Other Helpful Details

Pixel Requirement

The Pixel per character requirement is 15 Pixels for Horizontal and 20 Pixels for Vertical.

The number of Pixels per character or license plate is determined by the field of view, and often, it's hard to estimate this prior to installation. The choice of lens also depends on the installation flexibility.