

Requirements and recommendations



For the proper operation of the module, it is imperative to correctly select, place and set up the camera, adjust the software motion detector and the module itself. When choosing the camera, it is recommended to consider the image quality requirements, control zone particularities, and the conditions of the camera installation and operation.

Requirements to the license plate image



It is assumed that the license plates of the vehicles to be recognized correspond to the requirements of the Vienna Convention on Road Traffic (Part I: Convention on Road Traffic – Attachment 2), in particular:

"2. The registration number shall be so composed and displayed as to be legible in normal daylight at a distance of at least 40 m by an observer placed on the axis of the vehicle, the vehicle being stationary ..."

"3. When the registration number is displayed on a special plate, this plate shall be flat and fixed in a vertical or nearly vertical position and at right angles to the vehicle's median longitudinal plane".

The license plate number will be recognized only if its image is rich in contrast and fits entirely in the frame.

Additionally, there is a requirement regarding the minimum height of a symbol on the image of the license plate in the frame (i.e. the height at which it is still possible to provide recognition): 30 pixels. This limitation is illustrated on the picture below. You can also see the minimum permissible dimensions for the license plate of Ukraine and Russia (the overall width is given for reference because it may help when calculating the focal distance).



- i** When the camera is installed outside, the natural noise pollution of the video image may happen due to the unfavorable weather conditions (rain, snow). In order to improve recognition in such circumstances, it is advisable to increase the size of the license plates in the frame.

Recommendations on camera installation



In this section you will find the recommendations on camera installation that need to be followed in order to ensure the reliable recognition of license plates in the control zone. Each installation location has its individual characteristics. This section contains the typical camera installation diagrams. They are to be taken into consideration at the stage of designing the traffic video surveillance systems with due account for the specific parameters of the site.

The correctly performed installation must ensure the following:

- The license plate image in the frame must correspond with the requirements specified in the previous section;
- The maximum duration of presence of the license plate in the frame.

It is also necessary to fulfill the following requirements listed below (both for highway and checkpoint installation locations).

To minimize the occurrence of false triggering in the process of recognition, it is imperative to install the camera in such a way as to avoid the presence of the high-contrast objects in the frame, for example, billboards, trees, grille fences etc.).

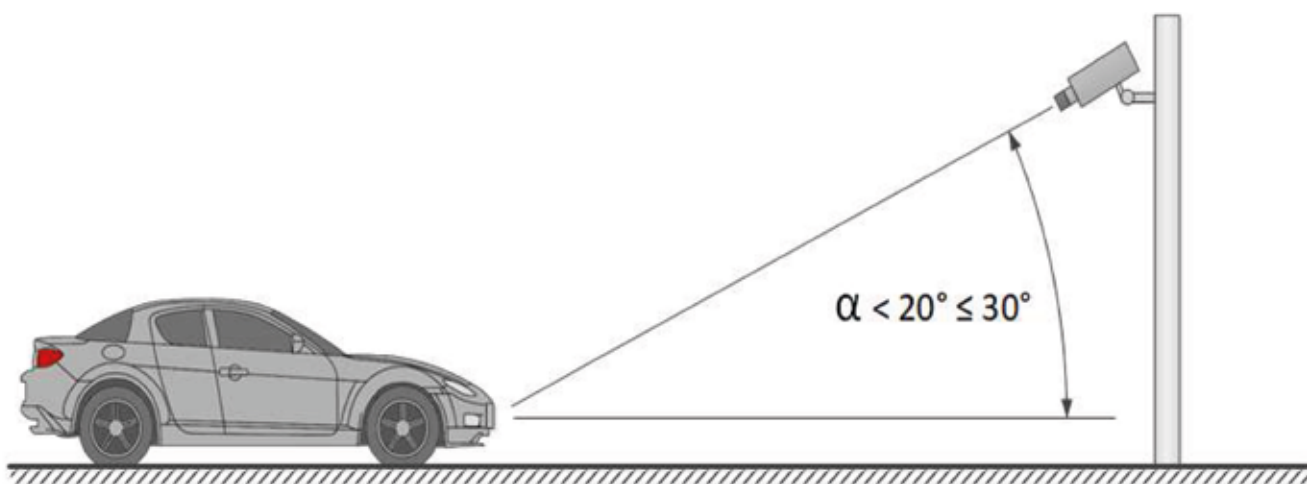
In order to avoid camera flaring, it shall not be directed at the light sources (the Sun, streetlamps) and at the highly reflective objects.

To prevent the distortion of the symbols on the license plate image, it is advisable to ensure the optimal camera installation angles. When performing the surveillance on descending or ascending vehicles, the road inclination angle must also be taken into consideration.

Vertical camera installation angle

Recommended: up to 18–20°

Maximum permissible: 30°

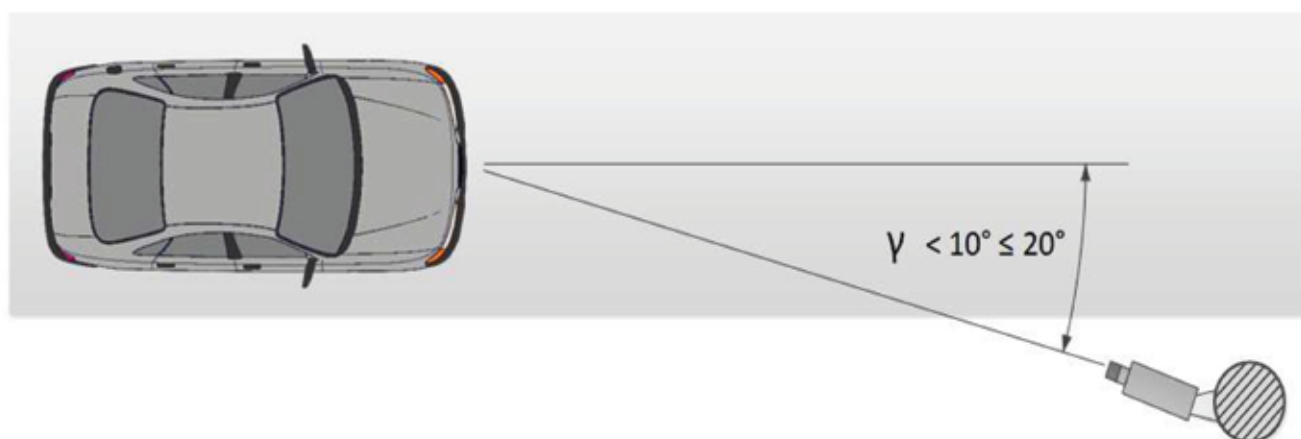


Example of camera installation on the road with a grade

Horizontal camera installation angle

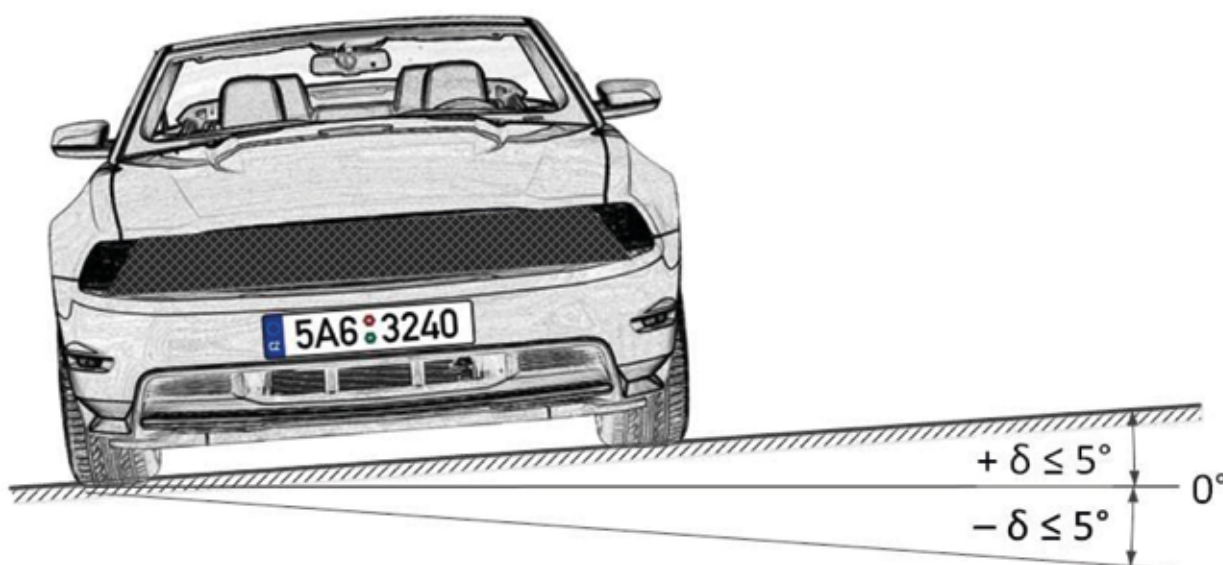
Recommended: up to 5–10°

Maximum permissible: 20°



In the course of the installation, it is required to ensure that the tilt of the license plate on the image in relation to the horizontal plane of the camera does not exceed 5° both clockwise and counterclockwise. When recognizing the single line numbers with no more than six symbols it is possible to check the appropriateness of the selected camera tilt angle using the "single line rule": the imaginary horizontal line must cross the first and the last symbols of the license plate.

Permissible license plate banking angle



Single line rule

The distance from the camera installation location to the beginning of the viewing zone is determined by the focal length of the lens. And conversely, if the distance from the camera installation location to the center of the control zone is known, it is required to ensure the appropriate focal length of the lens. When using the separate IR illuminator, the angle of the infrared light must correspond to the camera viewing angle. The correspondence of the IR illuminator beam angle and the camera lens viewing angle is especially important at the large distances, when the camera operates at the limit of its sensitivity.

The typical camera installation diagrams for license plate recognition are given below.

Camera installation on a checkpoint

When performing video surveillance of the entrances and exits of the protected areas, the speed of the vehicles normally do not exceed 20 km/h, meaning that it is possible to use the license plate recognition module in the Parking mode. In this case, the camera is normally installed at the edge of the lane.

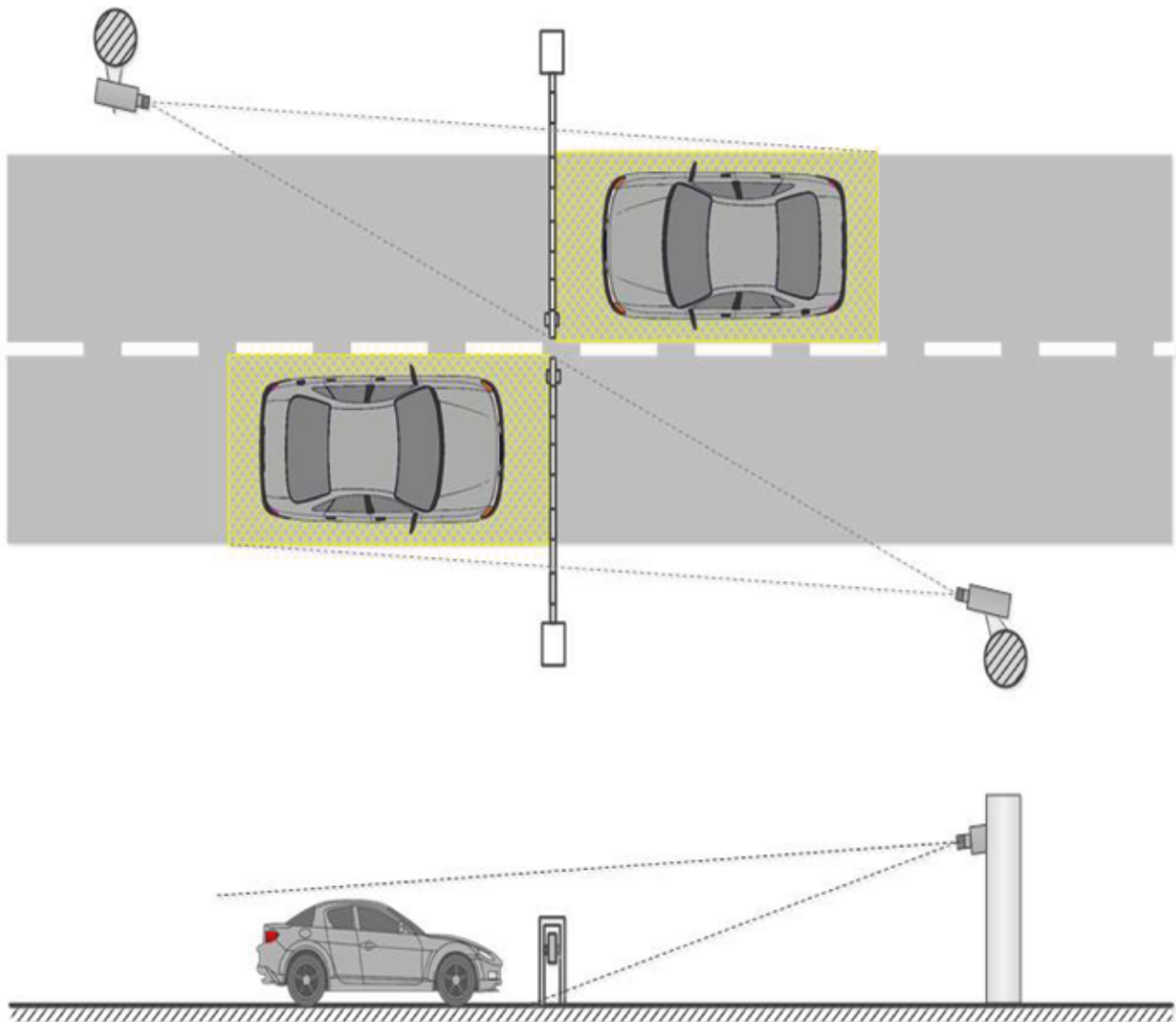
- The camera installation height shall be above the level of the headlights of the vehicles.
- The distance between the place of installation and the focus area must be at least 3 meters.

The installation of the camera in close proximity to the prospected license plate detection area and the usage of the short focus lenses lead to the depth of field reduction and the distortion of the image at the edges. Both must be avoided to ensure reliable recognition.

For the separate control of the exits and entrances, it is recommended to install separate cameras, one on the entrance and the other on the exit. When only one camera is used, the vehicles travelling in the opposite directions may block one another. Moreover, it is advisable to separate the traffic lanes not only with road marking, but also with a barrier, where the width of the road allows it.

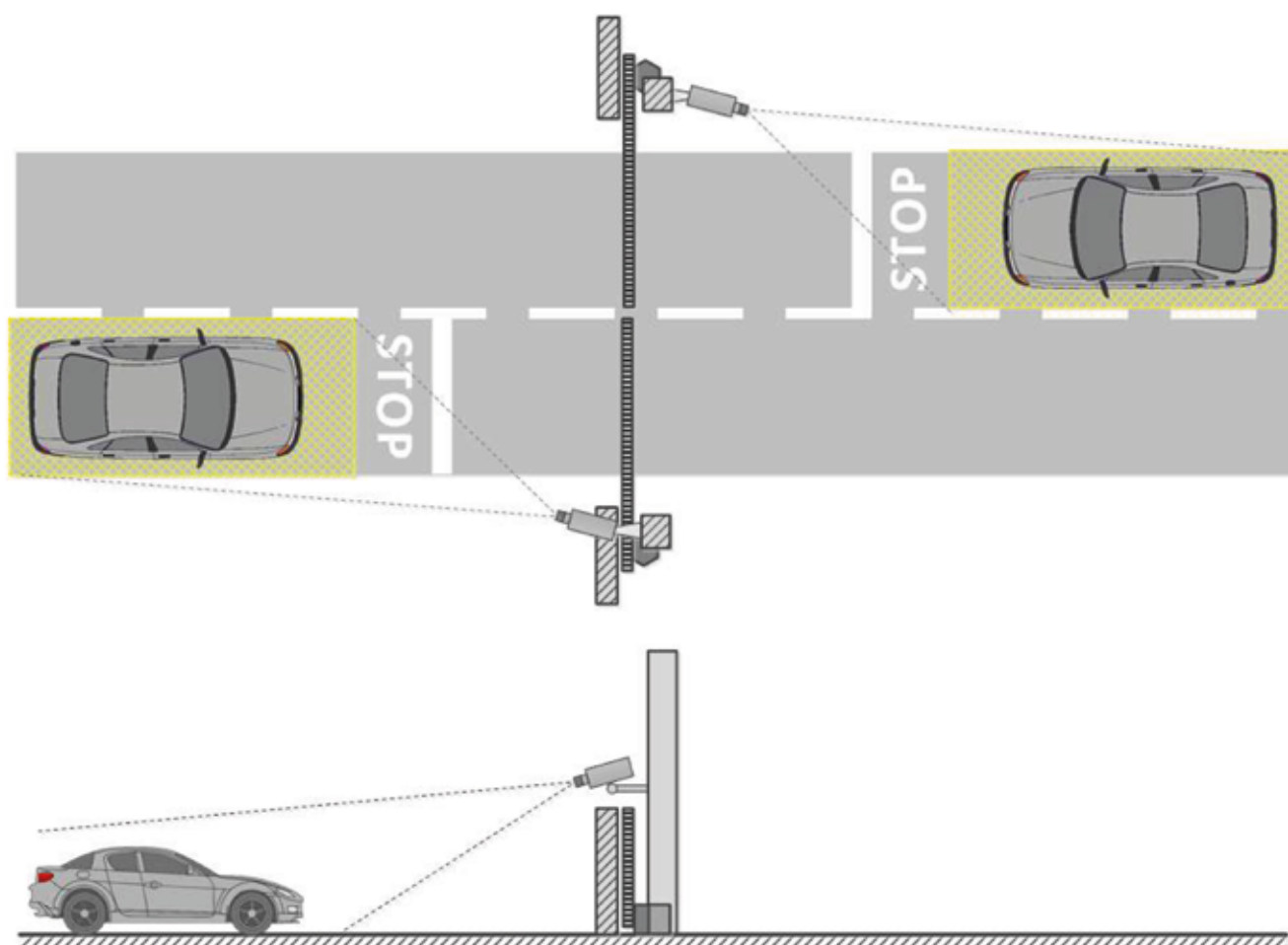
When using the rising arm barrier, the controlled area may start immediately before it. In this case the camera is to be installed at a distance from the barrier line.

Controlled areas with separate lanes and a rising arm barrier



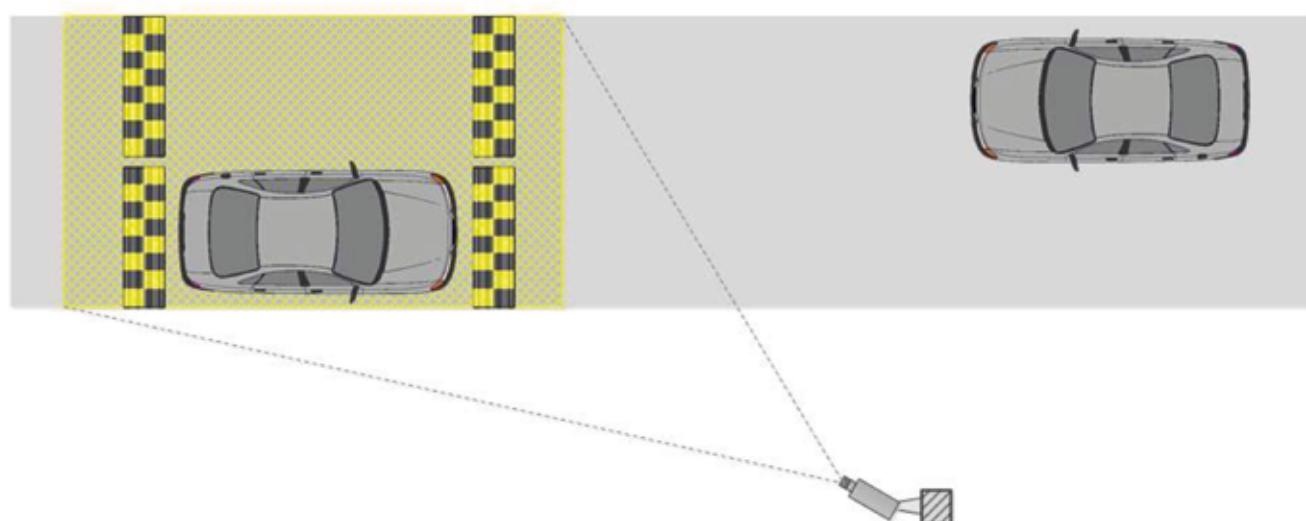
When using the gates, the controlled area must not start immediately before the gates, because the camera is usually installed at the level of the gates. In such a case a stop line, a mandatory stop sign or a traffic light is used for stopping the vehicle in the controlled area.

Controlled areas with separate lanes and gates



At the unregulated crossing points it is required to use speed bumps (road humps) to make the drivers reduce speed to ensure successful recognition; it is also advisable to use additional means such as the speed limit signs (up to 5 km/h), mandatory stop signs, stop lines etc.

Open controlled area with two-way traffic



The suggested camera installation parameters for surveillance of exits and entrances calculated for the cameras with the sensor size of 1/3" are shown in the following table. These parameters allow to provide the minimum distance between the camera installation location and the controlled area of the

given width. It is also required to be guided by the quality of the license plate image in the focusing area in the course of the installation.

Sensor size: 1/3"						
Installation height (m)	1	1,5	2	2,5	3	4
Area width: 3 m						
Vertical angle, °	18	25	30	30	30	30
Focal distance (mm)	5	5	6	7	8	11
Near zone (m)	1,3	1,6	1,9	2,6	3,5	5
Focal zone (m)	3,1	3,4	3,5	4,3	5,2	7
Far zone (m), M	∞	20	8,5	9	9,6	10
Area width: 6 m						
Vertical angle, °	9	14	19	23	28	30
Focal distance (mm)	5	5	5	5	5	6
Near zone (m)	1,7	2,2	2,5	2,7	2,7	4
Focal zone (m)	5,7	6	5,8	5,9	5,6	7
Far zone (m)	∞	∞	∞	44	21	17



The parameters shown in the above table are indicative. It is strongly recommended to calculate the camera installation parameters individually, using the CCTV calculator, with due regard for the design and operational characteristics of the particular cameras and their working environment.

Camera installation on a highway

When organizing the surveillance on a highway, the camera is normally installed on an L-shaped pole at the edge of the lane or on the arch support above the center of the lane.

The standard installation height is 4 to 6 (maximum 20) meters.

The vertical camera tilt angle is regulated by the basic guidelines.

The distance to the controlled area and, correspondingly, the focal distance of the lens are determined based on the camera installation height, tilt angle and width of capture.

The higher the camera is installed, the higher is the probability that the license plates of the vehicles moving at a small distance from one another (for example, in case of a traffic jam) will get into the frame. But it needs to be noted that the increase of height leads to the higher distortion of the license plate images, and the symbol size may be close to the permissible minimum (or may even be unacceptable). In such cases it is possible to shift the region of interest to the higher distance by reducing the camera vertical tilt angle and changing the focal distance in order to ensure reliable recognition.

The modern IP cameras are capable of covering several (up to 4) traffic lanes. Thus, it is possible to reduce the quantity of cameras to be installed in the controlled area. But in this case it is required to choose the installation height, tilt angle, and focal length in such a way as to minimize the optical image distortion (for example, the short focus lenses give significant image distortion on the periphery of the frame).

In the table below you will find the approximate parameters of camera installation for performing video surveillance on a highway. The camera parameters used for the calculation are as follows: 1/3" sensor and 5-50 mm varifocal lens. The values shown in the table allow to provide the minimum distance from the camera installation location to the controlled zone of the specified width. In the course of the installation it is imperative to ensure the quality of the license plate image to be obtained by the camera in the focal zone.

Sensor size: 1/3"					
Installation height (m)	4	6	10	15	20
Area width: 3 m					
Vertical angle, °	30	30	30	30	30
Focal distance (mm)	11	17	28	42	(56)*
Near zone (m)	5	8,2	15	23,6	(32)
Focal zone (m)	7	10,4	17	26	(34,6)
Far zone (m)	10	13,5	20	29	(37,4)
Area width: 6 m					
Vertical angle, °	30	30	30	30	30
Focal distance (mm)	6	8	14	21	28

Sensor size: 1/3"					
Installation height (m)	4	6	10	15	20
Area width: 3 m					
Area width: 6 m					
Near zone (m)	4	6,5	13	21,5	30
Focal zone (m)	7	10,4	17	26	34,6
Far zone (m)	17	19,2	24	32	40,4



The table above contains the indicative values. It is strongly advised to perform calculations of camera installation parameters individually, using the CCTV calculator, with due consideration to the design and operational characteristics of the particular cameras and their working environment.