



CADASTRAL MAPPING BASED ON UAV IMAGERY

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CADASTRAL MAPS



LANDS



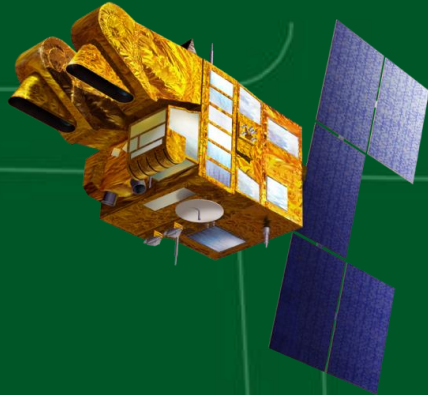
DWELLINGS



BUILDINGS



CADASTRAL MAPS





**IF AN ACCURACY OF ORTHOIMAGES
CREATED BASED ON UAV DATA
IS SUFFICIENT TO CADASTRAL MAP UPDATE?**



CHRZĘSNE (POLAND)

52°26'45.0"N

21°28'52.0"E



TRIMBLE UX5 UAV SYSTEM



SONY NEX 5R



TRIMBLE UX5 UAV – SOLUTION COMPONENTS



Type	Body with the wings
Weight	2.5 kg
Wing span	1 m
Wing surface	34 dm²
Dimensions	100 x 65 x 10 cm
Motor	Electric motor with propellers
Battery	14.8 V, 6000 mAh
Altitude	75 – 750 m
GSD	2.4 - 24 cm
Image overlap	60-90%





Sony NEX 5R	
przetwornik	CMOS APS-C 23.4 mm × 15.6 mm
resolution	16.1 Mpix
size	111/59/39 mm
weight	210 g (without battery)



Lens SEL-16F28
Focal length 16 mm, equivalent 24 mm

Data Capture

Mission
planning

Control point
measurement

UAV Flight

Data Processing

Bundle
adjustment

Digital Elevation
Model creating

Ortho creating

Mosaicking of
orthoimages

Cadastral map vs. orthoimage

Analysis of
orthoimage
accuracy

Assessment of
possibility of
orthoimage
interpretation

<http://uas.trimble.com/calculator>



Flight calculator

Calculate the ground sample distance, area coverage, flight time and number of pictures for both the UX5 and UX5 HP.

Flight height

m

min 75, max 750

Overlap of pictures

%

min 60, max 90

Area length

km

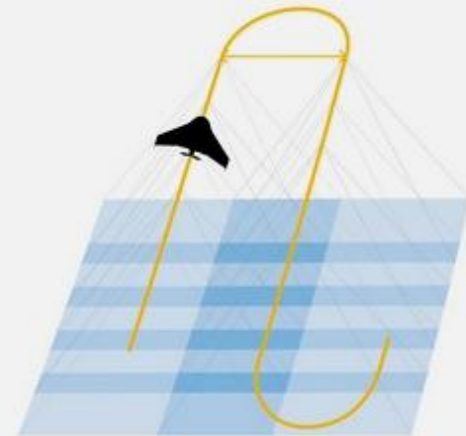
min 0.1

Area width

km

min 0.1

Calculate



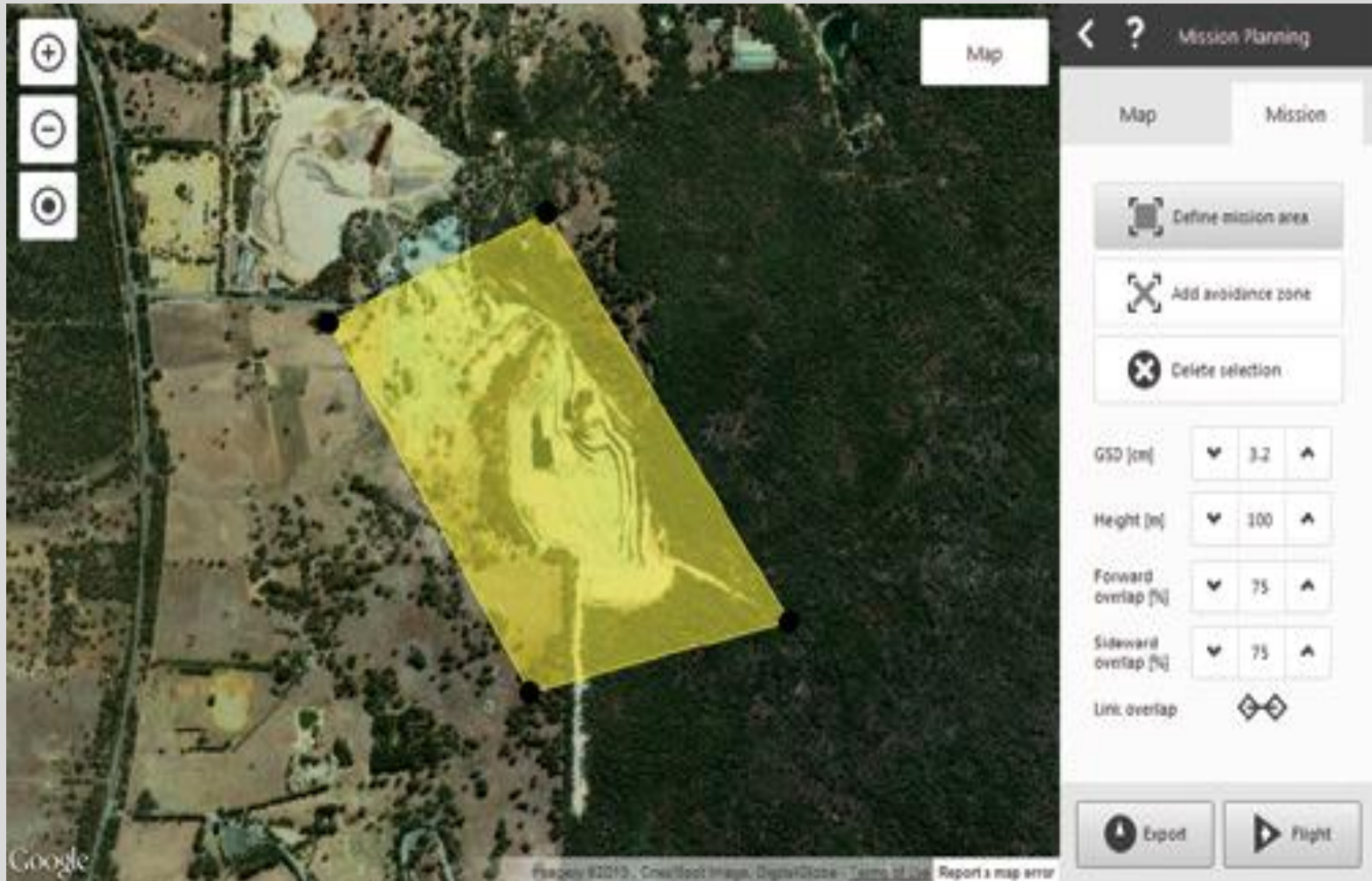


<http://uas.trimble.com/calculator>

	Type	Lens	GSD *	Area Coverage	# Flight Lines	Flight Time	# Pictures
	UX5	15mm	2 cm	0.085 km ²	19	15 minutes	76
	UX5 HP	15mm	2.4 cm	0.085 km ²	12	11 minutes	48
	UX5 HP	25mm	1.5 cm	0.085 km ²	20	15 minutes	80
	UX5 HP	35mm	1 cm	0.085 km ²	28	19 minutes	112



MISSION PLANNING



Parameter	Test package
Number of rows	37
Number of images	3 625
Camera / focal length [mm]	NEX 5/ 15.51
overlap (along / across-track direction) [%]	80/ 70
Flight altitude [m]	200
Exposure time	1/2.500 s
Camera matrix pixel size [μm]	4.75

GROUND CONTROL POINTS

ACCURACY OF GPS RTK MEASUREMENT

m_x [m]	m_y [m]	m_z [m]
0.03	0.03	0.03



EXAMPLES OF SIGNS

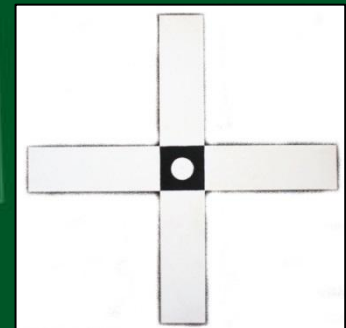
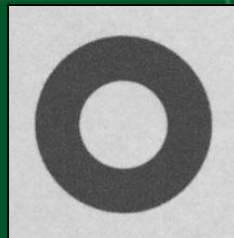
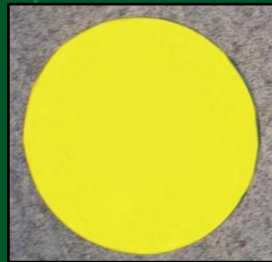


Photo Measurement Tool - [C:\poligon_wedzyn_inpho\poligon_wedzyn_lot1_inpho.prj]

File Edit Display View Window Options Help

Block: MultiAerial

Points

Point List

ID	Type	Predictions	Links	StripRefs
✓ FOTO07	HV	0	0 (0) 0	
✓ FOTO08	HV	0	0 (0) 0	
✓ FOTO09	HV	0	0 (0) 0	
✓ FOTO10	CHV	15	16 (16) 4	
✓ FOTO11	HV	13	13 (13) 3	
✓ FOTO12	HV	15	15 (15) 4	
✓ FOTO13	HV	15	15 (15) 3	
✓ FOTO14	HV	0	0 (0) 0	
✓ G1	HV	0	0 (0) 0	
✓ G2	HV	0	0 (0) 0	
✓ G3	HV	0	0 (0) 0	

Point Details

General

Identification FOTO10

Type CHV

Status True

Description 0

Position [m]

Coordinates [510381.119, 5808456.521, 126.45]

Residuals [0, 0, 0]

StdDevs [0, 0, 0]

Measurements

Predicted 15

Measured 16

Point Image Points

ID	Photo	x [mm]	y [mm]	vny [um]	Mode	Block	Elimin.
✓	DSC08505	6.66884	8.59943	0.00000	LSM	*	-
✓	DSC08506	4.02215	9.03108	0.00000	LSM	*	-
✓	DSC08507	-0.59726	8.65640	0.00000	LSM	*	-
✓	DSC08508	-3.65391	9.22077	0.00000	LSM	*	-
✓	DSC08509	-4.96698	9.13485	0.00000	LSM	*	-
✓	DSC08612	6.06241	1.02986	0.00000	LSM	*	-
✓	DSC08613	4.21235	0.20240	0.00000	UNK	*	-
✓	DSC08614	2.15442	0.55893	0.00000	LSM	*	-
✓	DSC08615	-1.59957	-0.60844	0.00000	LSM	*	-
✓	DSC08616	-4.55918	-1.94263	0.00000	LSM	*	-
✓	DSC08661	6.36584	-6.60879	0.00000	LSM	*	-
✓	DSC08662	1.57829	-5.37012	0.00000	LSM	*	-

Image DSC08505

Image DSC08506

Image DSC08507

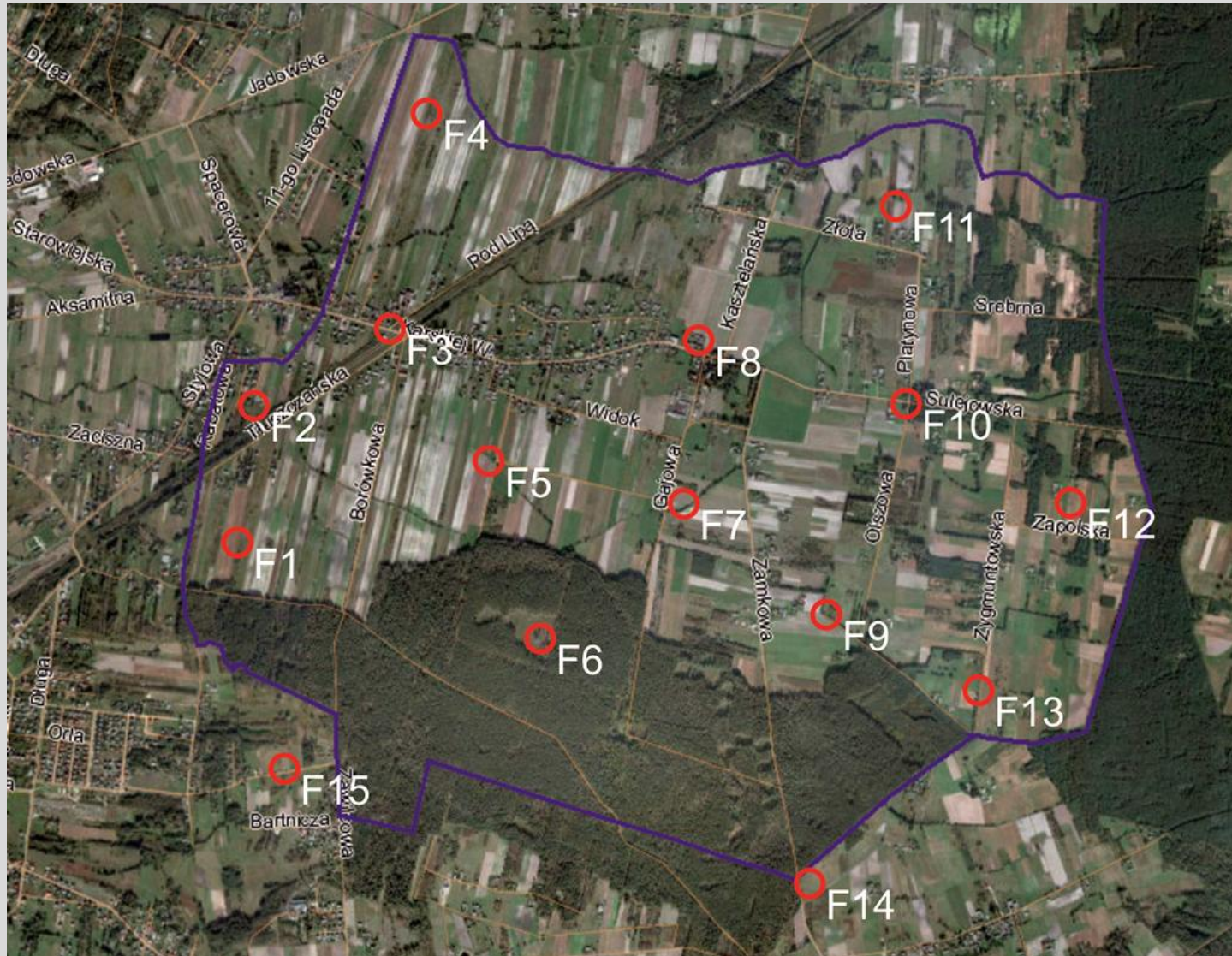
Image DSC08508

Output Log Statistics

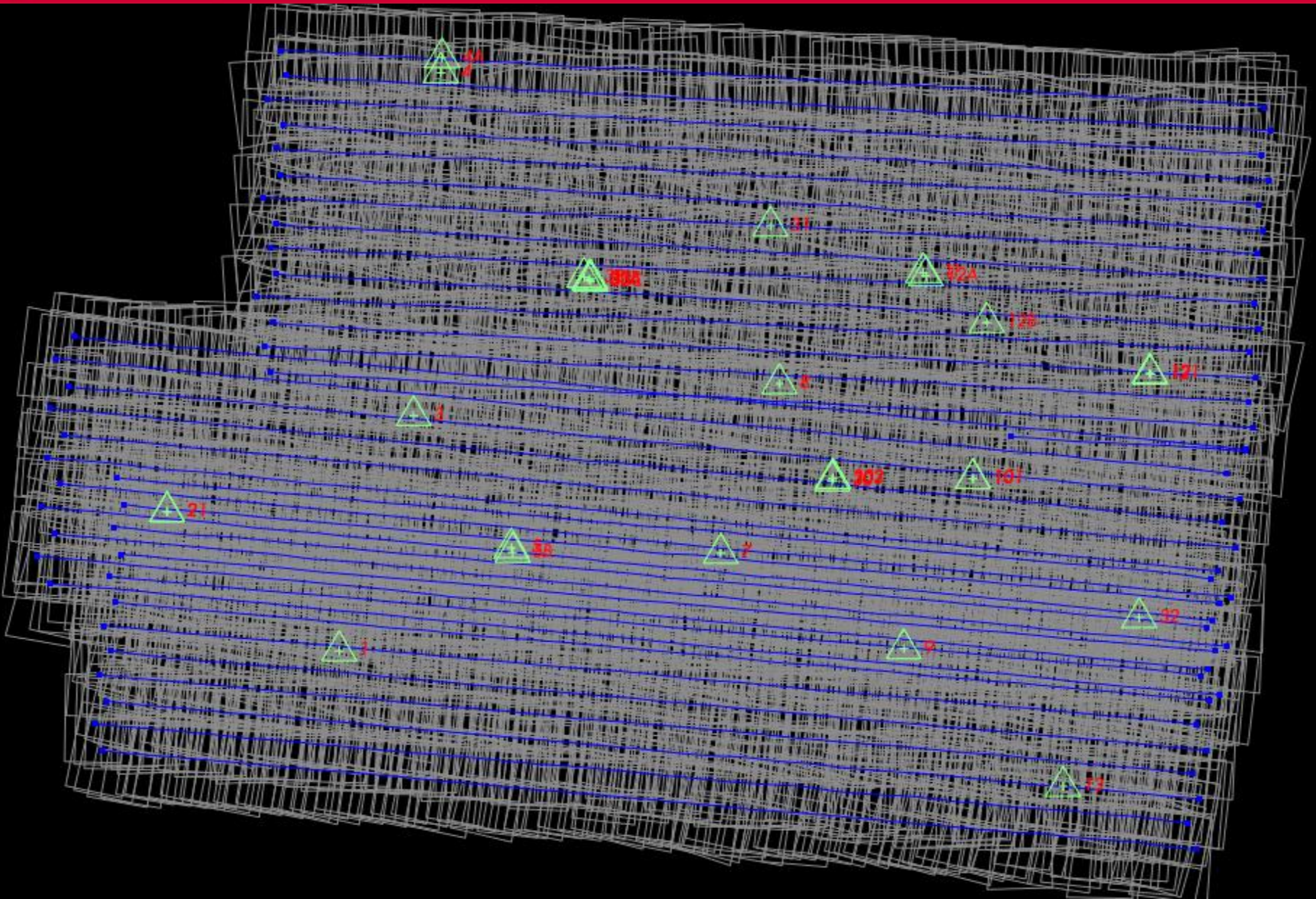
Skanowanie komputera
Skanowanie komputera zostało rozpoczęte
5808456.663 m ; 126.450 m

PL 16:05
2014-10-30

GROUND CONTROL POINTS



RESULTS OF BLOCK ADJUSTMENT



RESULTS OF BLOCK ADJUSTMENT

σ_0 [μm]/[pix]	6.9/1.4
Number of control points	16
Number of check points	5
RMS error for control points (X, Y, Z) [m]	0.03; 0.03; 0.09
RMS error for check points (X, Y, Z) [m]	0.11; 0.04; 0.13
mX0 [m] / mY0 [m] / mZ0 [m]	0.10 / 0.08 / 0.09
m ω [°] / m ϕ [°] / m κ [°]	0.020 / 0.026 / 0.007



DIGITAL ELEVATION MODEL

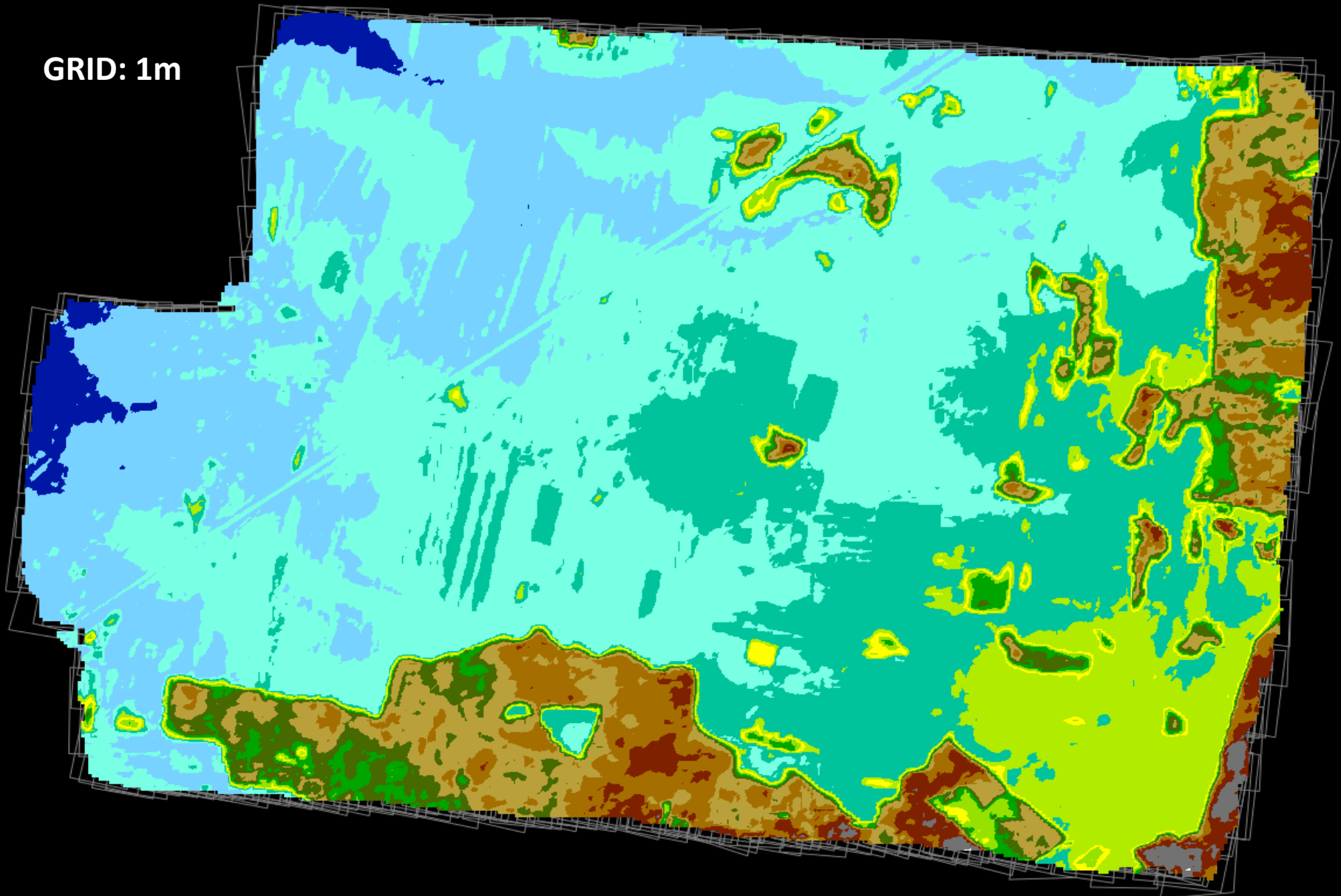
Point Cloud density: 8 points/m²





DIGITAL ELEVATION MODEL

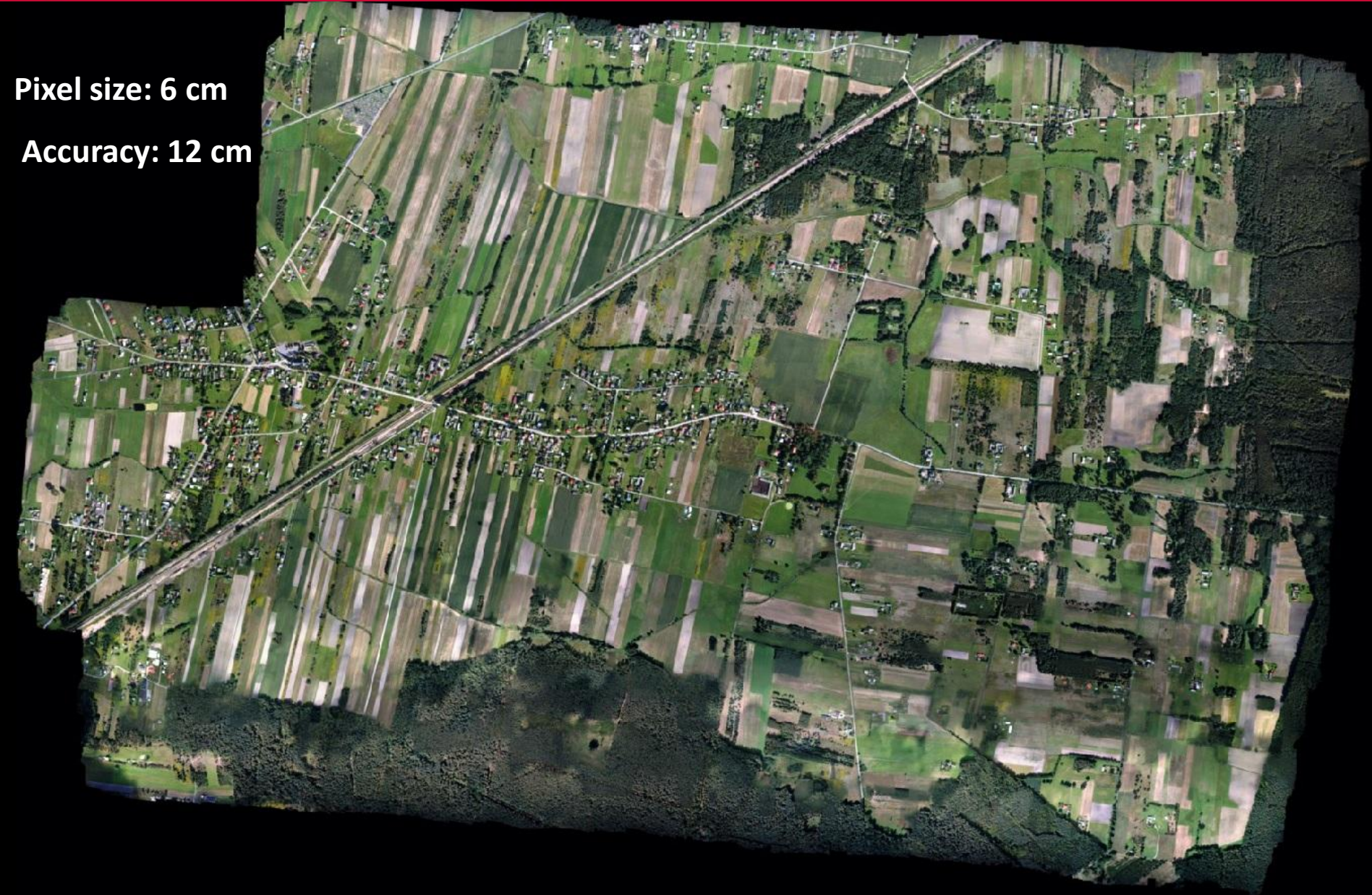
GRID: 1m



ORTHOIMAGE OF CHRZĘSNE BASED ON UAV IMAGERY

Pixel size: 6 cm

Accuracy: 12 cm





CADASTRAL MAP OF CHRZEŚNE



ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

LOW URBAN AREA



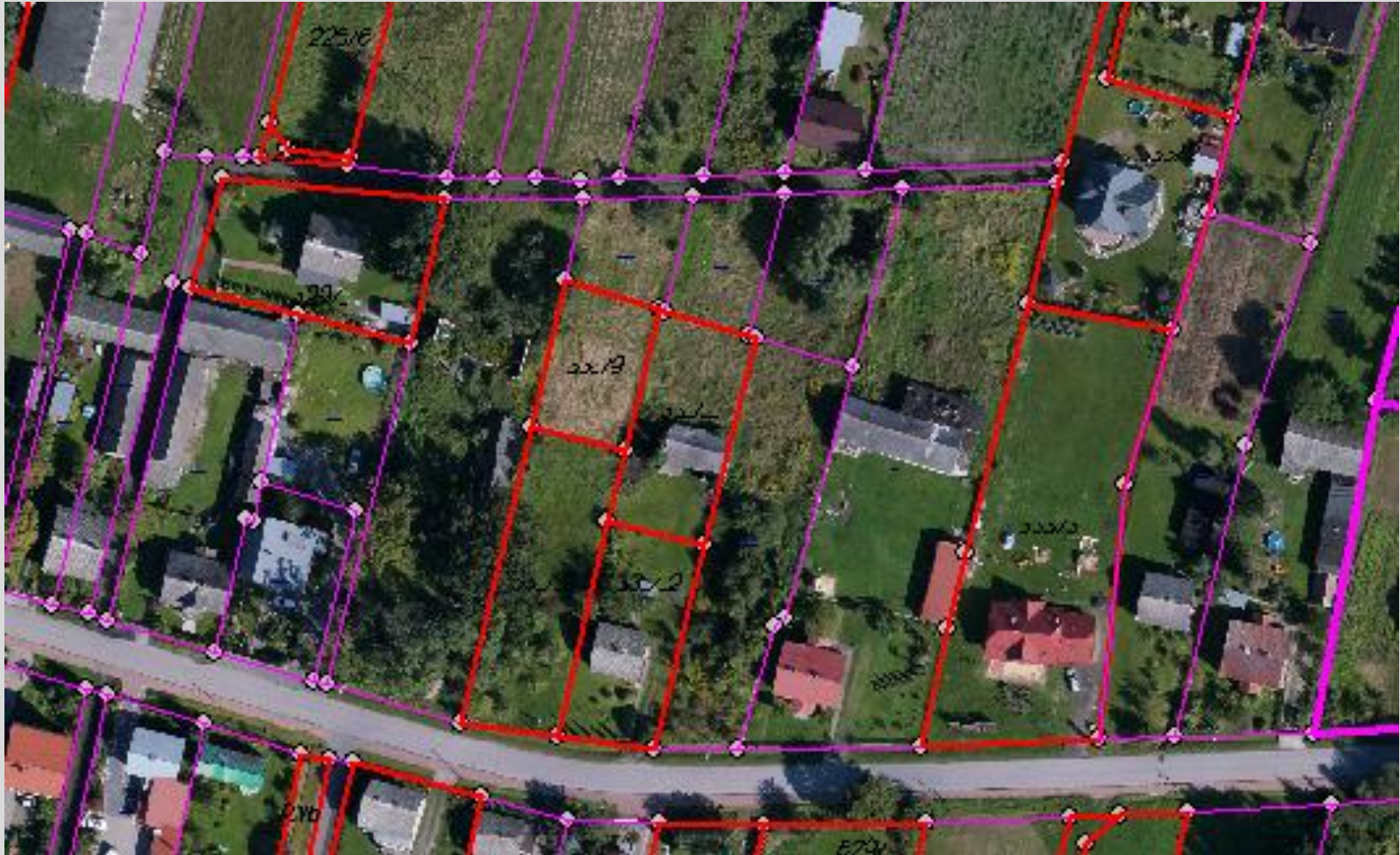
ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

LOW URBAN AREA - BUILDINGS



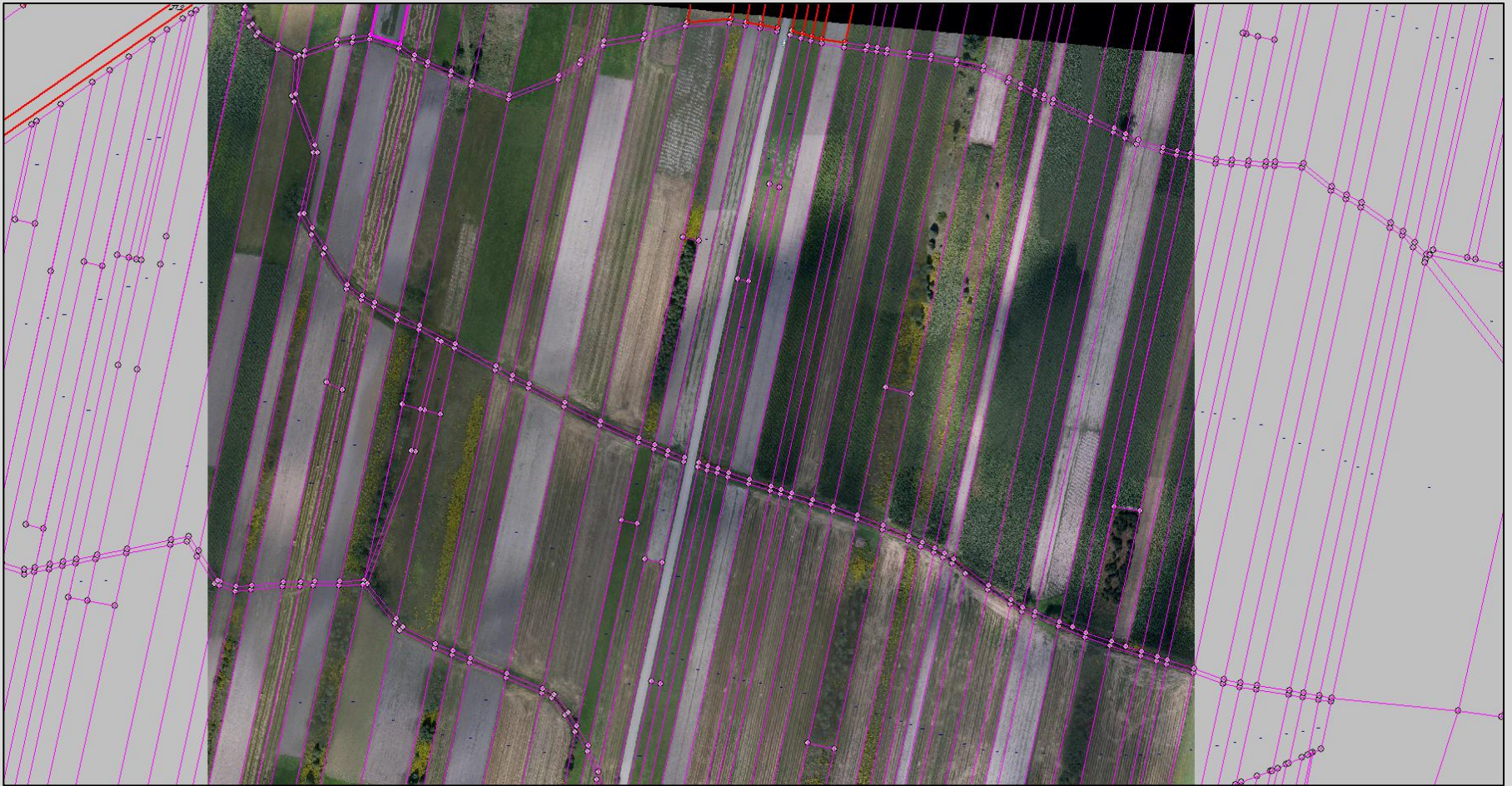
ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

LOW URBAN AREA - PLOTS



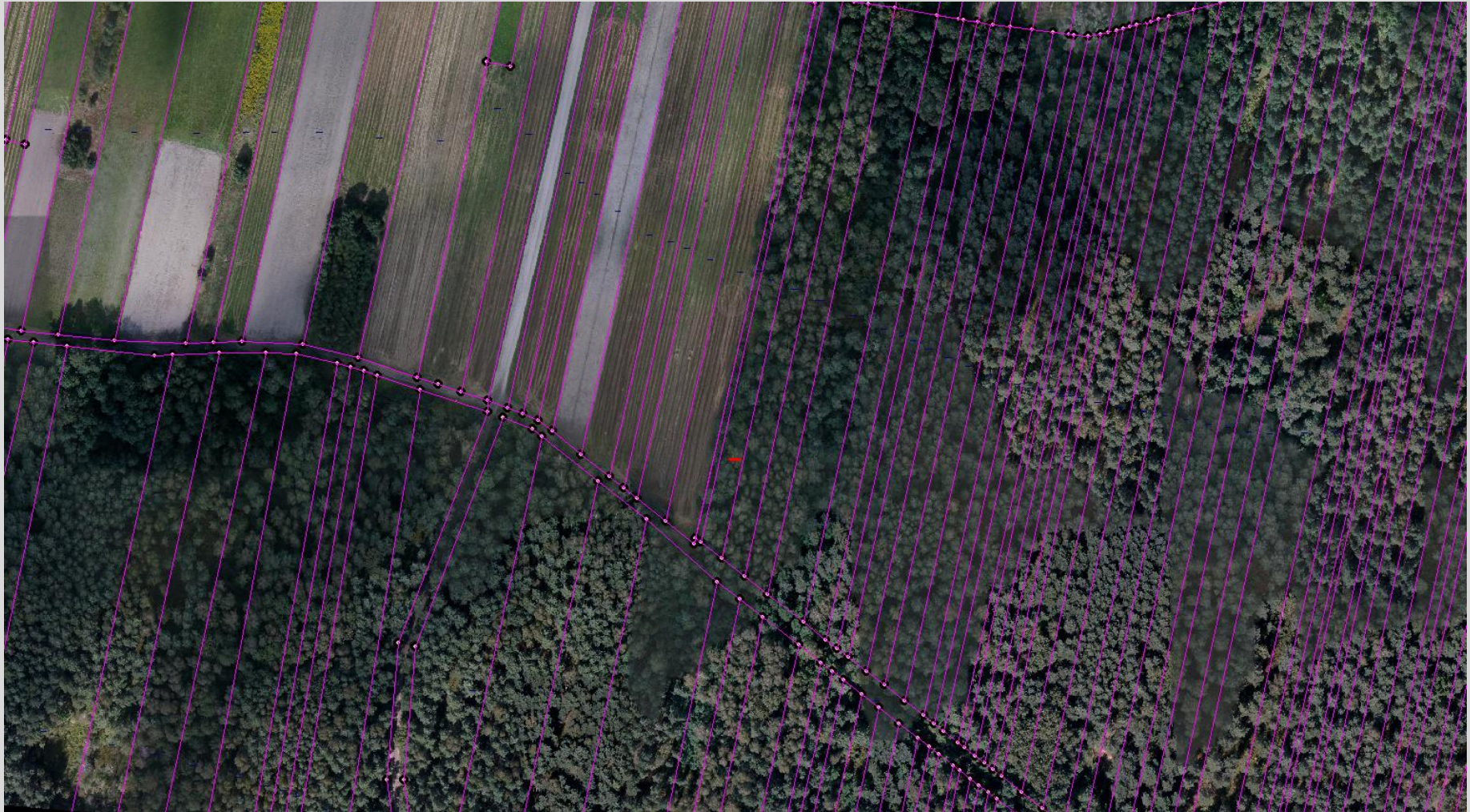
ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

ARABLE LANDS



ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

FOREST





CADASTRAL MAP VS. ORTHOIMAGE

	number of objects	Identification of objects [%]	m_0 [m]
Buildings	75	91	0.80
Plots	40	80	0.51
Roads	15	95	1.02
Arable Land	20	80	0.40

1. The accuracy of orthoimage generated based on uav imagery and the accuracy cadastral map were compared.
2. The analysis included: buildings, plots, roads, arable lands and forest.
3. The ability of identifying objects was over 90% (buildings, roads), more than 80% (plots and arable lands).
4. The geometric accuracy and interpretative advantages of the resulting orthoimages allow to updating the cadastral map in rural areas.
5. The interpretive possibilities of orthoimages is influenced by the flight altitude pixel size, spectral and radiometric resolution of a sensor.
6. It is estimated that such an update of cadastral maps based on UAV imagery can be less costly than on-ground measurements.

THANK YOU FOR YOUR ATTENTION

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