The principles of CCTV design in VideoCAD

Part II Person detection area, person identification area, license plate reading area. Spatial resolution.

Edition for VideoCAD 7

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In the first part of the article we have considered modeling **camera view area** and the order of simple project creation. In the second part we will consider, how in VideoCAD the **person detection area**, **person identification area, license plate reading area** and **spatial resolution** are automatically calculated for each camera in the project.

By setting parameters of the view area, we obtain an **optimum camera position**. Spatial resolution, areas of detection, identification and reading are calculated automatically and independently for the obtained camera position.

Practically it is easy enough to get results of calculation, for this purpose it is necessary to set only values of **criteria** for calculation. VideoCAD generates the result of calculation of areas in the form of vertical and horizontal projections on the plan, like projections of the view area. Spatial resolution is visualized by different colors or hatch styles within the view area projections.

The built-in in VideoCAD algorithms can be applied for the calculation of detection, identification and reading areas, not only of persons or license plates but also of any different object. Principles of calculation are universal.

The identification and especially detection are based on probability. In other words, an object can be really identified or detected in most cases only with some probability not equal to 100%. Thus, it is possible to speak only about much higher probability of detection and identification in the areas calculated by VideoCAD in relation to the rest of the camera view area. In practice it is impossible to calculate this probability absolutely precisely because of the variety and complexity of modeling and influencing factors, including the human factor. But, choosing values of identification and detection criteria, we can get areas of different sizes with relatively greater or smaller probability of detection and identification.

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Person identification area

The **person identification area** in VideoCAD – is a part of **camera view area** in which all **person identification criteria** are fulfilled. If a person's face appears in the **person identification area**, the person can be identified with higher probability.

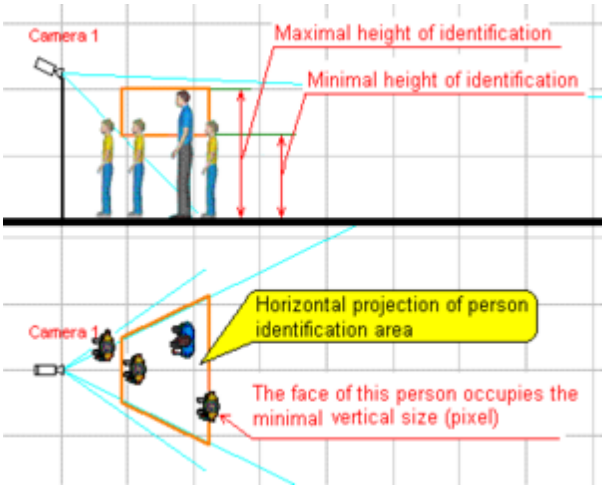

Fig. 1.1 Person identification area.

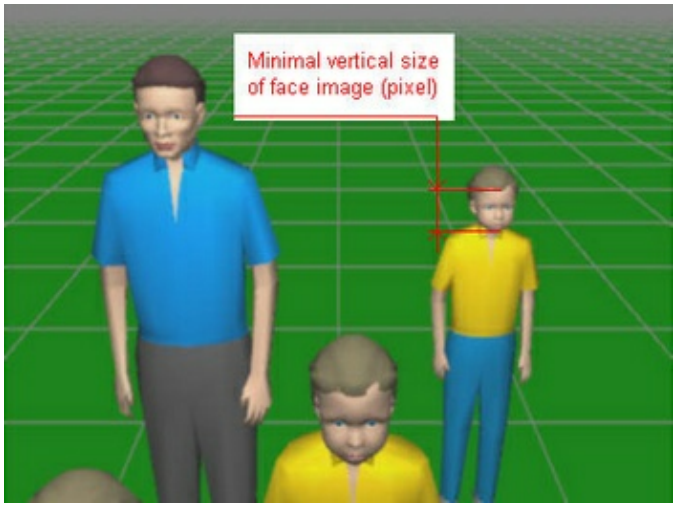

Fig. 1.2 Image on the screen from the same camera.

The following **person identification criteria** are used in VideoCAD:

- **Minimal height of identification;**
- **Maximal height of identification;**
- **Minimal vertical size of face image (pixel);**
- **Maximal angle between a direction on the camera and horizontal.**

All criteria can be changed, thus adapting an automatic calculation of the person identification area to the current requirements. The **height of a person's face** in calculations is considered equal to **0,2 m**.

Minimal height of identification, Maximal height of identification

From **Fig 1.1** the meaning of these criteria is clear. For identification of a person of any height, first of all, his (or her) face should be in the view area. For a standing or walking person values of these criteria specify a range of heights in which faces of people of different heights can appear.
The values of these criteria do not depend on image quality, but can depend on height of people, terrain and crossing view area particularities etc.
Usually it is enough to set the following values: **1.3 m for minimal and 2 m for the maximal identification height** that corresponds to the identification of standing or walking **1.5 - 2 meters tall people**.

Minimal vertical size of face image (pixel)

The next identification condition is the sufficient detail of the face imaging. This criterion sets **minimum required size of the face image on the screen**, necessary for the identification.

There are recommendations which can be used when choosing a value of the criterion. Though the recommendations are different, any of them can be transformed to a criterion value for VideoCAD by simple mathematical calculation.

According to the **recommendations of the UK Home Office** (Guidelines for identification), for the identification of a person known to the operator his image should occupy more than **50 %** of the vertical size of the screen, for identification of unknown person the size of the image of the person should be more than **120 %** of the size of the screen (i.e. the person doesn't entirely fit on the screen). If to accept, that the face of the person occupies about **12 %** from his height, and the recommendations have been elaborated for the analog video with 576 vertical lines,

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the following values of criterion will be:

- **For identification of a familiar person** - 50/100%*12/100%*576=**35 pixels**;
- **For identification of unfamiliar person** - 120/100%*12/100%*576=**83 pixels**.

According to recommendations **P 78.36.008-99**, for object identification **one TV-line on the screen should covers no more than 2 mm of real object**. For the **400 TV lines** horizontal resolution it corresponds to vertical field-of-view: 2*400 * (3/4)/1000 =**0.6 m**. The vertical size of the face image, used in calculation - **0.2 m** makes **33 %** from the vertical size of the screen. Thus, according to P 78.36.008-99, for 576 lines, criterion value equals 33/100%*576=**190 pixels**.

It is easier to use any of the existing recommendations, however, the recommendations mentioned above are average, contradictory and ignore many factors. An optimum value of this criterion for a specific target can considerably differ from them.

First of all the CCTV system should satisfy the customer's requirements. The final choice of criterion value remains for the designer and is selected according to the system parameters and set tasks.

In VideoCAD **Help system** there is a technique for the choice of the optimum value of this criterion based on the existing standard image from the video system in use. This technique is described in the section **Examples >Example 6 Determining person identification criteria by a real image**.
This technique allows to take into account much more video image parameters, than the existing recommendations do, and also to get a face image model in boundary positions of the person identification area for customer consideration.
It is recommended to use recommended values as a basis, and then to check and correct them using the technique given in the **Help system**.
* *Choosing a value of this criterion it is necessary to take into account both the video image quality, and the required probability of identification.*
* *As the identification, usually, is done with usage of recorded image, it is necessary to take into account quality of the recorded images, after compression. The compression considerably worsens the identification quality because the little differences of brightness are distorted. Therefore the criterion cannot be reduced only to the amount of the TV-lines, estimated by the test chart, which cover face image. The fact that images from cameras have small size and resolution in the multi-screen mode very often can be neglected in live monitoring mode.*
* *Though the criterion, as well as others, limits identification area on the plan by the precise line, it is necessary to understand, that probability of the identification is reduced smoothly, especial in the case of use long-focal-length lenses.*

Maximal angle between a direction on the camera and horizontal

The angle specified by this criterion generally differs from the **camera inclination** and corresponds to the **display angle of the face on the screen**.

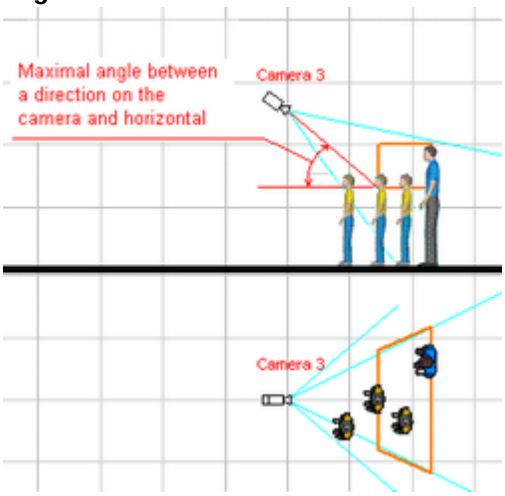

Fig. 2.1 Maximal angle between a direction on the camera and horizontal.

Fig. 2.2 Image on the screen from the same camera.

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The identification is much more complicated when the person's face is displayed on the screen at a big angle in spite of the fact that the face image size on the screen meets the requirements of the previous criterion. If people on the screen appear in headgears, or look underfoot, for example, on stairs, the identification became extra difficult.
Value of this criterion also can be chosen by a technique from the Help system. For people without headgears recommended value - **35-45 degrees**.

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License plate reading area

License plate reading area in VideoCAD - a part of **view area** in which all **license plate reading criteria** are fulfilled. If license plate appears in license plate reading area, it can be read.

Calculation of the license plate reading area is similar to calculation of the person identification area. The height of license plate in calculations is considered equal **0.1 m**.

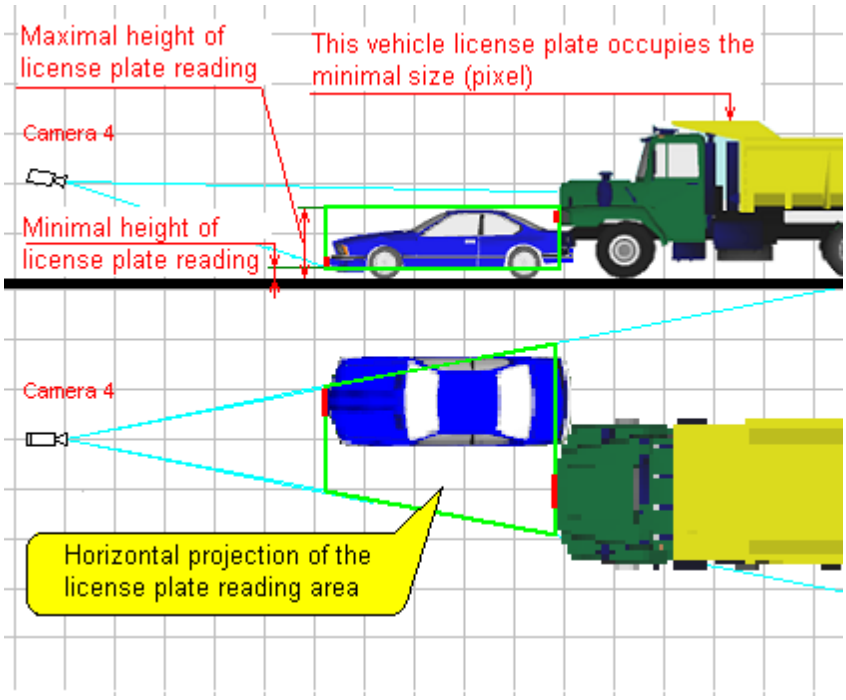

Fig 3.1 License plate reading area

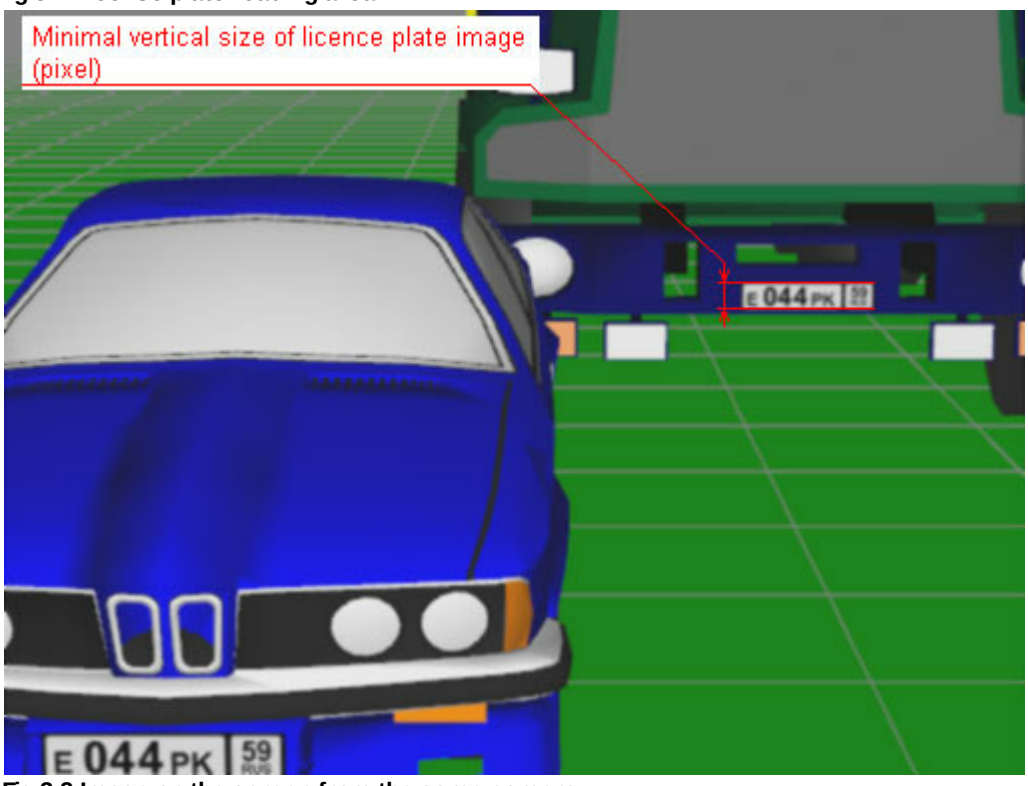

Fig 3.2 Image on the screen from the same camera.

For license plate reading area calculation the following **criteria** are used:

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- **Minimal height of license plate reading;**
- **Maximal height of license plate reading;**
- **Minimal vertical size of licence plate image (pixel);**

Minimal height of license plate reading, Maximal height of license plate reading

The choice of the minimal and maximal heights of license plate reading is based on probable heights of license plates location, which are necessary to read.

Minimal vertical size of license plate image (pixel)

According to its meaning this criterion is similar to "**Minimal vertical size of face image (pixel)**" criterion in calculation of person identification area.

According to **UK Home Office recommendations**, to read a vehicle license plate, the image of a vehicle should occupy not less than **50 %** of the vertical size of the screen.
If to consider, that the average height of a car is about **1.4 m**, and the height of license plate in VideoCAD is equal **0.1 m** we will get the value of the criterion –0,1/(1,4/50) *576 /100%=**21 pixels**.

* *Aside from the image quality, an optimum value for this criterion depends on the **size of signs** on license plate which are necessary to read.*

* *If VideoCAD is used for calculation of camera position for the **license plates recognition system**, it is necessary to use values of criterion from characteristics of this system.*

* *As the license plate is a **flat object**, the angle of license plate display on the screen is not taken into account separately. It is partly taken into account in the "**Minimal vertical size of face image (pixel)"** criterion as VideoCAD calculates the size of any object on the screen taking into account the angle of inclination and exact position in space. However it is necessary to remember, that in practice, at the large values of this angle the small vertical skew of real license plate can lead to impossibility of reading.*

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Person detection area

Person detection area in VideoCAD - a part of view area in which all **criteria of person detection** are fulfilled. If a person appears in the person detection area, he (or she) can be detected with the high probability.

Person identification area and license plate reading area are calculated on the base of the condition of **person's face or license plate getting into the view area**.
The person detection area is calculated in a different way. It is supposed, that for person detection **any part of person's body**, appeared on the screen, is enough. Thus, if the person will get into limits of person detection projection any part of his (her) body will appear on the screen.

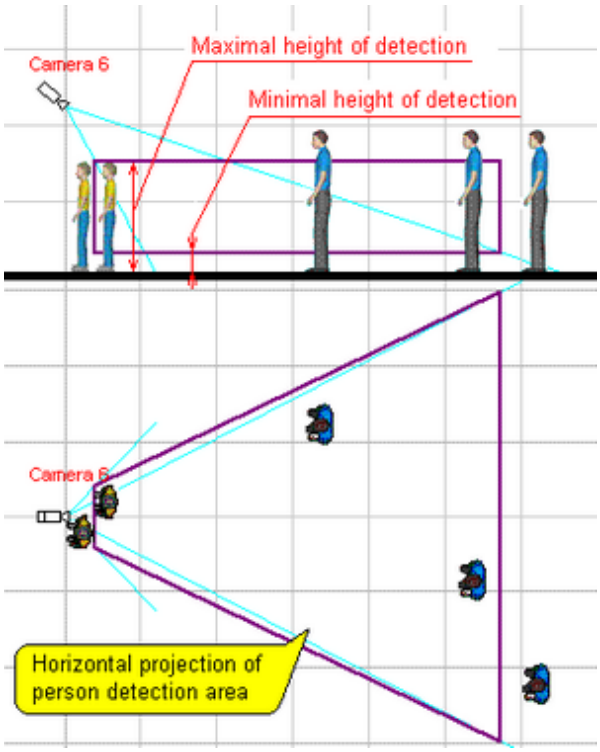

Fig 4.1 Person detection area

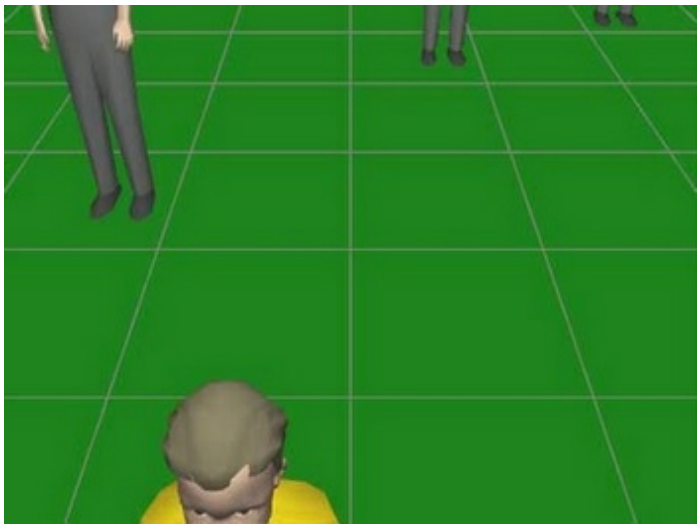

Fig 4.2 Image on the screen from the same camera.

For calculation of a person detection area the following criteria are used:

- **Minimal height of detection;**
- **Maximal height of detection;**
- **Minimal vertical resolution (pixel/m, pixel/ft);**

Minimal and maximal heights of detection

These criteria determine the **range of heights**. Any person, whose **part of body** gets in this range, is considered to be detected.

* *Pay attention to a difference with similar criteria of a person identification area. In calculation of a person identification area **any person's face** getting into the range of heights set by these criteria is considered identified. In calculation of person detection area a person, whose **any part of body** gets in the range of heights, is detected.*

Optimum values for these criteria have little dependence on image quality, but can depend on subject's height, terrain, view area crossing features etc.
Range recommended for usual conditions is **0.3-1.5 m**. Because legs are moving too fast and take small area on the screen there is a restriction from below.

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Minimal vertical resolution (pixel/m, pixel/ft)

According to its meaning this criterion is similar to the criterion «**Minimal vertical size of face image (pixel)**» in calculation of person identification.
Also there are recommendations for the choice of the criterion. Though the recommendations are not exhaustive enough, in practice, choosing this criterion, it is easy to use them, making your own corrections if necessary.

According to **recommendations of the UK Home Office**, for detection of a person his (or her) image should occupy not less than **10 %** of the vertical size of the screen.
Taking into account height of the person used in recommendations – **1.6 m**, and the recommendations have been elaborated for the analog video with 576 vertical lines, we get maximal vertical field-of-view – 16m and the minimal vertical resolution 576/16=**36 pixels/meter**.

Choosing independently the value of the criterion, it is possible to use a technique containing in the **Help system**, taking into account the following factors, which influence on detection probability:

* *For detection it is important to take into account the **difference of contrast** between a person and background, which can vary in significant ranges within 24 hours and depend on a season, clothes color of the person, illumination;*

* *As detection has the greater value in the **live monitoring mode**, it is necessary to take into account **real viewing condition**: the screen size, and also amount of the screens controlled by one operator;*

* *If for detection the **Motion detector** is used, first of all it is necessary to take into account its capabilities.*

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Quality levels

Set of criteria of person identification, person detection and license plate reading forms the **quality level**. The quality level meets both the certain image quality and the certain level of requirements to the probability of the tasks solution assigned to the camera.

There are **10 quality levels** in VideoCAD. Criteria in each quality level can be set independently from other quality levels.
In order to fulfill the calculation of person identification, person detection and license plate reading areas for the certain camera according to the set criteria, it is necessary just to assign this camera the quality level with these criteria.

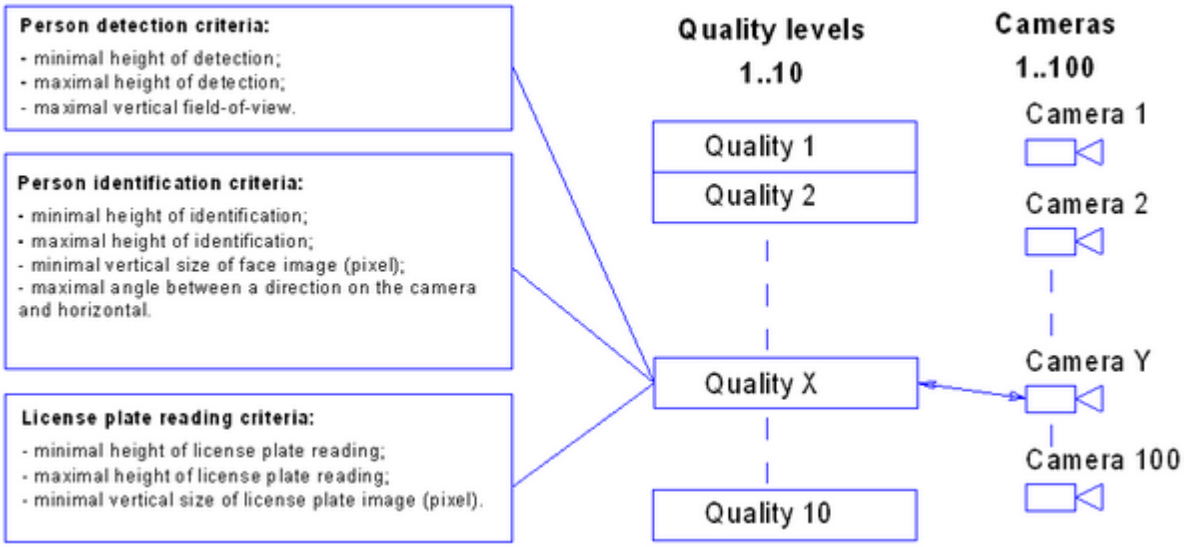

Fig. 5 Quality levels

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Getting projections of person detection and identification, license plate reading areas

As an example we will consider, how to get **projections of the person identification, person detection and license plate reading areas** according to the **UK Home Office recommendations**.

First we will name one of the **quality levels** "**UK Home Office guidelines**", then for this quality level we will set values of detection, identification and reading criteria according to requirements of recommendations. Then we will assign this quality level to the camera and specify the image sizes from the camera. Then, while placing this camera on the plan, we will see projections of person detection, identification and license plate reading areas, automatically calculated according to recommendations of the UK Home Office.

Start VideoCAD and open your project.

* *To get more details about the beginning of work with the software see the first part of the article.*

Quality level renaming

Click on item in the **Main menu > Criteria > Quality levels**.
Double click on a row with the name of any quality level, for example «Quality 1».
In the appeared dialog box enter the new name for this quality level «UK Home Office guidelines».
Click **OK**.
Add the additional description to this quality level in the Description box, if necessary, for example «Identification of familiar person».

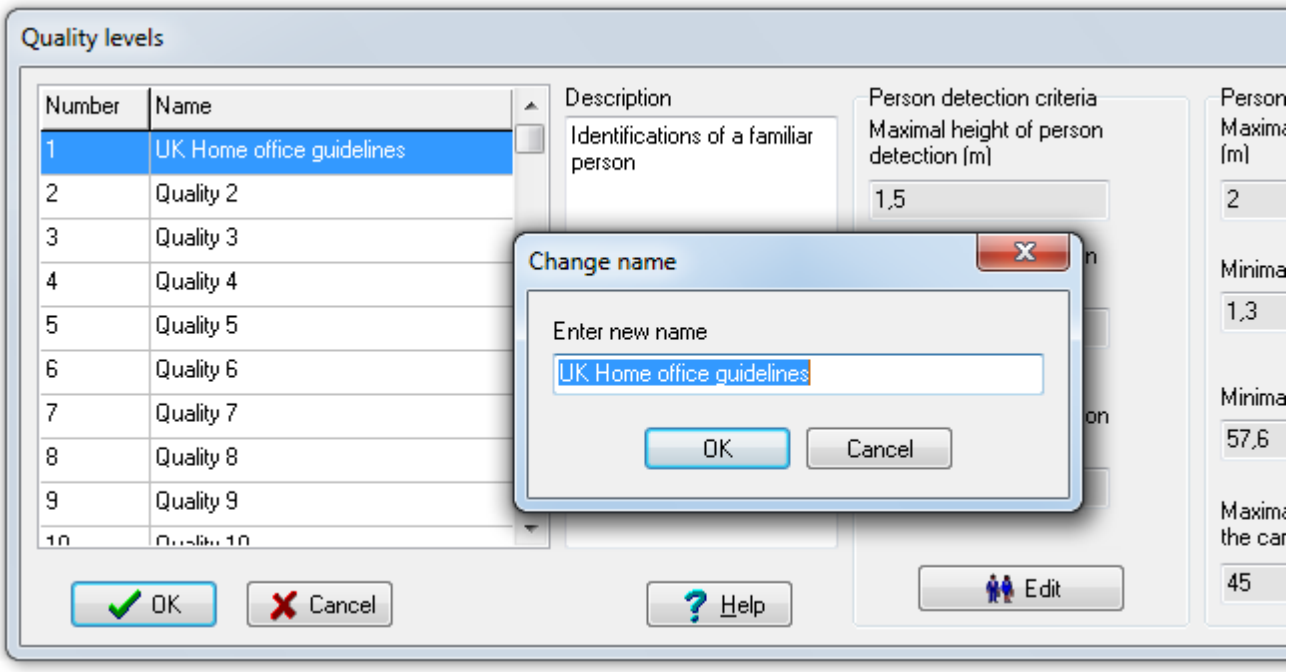

Fig. 6 Quality level box

Click **OK** also in the **Quality levels box**.

* *In many boxes there are **OK** and **Cancel** buttons. Changes of any parameters in these boxes go into effect immediately. You can see results of changes in the **Graphics window**, **3D window** and thus visually adjust necessary parameters. If after that to click **Cancel** button the box will be closed, and all changes made will be canceled. If to click **OK** changes will be recorded in the project.*

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Setting person identification criteria

Click the **Main menu> Criteria> Person Identification** item.
In the **Quality level** combo box select "UK Home Office guidelines".

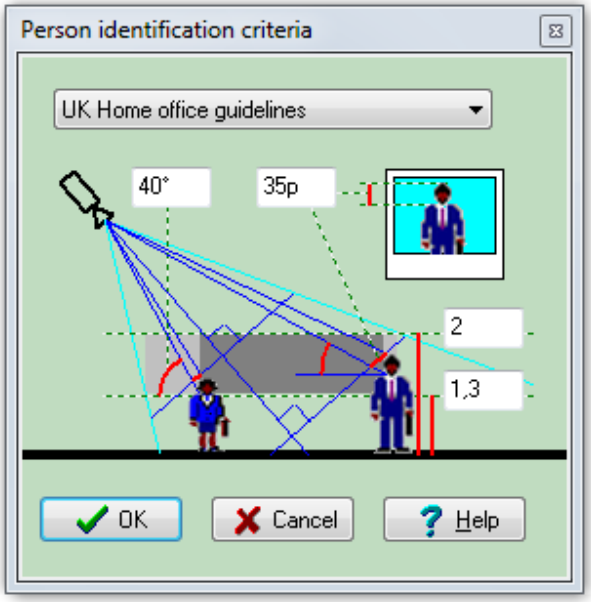

Fig. 7 Criteria editing box of person identification area

Enter in boxes:

* *If you move cursor to a box, a name of the box will be shown.*

- Minimal height of person identification – **1.3 m**;
- Maximal height of person identification – **2 m**;
- Minimal vertical size of face image (pixel) - **35**;

* *For the identification of familiar people.*

- Maximal angle between a direction on the camera and horizontal - **40** degrees.

Click **OK**.

Setting person detection criteria

Click on **Main menu> Criteria> Person detection** item.
In the Quality level combo box select "UK Home Office guidelines".

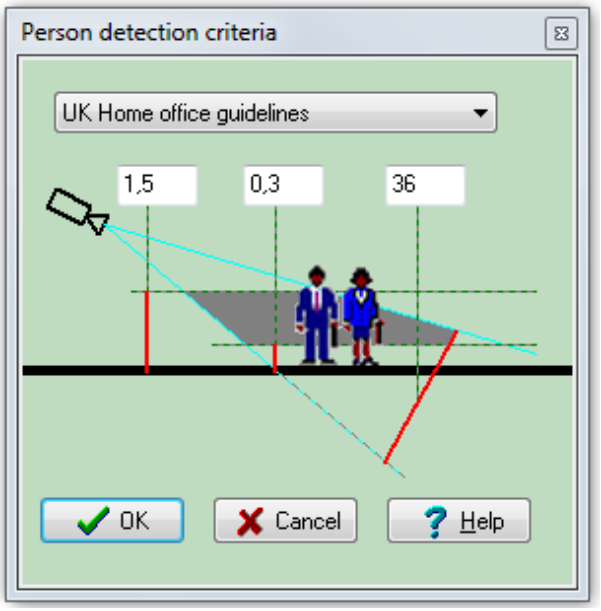

Fig. 8 Criteria editing box of person detection area

Enter in boxes:

- Minimal height of person detection – **0.3 m**;
- Maximal height of person detection – **1.5 m**;
- Minimal vertical resolution (pixel/m, pixel/ft) – **36**;

Click **OK**.

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Setting license plate reading criteria

Click on **Main menu> Criteria>License plate reading** item.
In the Quality level combo box select "UK Home Office guidelines"

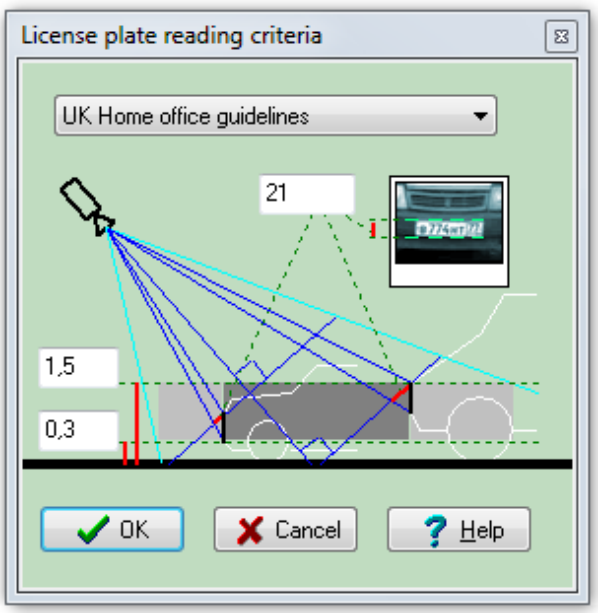

Fig. 9 Criteria editing box of License plate reading area

Enter in boxes:

- Minimal height of license plate reading – **0.3 m**;
- Maximal height of license plate reading – **1.5 m**;

* *The criterion is set for cars and lorries.*

- Minimal vertical size of licence plate image (pixel) - **21.**

Click **OK**.

Adjusting Image size

Since VideoCAD 6 version, Criteria in Quality levels concerned with limiting image resolution (**maximum vertical field of view size, minimal parts of screen occupied by a license plate and a face**) are related to the **number of pixels** for modeling and comparing digital cameras with different resolution.

In case of analog camera modeling you need not to specify the number of pixels . By default, calculation is performed for 576 vertical pixels (lines in PAL TV system).

If number of pixels of real camera is different, it is necessary to specify the number of pixels.
For criteria calculation minimal number of pixels from parameters of camera image sensor and parameters of output image is used.
Number of pixels of image sensor is specified on the **Sensitivity and Resolution** box.
Number of pixels in output image is specified on the **Processing** tab of the **Image parameter panel**.

If number of pixels is not set (N/A), calculation is performed for 576 vertical pixels, what corresponds to analog camera.

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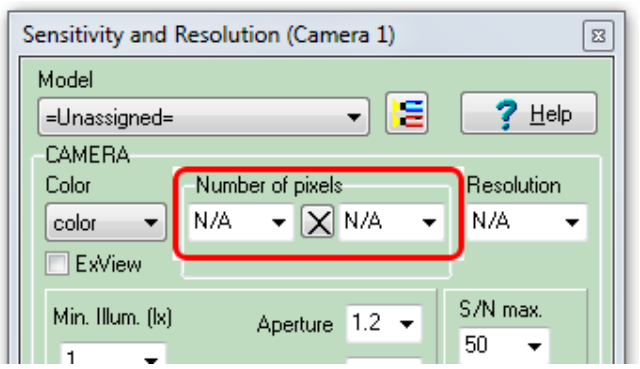
Specifying number of pixels of the camera image sensor



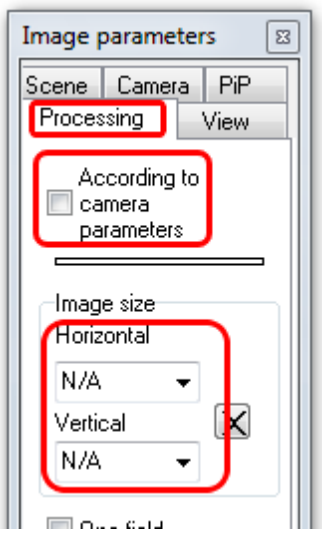
Activate the appropriate camera by clicking on it's lens or choosing from the **Active camera** combo box.
Open the **Sensitivity and resolution box**, by clicking on the **Sensitivity and resolution** button on the **Tool bar**.

On the **Sensitivity and resolution** box, in the **Number of pixels** combo boxes enter the number of pixels of the camera image sensor.
Close the **Sensitivity and resolution** box and confirm changes.

Specifying number of pixels in the output image

Video signal received from an analog camera, comes to DVR or multiplexer input, where it is processed by **analog-digital conversion**.
Analog-digital conversion does not coincide with number of pixels of the camera image sensor. As a result, the **output image size**, as a rule, does not coincide with **number of pixels of the image sensor**. Because of such mismatch, there are distortions.

In **IP cameras** the number of pixels on the output image can differ from number of pixels on the image sensor.



Open the **3D window** . Open the **Image parameter panel** by right-clicking on the **3D window**. On the **Image parameter panel** choose **Processing** tab.

On the **Processing** tab, in the **Image size** panel, enter the number of pixels of the output image.

Click **Save** for saving the changed parameters.

If at clicking **Save** button the **Save to selected cameras** box is marked, processing parameter set on the Processing tab will be saved in all selected cameras.

After specifying and saving numbers of pixels of all cameras check the the **According to camera parameters** box. If this box is checked, processing parameters are set according to processing parameters of the active camera. As a result activation of other camera, processing parameters will be changed according to processing parameters of this camera. Manual changing processing parameters will be disabled.

If this box is not checked, processing parameters could be specified manually. The set parameters will not be changed during activation of different cameras.

Quality level assignment to camera

Activate any camera in the project for which calculation of detection, identification or reading areas is necessary.

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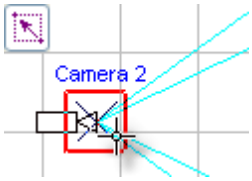

For loading double click precisely on the camera lens on the plan.

Open the **Camera geometry** box, by clicking on the **Camera Geometry** button .

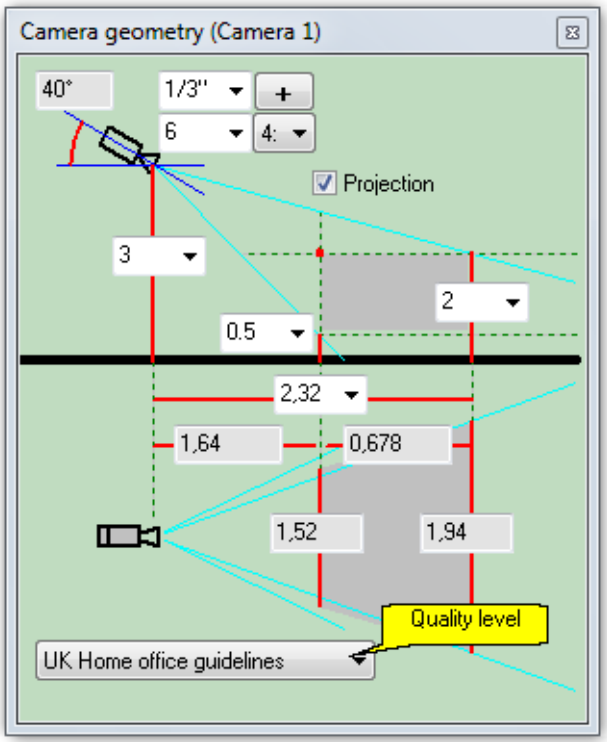

Fig. 10 Camera geometry box

In the **Camera geometry** box in the **Quality level** combo box select «UK Home Office guidelines».

Close **Camera geometry** box.

Save the camera, by clicking the **Save to project** button .

Getting calculated projections of person identification, detection and license plate reading areas

Pay attention to buttons on the Toolbar . These buttons switches on and off displaying of person detection, identification and license plate reading areas projections for the loaded camera. At the activation of this area projection displaying appears the box with the corresponding horizontal projection sizes.

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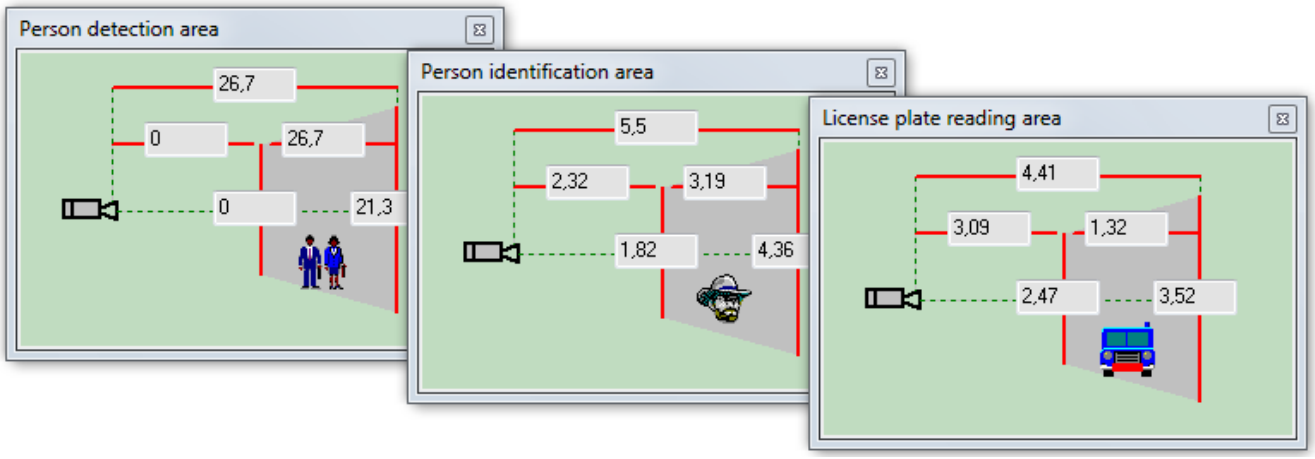
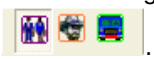
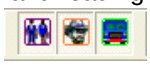


Fig. 11 Person detection, identification, license plate reading area size boxes

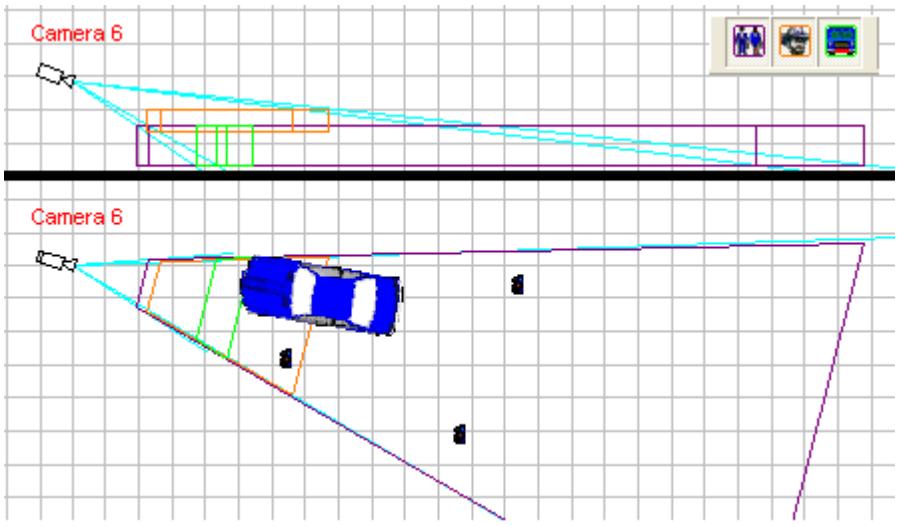
The box can be closed, and the area display in the Graphics window remains. To switch off area display, click the same button again.

The state of these buttons (pressed or not) **at the moment of loaded camera saving** determines, whether projections of detection, identification and reading areas for this camera will be displayed when this camera will not be loaded.

VideoCAD constantly controls and displays presence or absence of detection, identification and reading areas for the loaded camera. If the area is present, the corresponding button will have a color frame  .

Switch on display of detection, identification and reading areas for the loaded camera, by clicking one by one all three buttons. Buttons should look pressed  .

Change camera parameters and its view area as described in the first part of the article. Together with projections of view area you will see calculated projections of person detection, identification and license plate reading areas.



* *The projection of person detection area is limited by a violet line, person identification area - orange line, license plate reading area - bright green line.*

Fig. 12 Horizontal projections of person detection, identification, license plate reading areas

Person identification area (and license plate reading area) may be absent in many camera positions. It does not mean that the person identification is impossible at any point of the view area. This only means, that **on a horizontal plane there are no points, at which a person of any height can be identified according to identification criteria**.

Look at the **vertical projection**. Try to change height of the camera installation, lens focal length, view area parameters, the identification criteria. Investigate, what criteria limit the identification and reading areas in different positions of the camera. Detection, identification and reading areas can also be limited by view area bounds.

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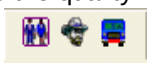
* *At the analysis of the vertical projection it is convenient to rotate the plan on the screen so that* ***the direction of the loaded camera's look became parallel to the screen plane****. For this purpose use the* ***Edit loaded camera*** *button*  .

* *Camera installation height, upper and lower bounds of view area can be changed not only in the* ***Camera geometry*** *box, but also in the vertical projection of the* ***Graphics window****. Use tools:* ***Change view area lower bound***  , ***Change view area upper bound***  , ***Change installation height***  .

* *The* ***Test object*** *tool* *is useful for more detailed studying of view area. You can change its real sizes, move in relation to the loaded camera and as a result you can see its sizes on the screen in % from the screen size, pixels, TV-lines or millimeters. In the* ***editing of loaded camera*** *mode (*  *button is pressed) you can see the Test object in the* ***Graphics window*** *and* ***3D window****, and also specify its position in the* ***Graphics window****.*

Pay attention, that it is not so easy to get the **optimum position and parameters of the camera** for the maximal size of the person identification area.
Probably, you will find out that many of camera positions used in projects actually are not optimum for person identification. Sometimes it is enough to displace the camera a little bit on height to find it optimum position. It can be rather difficult to make it practically, at the object, in view of all range of human height. In this case exact calculation in VideoCAD can provide optimum position and parameters of the camera.

From the point of view of camera quantity reduction, it is more efficient to use one camera both for the identification at close distance, and for detection on the big distances. In this connection the installation site of the camera should be precisely calculated. In the **Help system** there is an example of such calculation: **Examples>Example 2 Calculation of cameras' parameters and selection of their relative locations**

Activate other camera by double click on its lens, choose the quality level for this camera in the **Camera geometry** box, switch on display of necessary areas by  buttons.

* *Thus it is possible to observe simultaneously the projections of necessary areas of any quantity of cameras in the project. It is convenient for a choice of relative position of several cameras.*

Verification and correction of person detection, person identification and license plate reading criteria

VideoCAD gives an opportunity to check and correct values of all criteria by **three-dimensional model of the real image from the camera**.
For correction of the loaded camera quality level criteria values: place 3D models on borders of the calculated areas, simulate image quality by quality level parameters and observe **model of the real image** in the **3D window**. If borders of areas do not meet your requirements - change values of criteria.

The technique is in detail described in the **Help system Examples>Example 6. Determining person identification criteria by a real image**.

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Spatial resolution

Visualization of the Spatial resolution - a relatively simple and obvious, but less rigorous tool. In contrast to the calculation of person detection, identification, license plate reading areas, it does not separate one area, considering limitations of resolution, range of heights and angle. It does not take into account camera tilt angle when calculating the size of a person in the frame.
This tool only divides the view area into regions based on sequentially changing values of a specified criterion. In many practical cases this is enough. But if you want a more rigorous calculation, you should use the calculation of person detection, identification, license plate reading areas.

View area of cameras can be divided into **regions** based on the following **criteria**:

- vertical spatial resolution (pixels/meters, pixels/foot);
- vertical field of view size (meter, foot);
- vertical number of pixels covered by an object of the specified height (meter, foot);
- the part of the frame height covered by an object of the specified height (meter, foot).

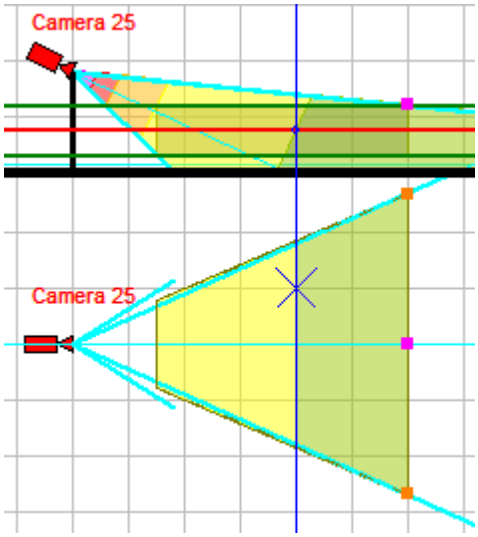

Fig. 13 Spatial resolution visualization

*These Criteria relates to the **spatial resolution** or the **field of view size**. For short, in the definitions, it is mentioned the **spatial resolution only** (the Spatial resolution box, the Spatial resolution pattern, the Spatial resolution criterion ...), except of special cases.*

In the **Graphics window**, projection of different **regions** of view area can be filled by different color and (or) type of hatching.

Type of the criterion, boundary values of the criterion and how the regions are filled and (or) hatched is determined by a **Spatial resolution pattern.** VideoCAD project can contain up to **30** spatial resolution patterns. Each pattern can include up to **10** regions. You can assign different patterns to different cameras.

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You can edit these patterns and assign them to cameras in the **Spatial resolution box**.
In the box there are prepared spatial resolution patterns according to the following criteria:

- Home Office Scientific Development Branch;
- Home Office Guidelines for identification;
- P 78.36.008-99.

Individual patterns can be customized according to any other criteria related to the spatial resolution or the field of view size.

Also in the box there are examples of images of group of people are automatically displayed for each region of spatial resolution.

Visualization of the Spatial resolution works irrespective of the quality levels, person detection, identification, license plate reading areas. These tools can be used separately. Shared parameter is only vertical resolution (number of pixel) of image.

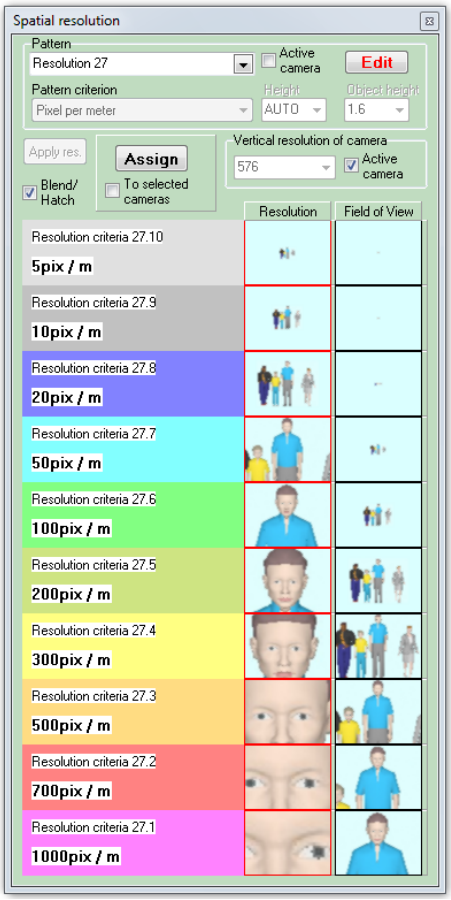

Fig. 14 Spatial resolution box

Visualization of spatial resolution according to the CCTV Operational Requirements Manual 2009

Criteria of CCTV Operational Requirements Manual 2009 for analog and digital video

CCTV Operational Requirements Manual 2009 developed by **Home Office Scientific Development Branch** establishes as a criterion a part of frame height occupied by a person of average height (1,64m - 1,76m or 5'4" – 5'8"):

- **Monitor and Control – 5%**

A figure occupies at least 5% of the screen height and the scene portrayed is not unduly cluttered. From this level of detail an observer should be able to monitor the number, direction and speed of movement of people across a wide area, providing their presence is known to him; i.e. they do not have to be searched for.

- **Detect – 10%**

The figure now occupies at least 10% of the available screen height. After an alert an observer would be able to search the display screens and ascertain with a high degree of certainty whether or not a person is present.

- **Observe – 25%**

A figure should occupy between 25% and 30% of the screen height. At this scale, some characteristic details of the individual, such as distinctive clothing, can be seen, whilst the view remains sufficiently wide to allow some activity surrounding an incident to be monitored.

- **Recognize – 50%**

When the figure occupies at least 50% of screen height viewers can say with a high degree of certainty whether or not an individual shown is the same as someone they have seen before.

- **Identify – 100%**

With the figure now occupying at least 100% of the screen height, picture quality and detail should be sufficient to enable the identity of an individual to be established beyond reasonable doubt.

This criterion is directly applicable only to analog video, therefore the document establishes rules how to use this criterion for digital images with progressive scan.
Vertical resolution of analog image with interlace scan is assumed equal to 400 pixels. Then the criterion is transformed to other resolutions by the relation of the number of vertical pixels to 400.

It is easier to express this criterion in pixels for digital images:

Monitor and Control – 5%*400=20 pix.

Detect – 10%*400=40 pix.

Observe – 25%*400=100 pix.

Recognise – 50%*400=200 pix.

Identify – 100%*400=400 pix.

Adjusting Spatial resolution pattern

In the Spatial resolution box there are pre-set patterns according to both versions of the criterion of CCTV Operational Requirements Manual 2009, so there is no need for adjusting.
If you want to adjust pattern or configure other patterns according to your own criteria, see **Help system>Interface VideoCAD 7>Spatial resolution>Work with the Spatial resolution box**.

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Adjusting image size

Adjust the number of pixels of the camera if you have not configured it before, by the same way as for calculating person identification and detection areas. See Adjusting Image size chapter above.

Assigning the spatial resolution pattern to a camera

Activate the appropriate camera by clicking on it's lens or choosing from the **Active camera** combo box.
Open the **Spatial resolution box**, by clicking on the **Spatial resolution box** button on the **Tool bar**.

On the **Spatial resolution** box, clear the **Active camera** checkbox near to the **Pattern** combo box, if it is checked

In the Pattern box, select one of the patterns:

Home Office Scientific Development Branch 2009 (PAL resolutions) - to use the pattern for analog cameras, with criterion which is a part (%) of frame height occupied by a person of average height.
Criterion of this pattern does not depend on resolution (number of pixels) of image.

OR

Home Office Scientific Development Branch 2009 (arbitrary resolutions) - to use a pattern for IP cameras, with criterion which is the vertical number of pixels occupied by a person of average height.
Criterion for this pattern depends on resolution (number of pixels) of image.

To assign the selected pattern to the active camera, click **Assign**.
If you have previously checked the **To selected cameras** box, clicking **Assign** assigns the pattern to all selected cameras.
Close the **Spatial resolution box**.

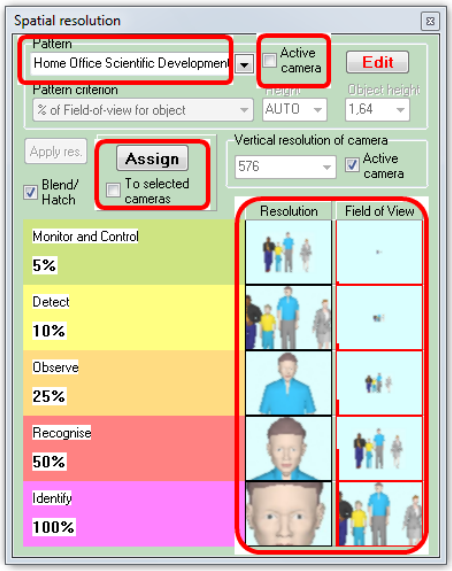

Fig. 15 Spatial resolution box

Adjusting visualization of spatial resolution

To display the spatial resolution of the active camera:
Deselect all cameras.
Select from the drop-down list of the **Spatial resolution** button (on the Toolbar of the Graphics window):

- Discrete colors - fill the regions in discrete colors in accordance with a spatial resolution at the far bounds of the regions.
- **Gradient** - fill the view area projection in gradient color according to the spatial resolution at each point on the projection.

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*In case of gradient color is chosen, the colors at the **far region bounds** equal to the colors of the **spatial resolution pattern**, but between the bounds color changes smoothly, as well as real spatial resolution.*
Gradient reflects the spatial resolution more accurately and looks impressive, but discrete colors are more intuitive and easy to use.

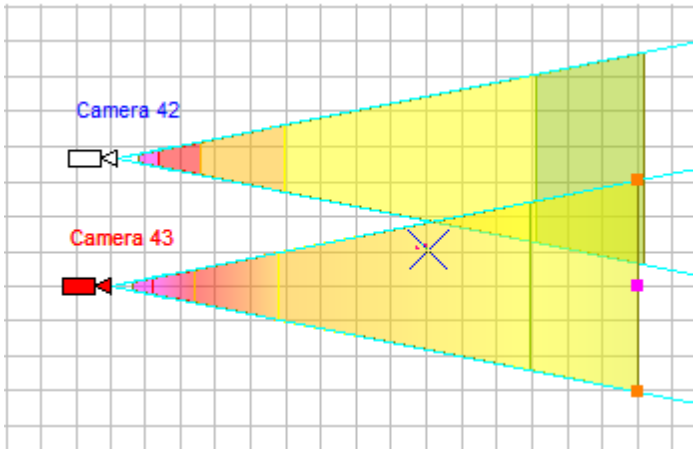

Fig. 16 Gradient filling

Using the **Fill projections** button you can switch view of spatial resolution in the form of a translucent filling or in the form of hatching or as a border lines only.
*If the **Gradient** item is chosen, but in the drop-down menu of the **Fill projections** button the **Hatching** item is chosen, then the projections will be hatched by a bold style of hatch without gradient.*

To adjust view of the spatial resolution for several cameras simultaneously - select the desired cameras and then adjust the spatial resolution.

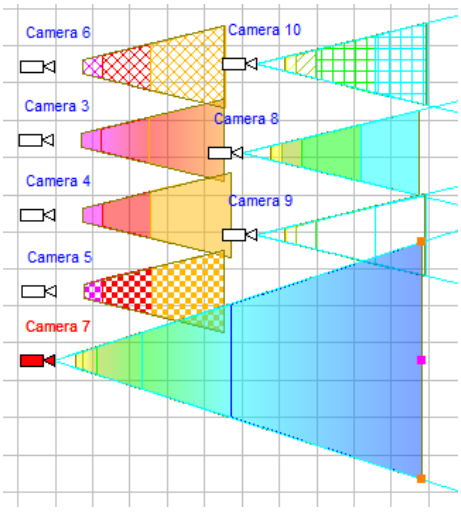

Fig. 17 Spatial resolution views

Control of spatial resolution on the layout

Open the **Spatial resolution box** again by clicking on the **Spatial resolution box** button on the **Toolbar**. Pay attention to the table in the box, the rows of which correspond to regions in the pattern, the two columns from the right (resolution and field of view) contain images.

The bottom row of the table corresponds the nearest to the camera region.

On the first column of the table, on the background rectangle filled by a color assigned to the region, the Name of the region and the **Criterion value** at the far bound of region are displayed.

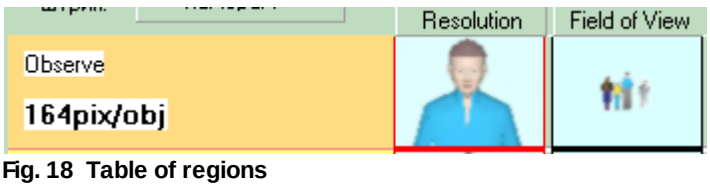

Fig. 18 Table of regions

The **Resolution** column contains fragments of images with people at the far bounds of each region. **These are fragments of images, not whole images**. **Field of view** of the fragments is less than the real **field of view**, but the **resolution** of people corresponds the real images exactly.

*On the images in the **Resolution** column, you can see with which resolution people at the far bound of each region will be visible.*

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The **Field of view** column contains **whole compressed images** of people with the **field of view** at the far bounds of each region. **Resolution** of these images is less than resolution of the real image, but the **field of view** corresponds the real images exactly.

*On the images in the **Field of view** column, you can see which part of the field of view people at the far bound of each region will cover.*

Images in **Resolution** and **Field of view** columns are automatically generated according to the **criterion value** of each region and the **Vertical resolution of camera** value.
The images visualize the boundary values of the criterion.

The height of "men in blue shirt" is 2 meters (about 6.5 feet).

It is convenient to keep the **Spatial resolution box** opened during the analysis of spatial resolution in the Graphics window. Comparing color of regions on the layout with color in table in the spatial resolution box, on the images in the **Resolution** and **Field of view** columns you can immediately see the expected resolution and field of view size at every point of view area of each camera.

*Table of regions can display any images in ***. jpg** format, for example: photos of objects, etc. Adding your own images you can see how your objects will look at the far bounds of regions. See: **Help system>Interface>Interface VideocAD7>Spatial resolution>Tools**.*

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Conclusion

Automatic calculation of person detection, identification and license plate reading areas – is an useful tool for CCTV system design in VideoCAD. Visualization of the Spatial resolution - a relatively simple and obvious, but less rigorous tool. Competent using these tools allows to accomplish many tasks quickly and efficiently.

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