

CCTV coverage

Release number v2.0

1. Introduction

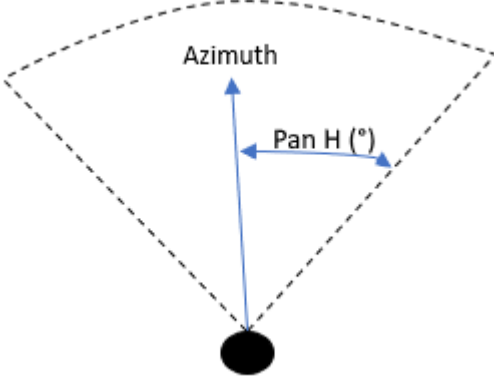
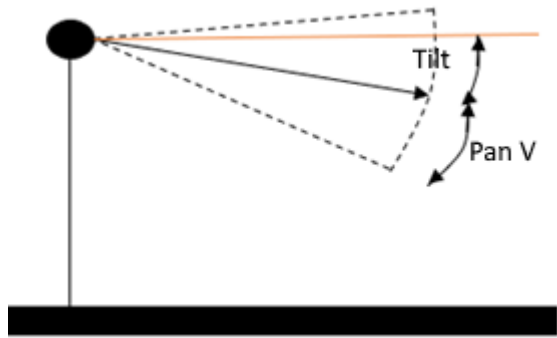
This document entails instructions on how to model, plan, simulate and analyze CCTV cameras in HTZ tool.

2. CCTV object

To add CCTV object to the map:

- 1- Right-click anywhere on the map.
- 2- Select "Add station".
- 3- Select "CCTV".

Main parameters:

<table style="width: 100%; border: none;"> <tr> <td style="border: none;">Type</td> <td style="border: none;">Status</td> </tr> <tr> <td style="border: none;">CCTV (18) ▾</td> <td style="border: none;">Unknown (0)</td> </tr> <tr> <td colspan="2" style="border: none; padding: 5px;"> <div style="border: 1px solid #ccc; padding: 5px;"> <p>General</p> <p>Mast height (m) <input style="width: 80px;" type="text" value="30.00"/></p> <p>Azimuth (0-359°) <input style="width: 80px;" type="text" value="0.00"/></p> <p>Tilt (-90° +90°) <input style="width: 80px;" type="text" value="0.000"/></p> <p>Pan H (+- deg) <input style="width: 80px;" type="text" value="90"/></p> <p>Pan V (+- deg) <input style="width: 80px;" type="text" value="45"/></p> <p style="text-align: right; font-size: small;">Pan = rotation</p> </div> </td> </tr> </table> <p style="text-align: center; font-size: small;">CCTV object parameters</p>	Type	Status	CCTV (18) ▾	Unknown (0)	<div style="border: 1px solid #ccc; padding: 5px;"> <p>General</p> <p>Mast height (m) <input style="width: 80px;" type="text" value="30.00"/></p> <p>Azimuth (0-359°) <input style="width: 80px;" type="text" value="0.00"/></p> <p>Tilt (-90° +90°) <input style="width: 80px;" type="text" value="0.000"/></p> <p>Pan H (+- deg) <input style="width: 80px;" type="text" value="90"/></p> <p>Pan V (+- deg) <input style="width: 80px;" type="text" value="45"/></p> <p style="text-align: right; font-size: small;">Pan = rotation</p> </div>		
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 <p style="font-size: small;">Pan H parameter (top view)</p>	 <p style="font-size: small;">Pan V parameters (side view)</p>						

- Mast height: Height of the camera above ground level.
- Azimuth [0 to 359]: Orientation of the camera's center of view relative to true North.
- Tilt [-90 to +90]: Tilting of the camera with -ve being towards the ground.
- Pan H (+-deg): That is in fact ½ of the maximum Horizontal range of angles. For example, if the camera specs specify 160° horizontal range of angles, user must divide this number by 2 and set it to 80°.

- Pan V (+-deg): That is in fact ½ of the maximum Vertical range of angles. For example, if the camera specs specify 46° vertical range of angles, user must divide this number by 2 and set it to 23°.

Ranges for horizontal angles = From Azimuth - Pan H to Azimuth + Pan H.

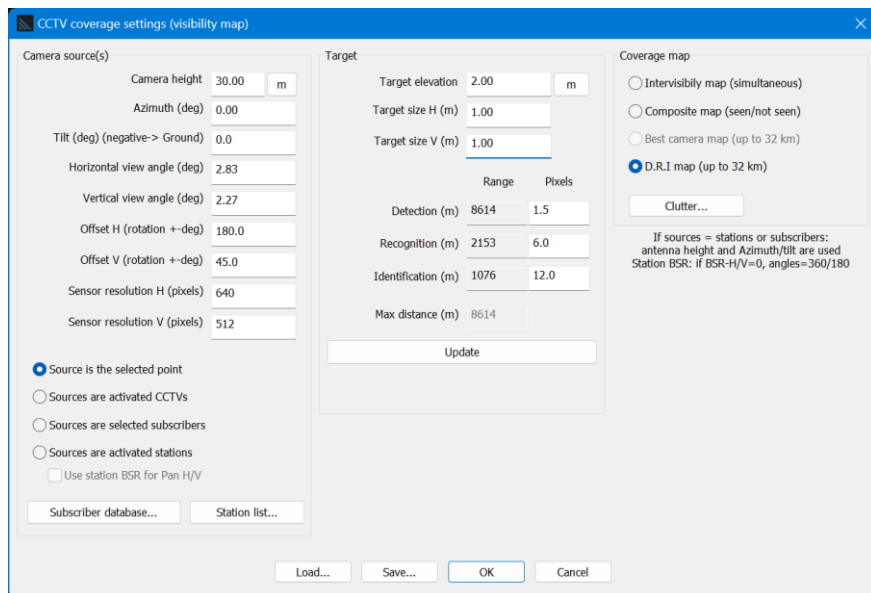
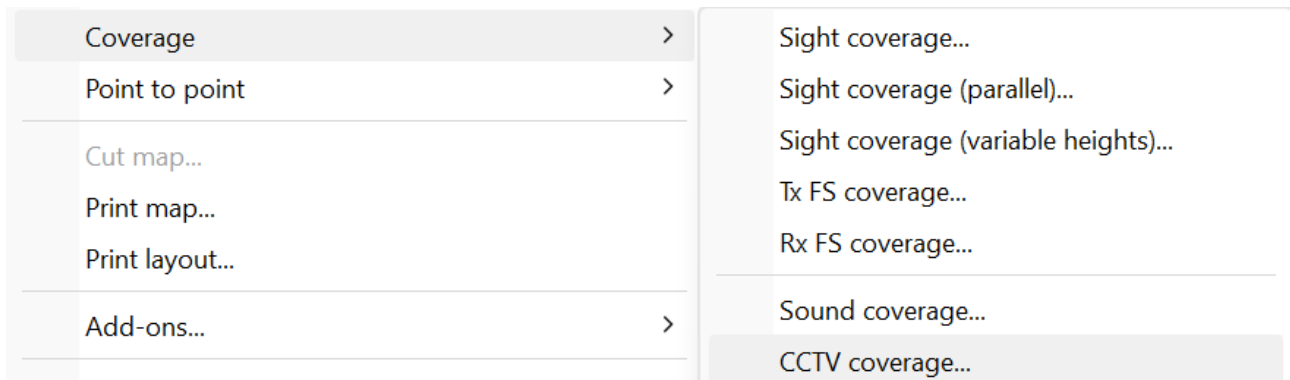
Ranges for vertical angles = From Tilt - Pan V to Tilt + Pan V.

3. CCTV coverage

Step 1: Right click anywhere on the map

Step 2: Go down to Coverage

Step 3: Select “CCTV coverage...”



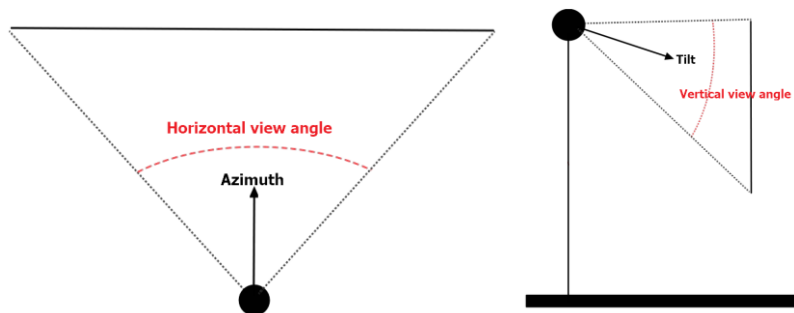
Step 4: Select the camera source.

- Common parameters whatever the selected source:

Horizontal view angle (deg)	2.83	Sensor resolution H (pixels)	640
Vertical view angle (deg)	2.27	Sensor resolution V (pixels)	512

Horizontal view angle (deg): For a given azimuth of the camera, this is the total range of horizontal angles that can be seen from the camera.

Vertical view angle (deg): For a given tilt of the camera, this is the total range of vertical angles that can be seen from the camera.



Sensor resolution H (pixels): Number of pixels on the image captured by the camera in the horizontal plane.

Sensor resolution V (pixels): Number of pixels on the image captured by the camera in the vertical plane.

- Source is the selected point: This option allows to model one camera only. It will enable the following settings:

Camera source(s)

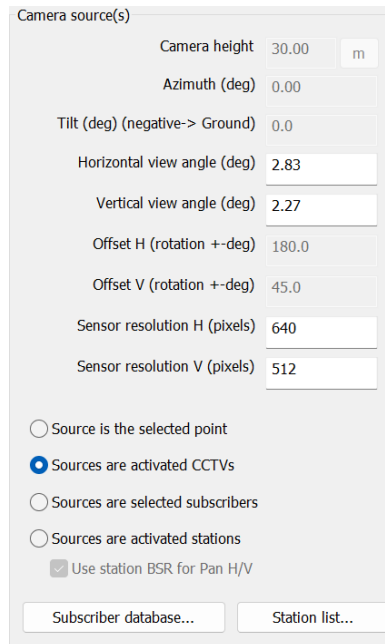
Camera height	30.00	m
Azimuth (deg)	0.00	
Tilt (deg) (negative-> Ground)	0.0	
Horizontal view angle (deg)	2.83	
Vertical view angle (deg)	2.27	
Offset H (rotation +-deg)	180.0	
Offset V (rotation +-deg)	45.0	
Sensor resolution H (pixels)	640	
Sensor resolution V (pixels)	512	

Source is the selected point
 Sources are activated CCTVs
 Sources are selected subscribers
 Sources are activated stations
 Use station BSR for Pan H/V

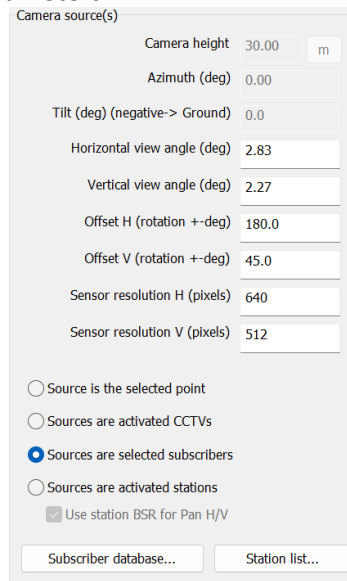
Subscriber database... Station list...

- Camera height.
- Azimuth.
- Tilt.
- Offset H (rotation +-deg): That is in fact ½ of the maximum Horizontal range of angles.
- Offset V (rotation +-deg): That is in fact ½ of the maximum Vertical range of angles.

- Sources are activated CCTVs: This option will make use of the CCTV object(s) defined by the user on the map. This option is ideal if user wishes to model multiple cameras added on the map and produce combined analysis.

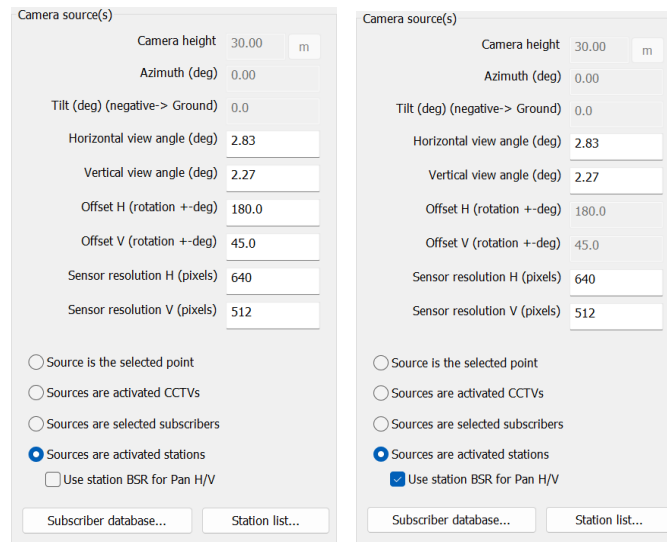


- Camera height: Extracted from the parameters of each CCTV object (Mast height).
 - Azimuth: Extracted from the parameters of each CCTV object.
 - Tilt: Extracted from the parameters of each CCTV object.
 - Offset H (rotation +-deg): Extracted from each CCTV object (Pan H).
 - Offset V (rotation +-deg): Extracted from each CCTV object (Pan V).
- Sources are selected subscribers: In this case, transmitting antenna heights and Azimuths/Tilts are extracted from subscribers parameters.



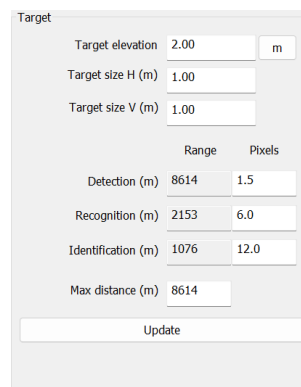
- Camera height: Extracted from the parameters of each subscriber (Antenna height).
- Azimuth: Extracted from the parameters of each subscriber.
- Tilt: Extracted from the parameters of each subscriber.

- Offset H (rotation +-deg): That is in fact ½ of the maximum Horizontal range of angles.
- Offset V (rotation +-deg): That is in fact ½ of the maximum Vertical range of angles.
- Sources are activated stations: This is used if user prefers to make use of standard Tx/Rx objects. In this case, transmitting antenna heights and Azimuths/Tilts are extracted from each station parameters. If the "Use station BSR for PanH/V" option is selected, Horizontal and Vertical view angles are computed according to station Beam Steering Range (BSR) values set in each station parameters.



The image shows two identical screenshots of the 'Camera source(s)' configuration window. The left window has the radio button for 'Sources are activated stations' selected. The right window has the radio button for 'Sources are activated stations' selected and the checkbox for 'Use station BSR for Pan H/V' checked.

Step 5: Configure the target and calculation ranges



The image shows the 'Target' configuration window with the following fields and values:

- Target elevation: 2.00 m
- Target size H (m): 1.00
- Target size V (m): 1.00
- Range (m) | Pixels
- Detection (m): 8614 | 1.5
- Recognition (m): 2153 | 6.0
- Identification (m): 1076 | 12.0
- Max distance (m): 8614
- Update button

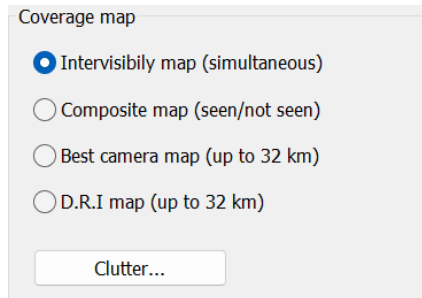
- Target elevation: This is the height of the object (AGL m) being targeted. For example, a person can be estimated to 1 meter. If it's a drone – then the expected height of the drone to be used.
- Target size H (m): Size of the target in the horizontal plane. Used to compute the maximum range(s).
- Target size V (m): Size of the target in the Vertical plane. Used to compute the maximum range(s).
- Ranges (limited to 32km)
 - The Detection, Recognition and Identification ranges (D.R.I) are computed according to the corresponding minimum number of pixels to be present on the image.
 - Max distance: This is greyed out if the "D.R.I map" option is selected. By default, it is set to the maximum value computed for D.R.I. ranges. It can be also user defined.

- The "Update" button will update the ranges according to the target sizes and the number of pixels required.

Notes:

- CCTV coverage settings can be saved / loaded to/from .CTV files.
- CCTV angle views can be computed (if needed) from a Web calculator such as: <https://www.cctvcalculator.net/en/calculations/viewing-angle/>

Step 6: Select the output map type



- Intervisibility map (simultaneous): The number of cameras simultaneously viewing each point is displayed on the map.
- Composite map (seen/not seen): The composite visibility map is displayed with Seen=1 / Not seen = 0.
- Best camera map (up to 32km): Available only for sources defined from CCTV or station objects. The nearest station number seeing each point is displayed on the map.
- D.R.I map (up to 32km): Detection / Recognition / Identification map. Please refer to the next section for more information.
- Select the clutter codes to be considered as a potential location of the target on the map.

4. D.R.I Analysis for human (1.8m x 0.5m)

A particular coverage can be performed in order to display and analyze the D.R.I coverage based on the camera's capabilities and target pixels criteria:

- D: Detection range (m)
- R: Recognition range (m)
- I: Identification range (m)

4.1. Background

50% confidence – based on a person

DRI as per 1.5 ± 0.5 pixels for **Detection** 6 ± 1.5 pixels for **Recognition** and 12 ± 2 pixels for **Identification** with 50% probability of achieving the objective, at the specified distance.

70% confidence – based on a person

DRI as per 1.88 ± 0.5 pixels for **Detection** 7.5 ± 1.5 pixels for **Recognition** and 15 ± 2 pixels for **Identification** with 70% probability of achieving the objective, at the specified distance.

90% confidence – based on a person

DRI as per 2.68 ± 0.5 pixels for **Detection** 10.74 ± 1.5 pixel for **Recognition** and 21.4 ± 2 pixels for **Identification** with 90% probability of achieving the objective, at the specified distance.

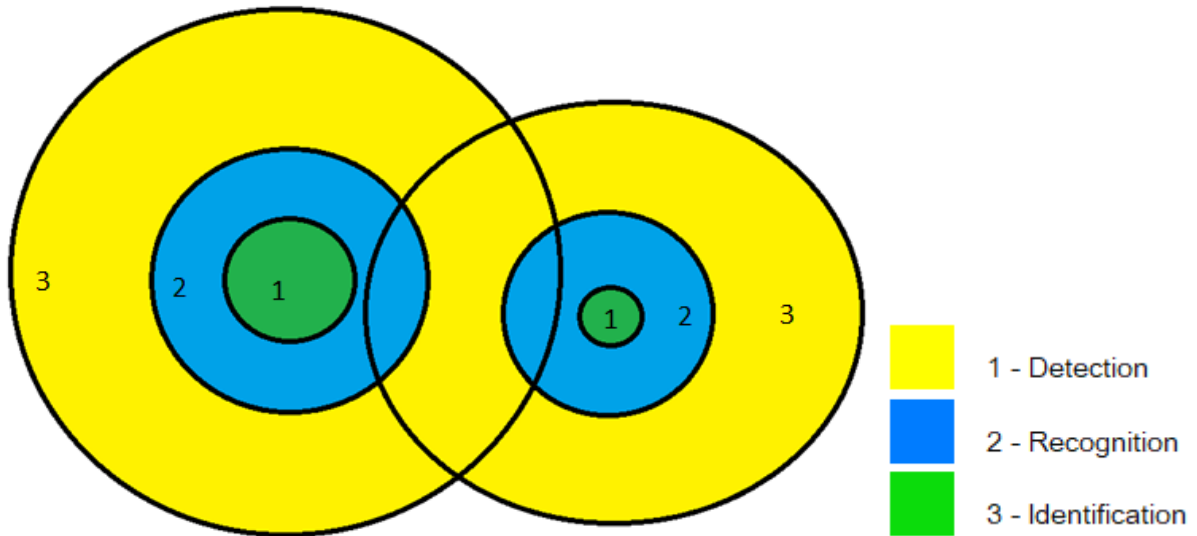


Figure 1: Theoretical DRI map

4.2. D.R.I map from CCTV objects

CCTV coverage settings (visibility map)

Camera source(s)

Camera height: 30.00 m

Azimuth (deg): 0.00

Tilt (deg) (negative-> Ground): 0.0

Horizontal view angle (deg): 2.83

Vertical view angle (deg): 2.27

Offset H (rotation +-deg): 180.0

Offset V (rotation +-deg): 45.0

Sensor resolution H (pixels): 1920

Sensor resolution V (pixels): 1080

Source is the selected point

Sources are activated CCTVs

Sources are selected subscribers

Sources are activated stations

Use station BSR for Pan H/V

Subscriber database... Station list...

Target

Target elevation: 1.00 m

Target size H (m): 1.80

Target size V (m): 0.50

	Range	Pixels
Detection (m)	6814	2.0
Recognition (m)	1703	8.0
Identification (m)	973	14.0

Max distance (m): 6814

Update

Coverage map

Intervisibility map (simultaneous)

Composite map (seen/not seen)

Best camera map (up to 32 km)

D.R.I map (up to 32 km)

Clutter...

If sources = stations or subscribers:
antenna height and Azimuth/tilt are used
Station BSR: if BSR-H/V=0, angles=360/180

Load... Save... OK Cancel

Select the sources as activated CCTVs.

Type: CCTV (18) Status: Unknown (0) # 1 activated

General

Mast height (m) 30.00
 Azimuth (0-359°) 90.00
 Tilt (-90° +90°) 0.000
 Pan H (+- deg) 90
 Pan V (+- deg) 45
 Pan = rotation

Info

Callsign CCTV 1
 Address Date 18000101 YYYMMDD
 Info (1) Type ID C
 Info (2) Link
 Network ID Group
 User Call number 0
 Date: start / end 0 / 0

Type: CCTV (18) Status: Unknown (0) # 2 activated

General

Mast height (m) 30.00
 Azimuth (0-359°) 180.00
 Tilt (-90° +90°) 0.000
 Pan H (+- deg) 30
 Pan V (+- deg) 40
 Pan = rotation

Info

Callsign CCTV 2
 Address Date 20231208 YYYMMDD
 Info (1) Type ID C
 Info (2) Link
 Network ID Group
 User Call number 0
 Date: start / end 0 / 0

Camera sensor settings:

- Resolution: 1920x1080
- Horizontal view angle: 2.83°
- Vertical view angle: 2.27°

Configure the target.

- Target elevation: this is the height of the object (AGL m) being targeted. For example, a person can be estimated to 1 meter. If it's a drone - then the expected height of the drone to be used.
- Target size (m): 1.80 x 0.5 (m)
- Ranges: Set the minimum number of pixels required for each case and click on "Update".

Simulation outcome

Palette

>= other	>= pc	>= dB	>=dBm	dBu/dBm labels	min
1	auto	auto	auto	Detection	min
2	auto	auto	auto	Recognition	
3	auto	auto	auto	Identification	

Close Load...

