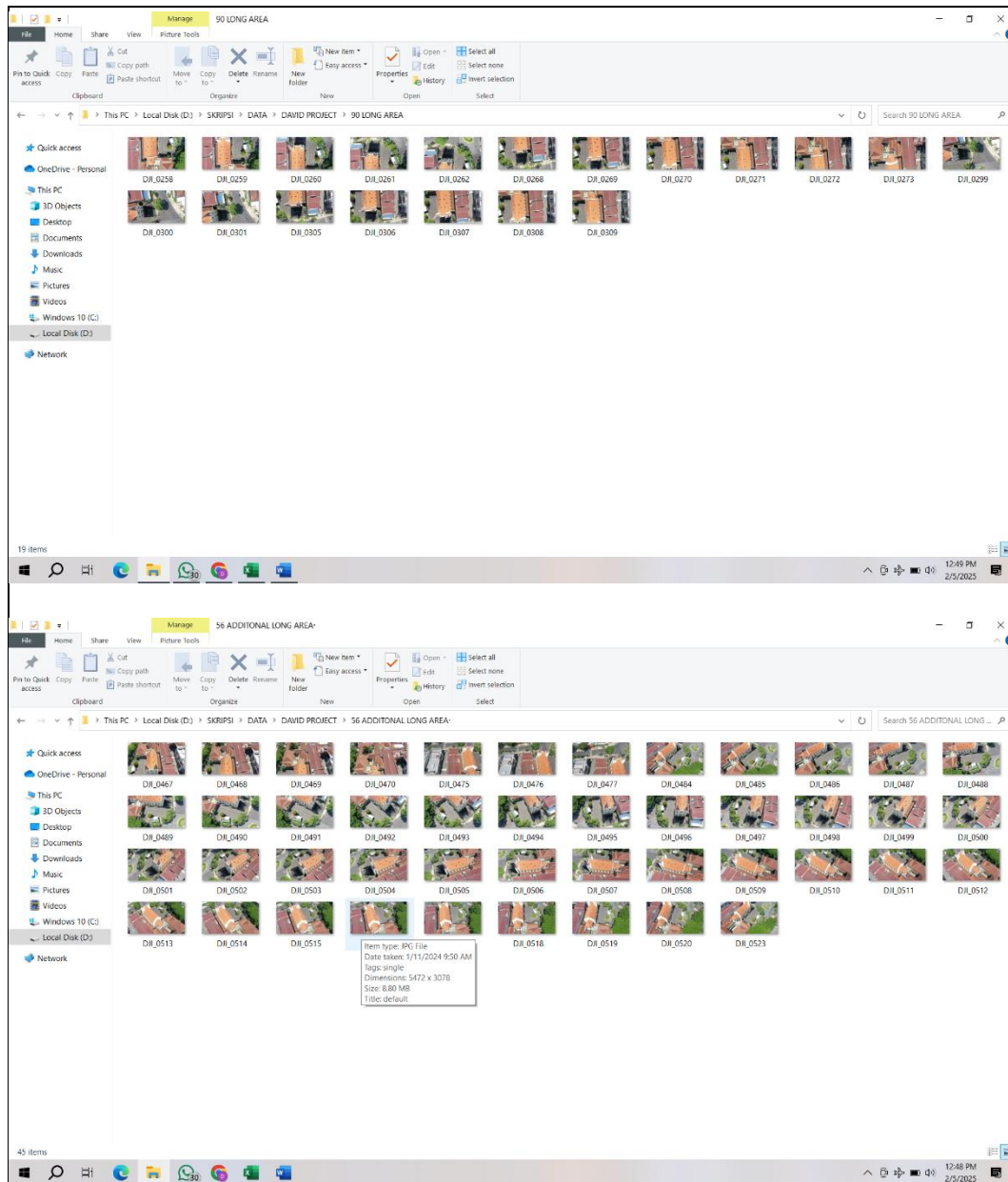
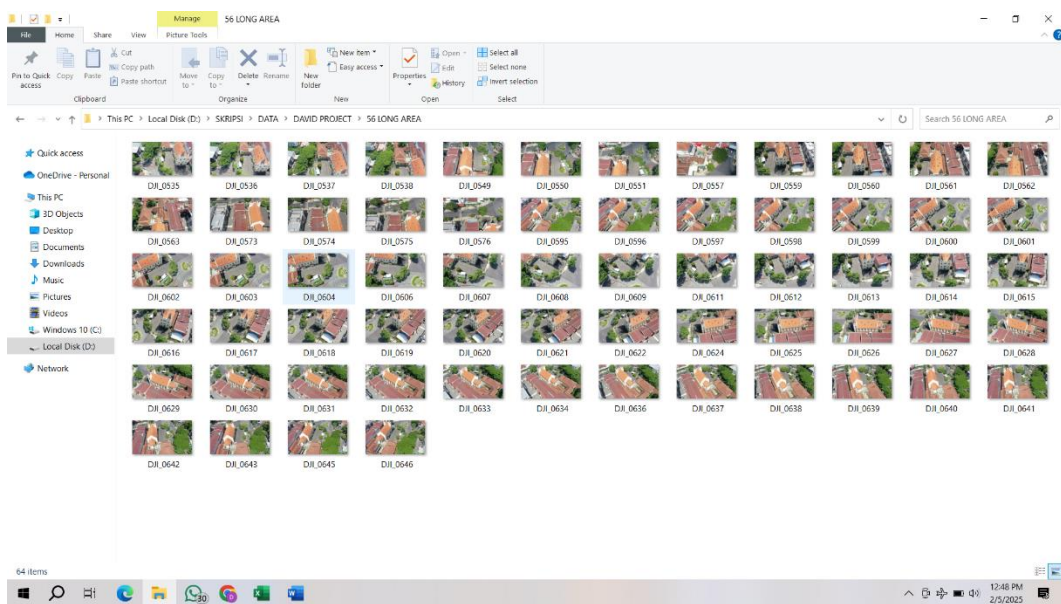
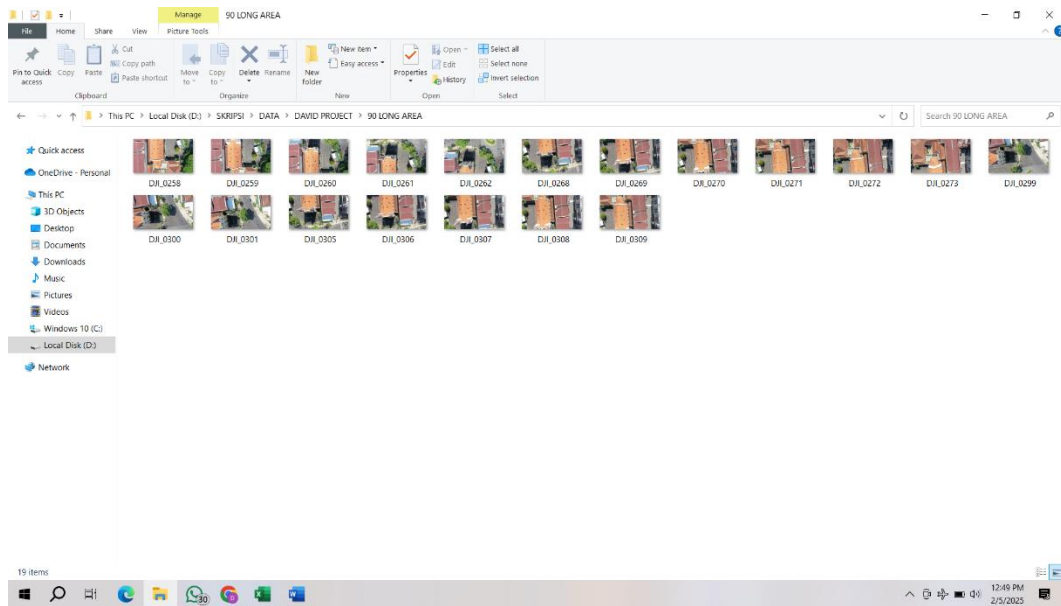
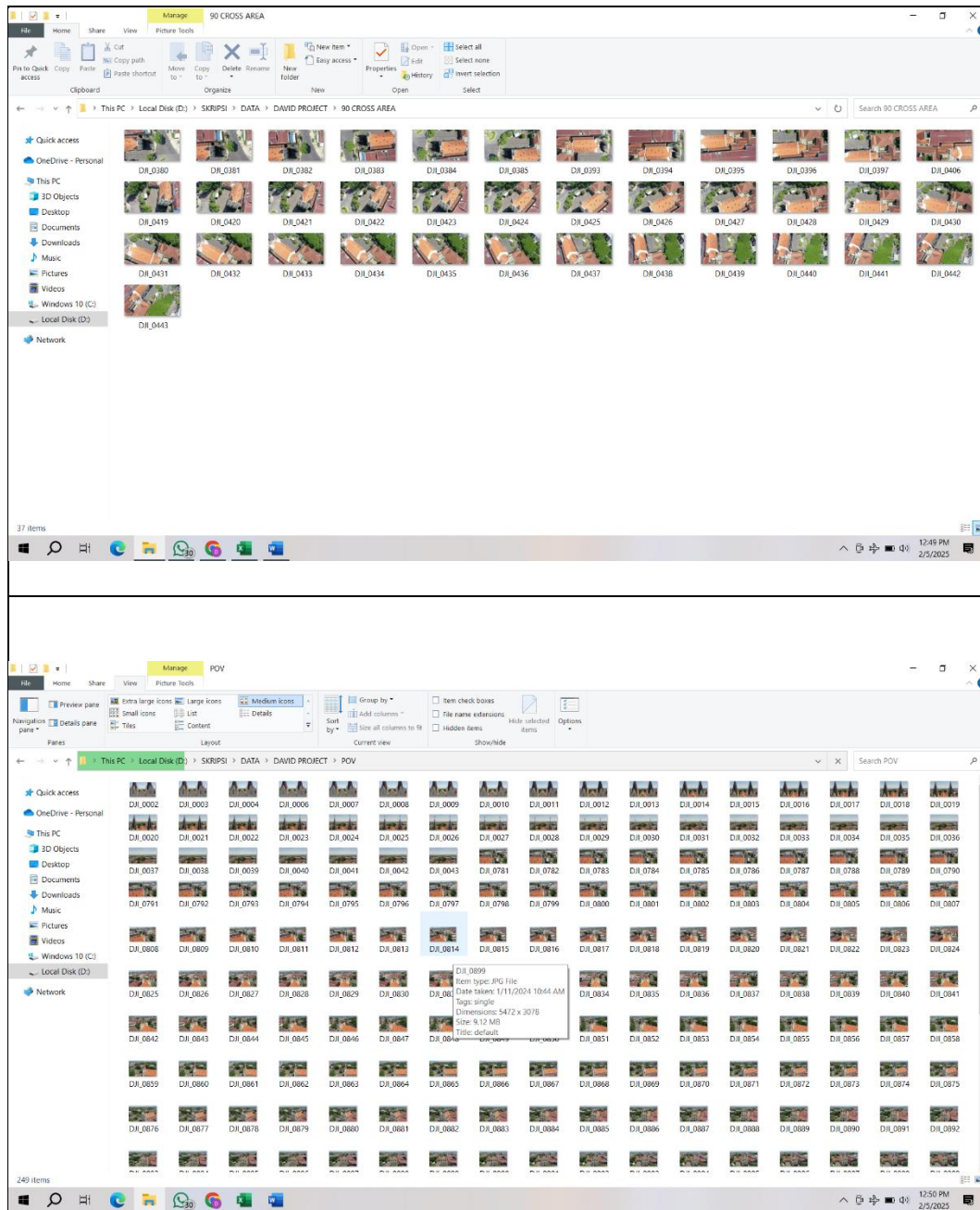


LAMPIRAN

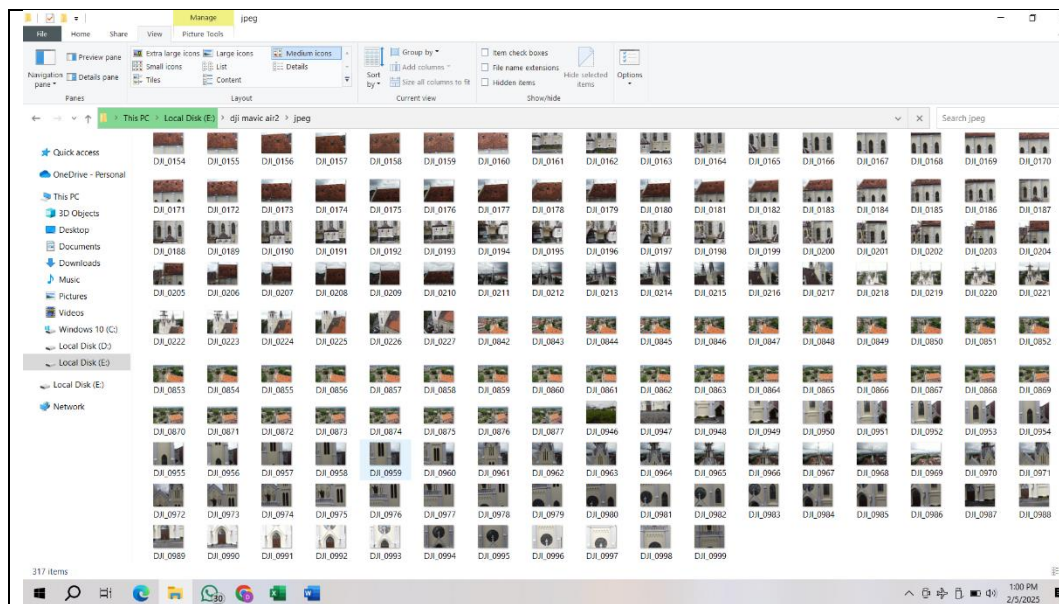
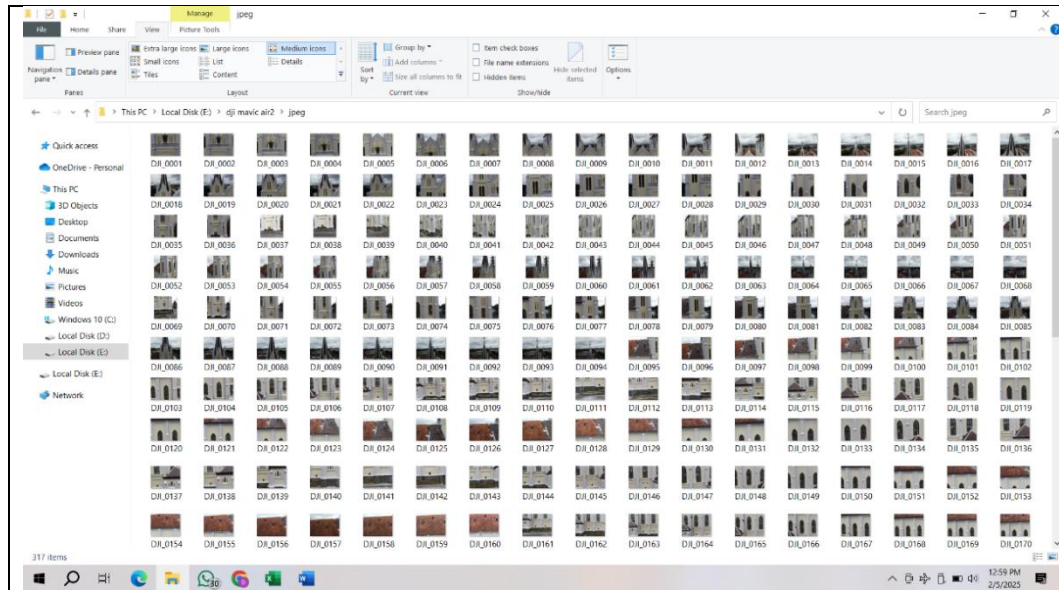
Data Lapangan Drone *Mavic 2 Pro*



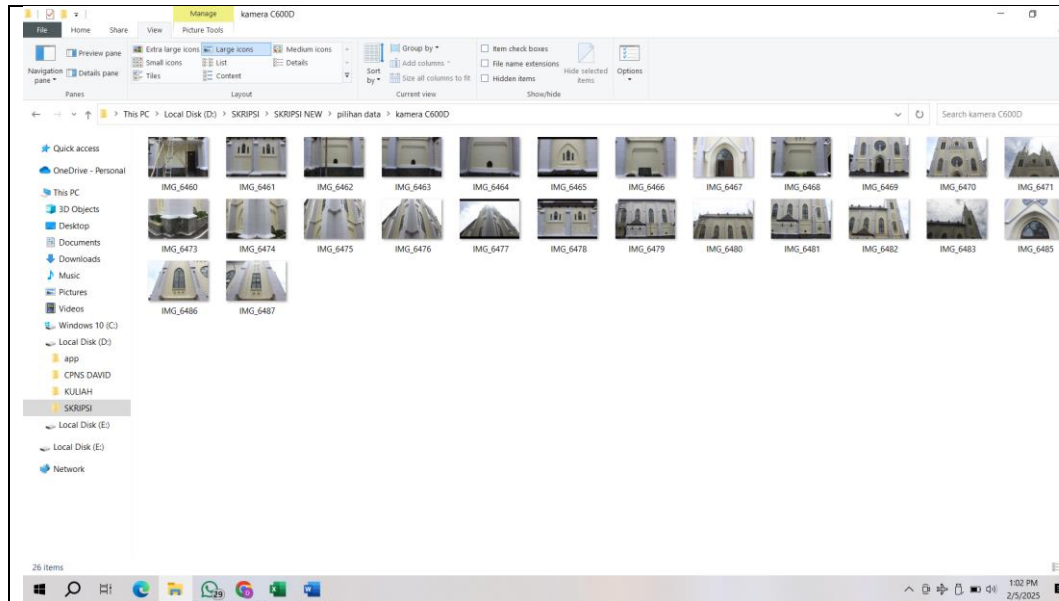




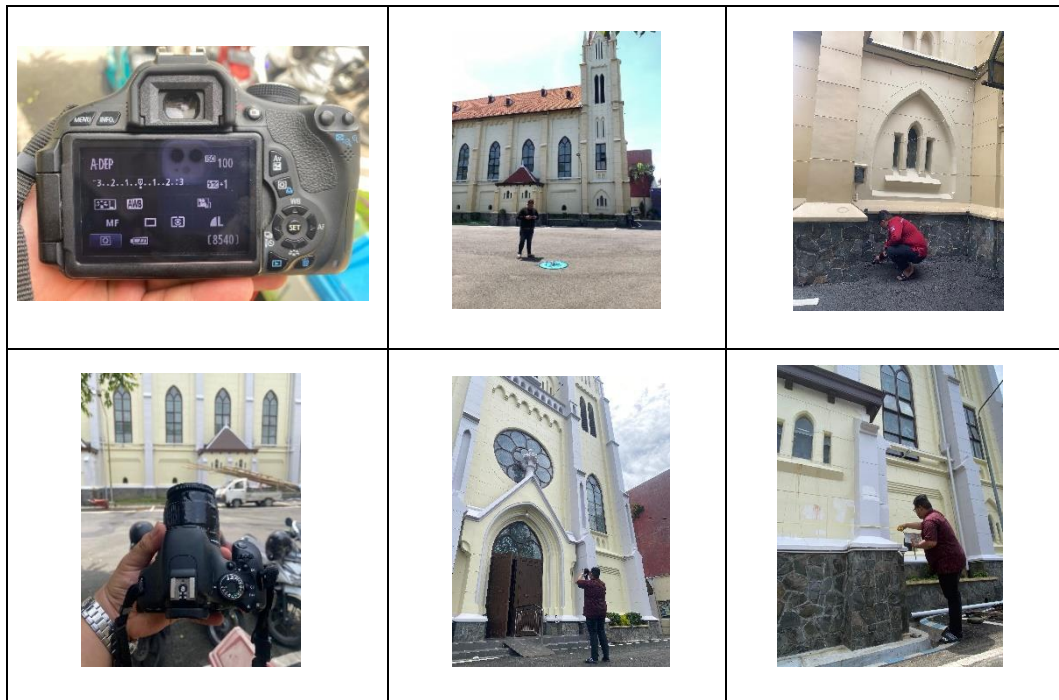
Data Lapangan Drone *Mavic Air 2*



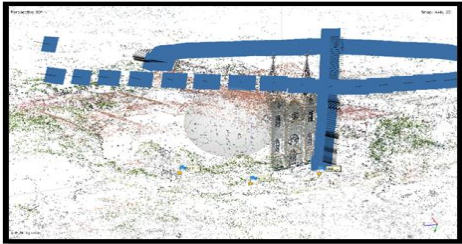
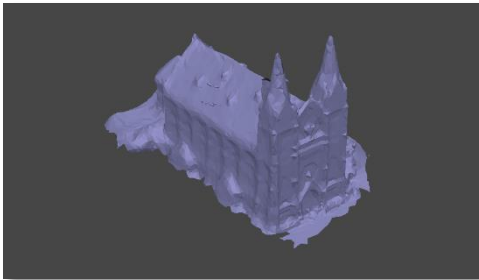
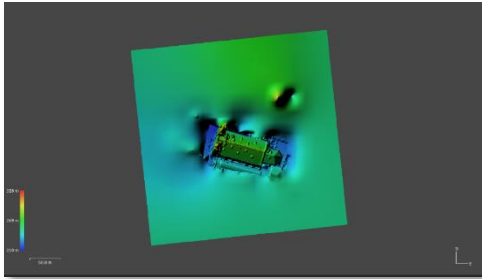
Data Lapangan Kamera DSLR 600D



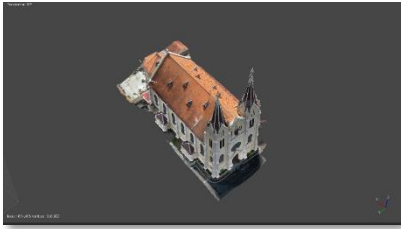
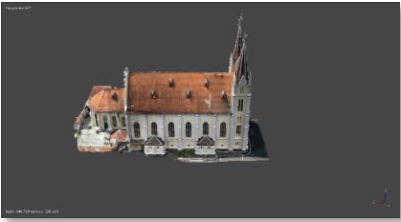
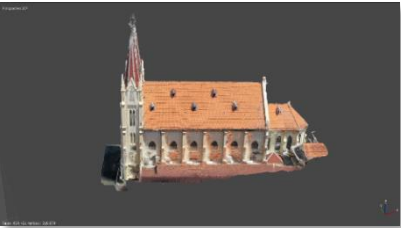
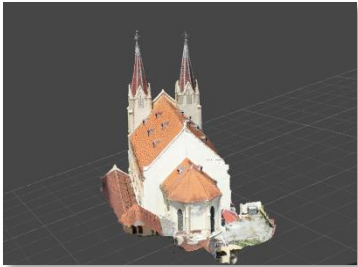
Dokumentasi Pengambilan Data Lapangan



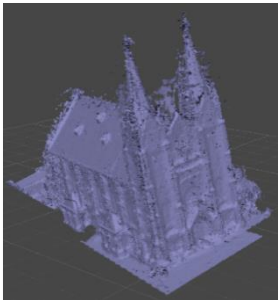
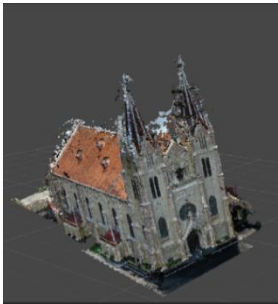
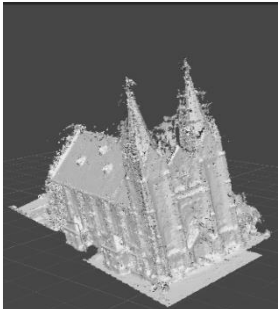
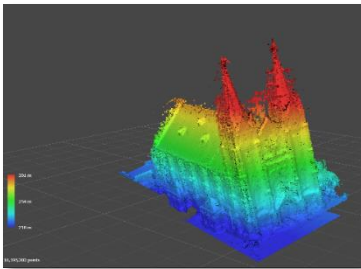
Hasil Pengolahan Data di *Agisoft*

	Hasil <i>Build Dense Cloud</i>
	Hasil <i>Mesh</i>
	Hasil <i>Texture</i>
	Hasil <i>DEM</i>
	Hasil <i>Orthophoto</i>

Hasil 3d dengan tampak 4 sisi bangunan

	Tampak sisi atas dan depan
	Tampak sisi samping kanan
	Tampak sisi samping kiri
	Tampak sisi belakang
	Tampak depan menara

Hasil Visualisasi *Point Cloud*

	Visualisasi <i>point cloud solid</i>
	Visualisasi <i>point cloud colors</i>
	Visualisasi <i>point cloud classes</i>
	Visualisasi <i>point cloud elevation</i>

Report Data Agisoft

gereja

Processing Report
16 February 2025



Survey Data

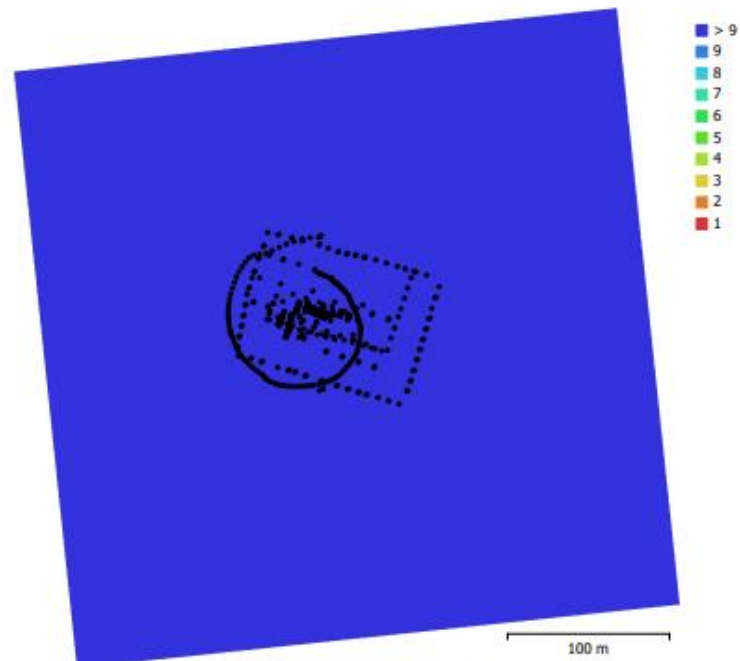


Fig. 1. Camera locations and image overlap.

Number of images:	706	Camera stations:	706
Flying altitude:	14.4 m	Tie points:	400,391
Ground resolution:	0.00590 m/pix	Projections:	1,343,228
Coverage area:	137984 m ²	Reprojection error:	1.05 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC3170 (4.5mm)	8000 x 6000	4.5 mm	0.811 x 0.811 μ m	No
L1D-20c (10.26mm)	5472 x 3078	10.26 mm	2.53 x 2.53 μ m	No

Table 1. Cameras.

Camera Calibration

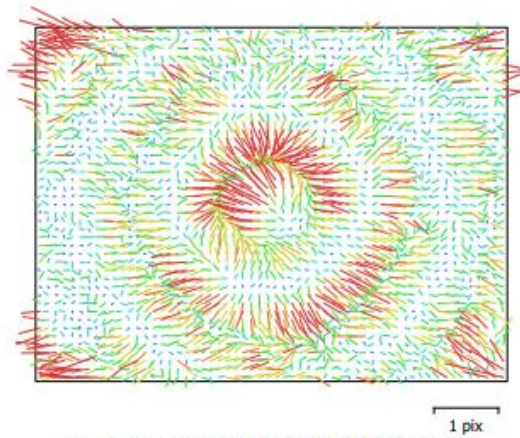


Fig. 2. Image residuals for FC3170 (4.5mm).

FC3170 (4.5mm)

279 images

Type	Resolution	Focal Length	Pixel Size
Frame	8000 x 6000	4.5 mm	0.811 x 0.811 μm

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	P1	P2
F	5874.04	0.66	1.00	-0.20	-0.19	-0.38	0.03	-0.11	0.26	-0.33	-0.09	-0.15
Cx	13.0861	0.45		1.00	-0.01	0.07	0.05	-0.02	-0.04	0.06	0.47	0.09
Cy	0.184488	0.56			1.00	-0.04	0.05	-0.01	0.00	-0.01	0.00	0.43
B1	-1.8009	0.22				1.00	-0.04	-0.01	-0.04	0.05	-0.01	0.10
B2	-1.11148	0.19					1.00	0.01	0.01	-0.02	-0.06	-0.04
K1	-0.0329177	0.00014						1.00	-0.93	0.85	0.04	-0.10
K2	0.175398	0.00047							1.00	-0.98	-0.04	0.01
K3	-0.185039	0.00047								1.00	0.04	-0.00
P1	-0.000118538	1.5e-05									1.00	0.00
P2	0.000443919	1.8e-05										1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Locations

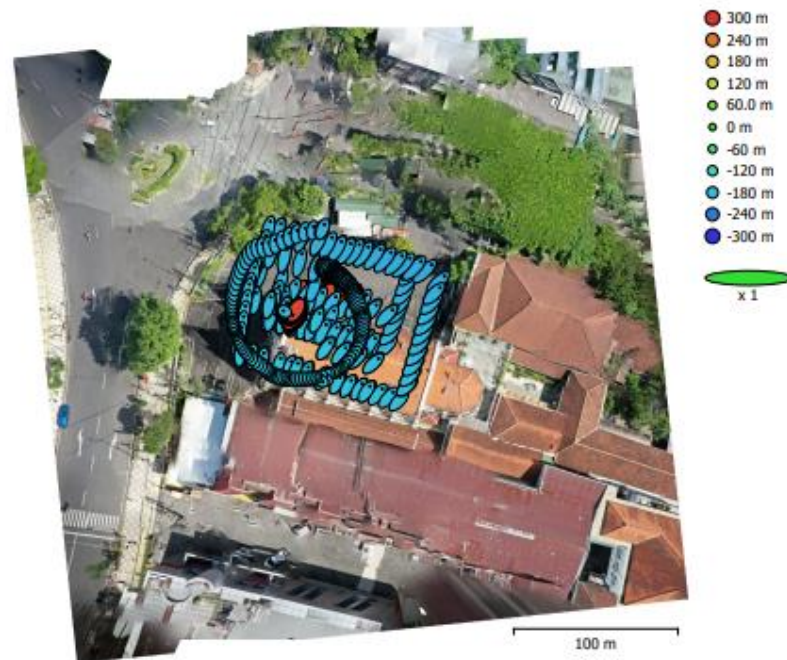


Fig. 4. Camera locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
Estimated camera locations are marked with a black dot.

X error (m)	Y error (m)	Z error (m)	XY error (m)	Total error (m)
3.37579	6.87496	224.394	7.65905	224.525

Table 4. Average camera location error.

X - Longitude, Y - Latitude, Z - Altitude.

Scale Bars

Label	Distance (m)	Error (m)
point 1_point 2	4.6383	0.0783021
point 3_point 4	1.01183	-0.00817477
point 7_point 8	4.5673	-0.982699
point 9_point 10	14.5343	0.574284
point 11_point 12	4.0362	1.1862
point 13_point 14	2.24768	0.0976774
point 15_point 16	29.711	1.58104
point 19_point 20	2.65375	-0.23625
point 21_point 22	3.91499	1.11499
point 25_point 26	1.40377	-0.01623
point 27_point 28	4.35702	4.35702
point 29_point 30	4.5215	0.9815
point 31_point 32	4.63808	0.238075
point 33_point 34	3.3882	-0.111805
point 35_point 36	3.26751	0.0275133
point 37_point 38	3.70387	0.0738746
point 39_point 40	2.3896	-0.840397
Total		1.26598

Table 5. Control scale bars.

Digital Elevation Model

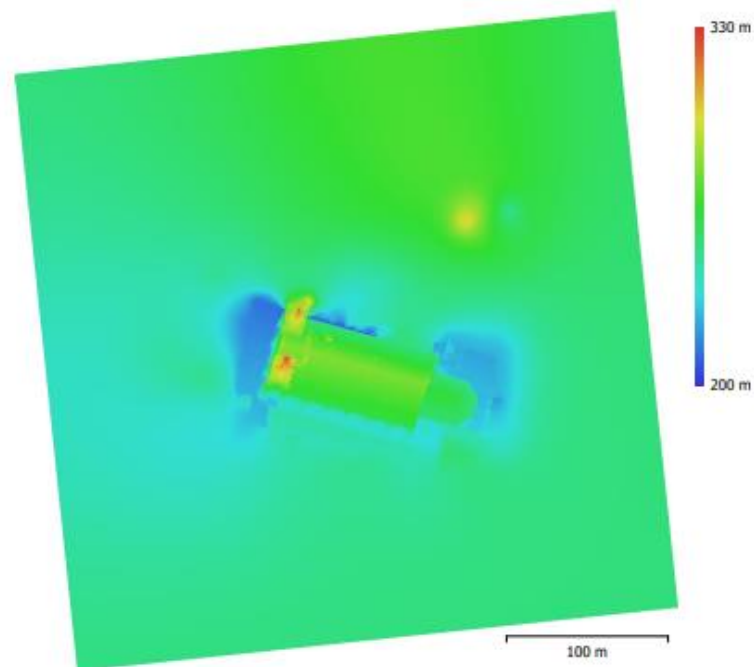


Fig. 5. Reconstructed digital elevation model.

Resolution: 0.0760 m/pix
Point density: 173 points/m²

Processing Parameters

General	
Images	706
Aligned images	693
Markers	24
Scale bars	12
Coordinate system	WGS 84 / UTM zone 49S (EPSG::32749)
Marker coordinate system	WGS 84 / UTM zone 49S (EPSG::32749)
Rotation angles	Yaw, Pitch, Roll
Tie Points	
Points	400,391 of 645,974
RMS reprojection error	0.185138 (1.03969 pix)
Max reprojection error	1.0584 (53.0182 pix)
Mean key point size	4.95385 pix
Point colors	3 bands, uint8
Key points	2.21 GB
Average tie point multiplicity	3.91113
Alignment parameters	
Accuracy	High
Generic preselection	Yes
Reference preselection	No
Key point limit	40,000
Tie point limit	4,000
Guided image matching	No
Adaptive camera model fitting	No
Matching time	3 hours 13 minutes
Matching memory usage	5.27 GB
Alignment time	30 minutes 37 seconds
Alignment memory usage	485.14 MB
Optimization parameters	
Parameters	f, b1, b2, cx, cy, k1-k3, p1, p2
Adaptive camera model fitting	No
Exclude corners	No
Optimization time	27 seconds
Date created	2025:01:19 23:51:05
Software version	1.6.1.10009
File size	2.27 GB
Point Cloud	
Points	10,195,383
Point attributes	
Color	3 bands, uint8
Normal	
Confidence	1 - 162
Point classes	
Created (never classified)	10,195,383
Depth maps generation parameters	
Quality	Medium
Filtering mode	Mild
Processing time	4 hours 55 minutes
Memory usage	3.74 GB
Point cloud generation parameters	

Processing time	6 hours 38 minutes
Memory usage	12.33 GB
Date created	2025:01:20 11:56:28
Software version	1.6.1.10009
File size	927.56 MB
Model	
Faces	634,486
Vertices	318,922
Vertex colors	3 bands, uint8
Texture	4,096 x 4,096, 3 bands, uint8
Depth maps generation parameters	
Quality	Medium
Filtering mode	Mild
Processing time	4 hours 55 minutes
Memory usage	3.74 GB
Reconstruction parameters	
Surface type	Arbitrary
Source data	Point cloud
Interpolation	Enabled
Strict volumetric masks	No
Processing time	9 minutes 26 seconds
Memory usage	5.16 GB
Texturing parameters	
Mapping mode	Generic
Blending mode	Mosaic
Texture size	4,096
Page count	1
Enable hole filling	Yes
Enable ghosting filter	Yes
UV mapping time	5 minutes 36 seconds
Blending time	2 hours 6 minutes
Date created	2025:01:20 12:12:44
Software version	1.6.1.10009
File size	57.38 MB
DEM	
Size	5,393 x 5,353
Resolution	0.0760 m/pix
Coordinate system	WGS 84 (EPSG::4326)
Reconstruction parameters	
Source data	Point cloud
Interpolation	Enabled
Processing time	42 seconds
Memory usage	307.83 MB
Date created	2025:01:21 11:16:21
Software version	1.6.1.10009
File size	96.22 MB
Orthomosaic	
Size	21,572 x 21,412
Resolution	0.0190 m/pix
Coordinate system	WGS 84 (EPSG::4326)
Colors	3 bands, uint8
Orthophotos	14.64 GB
Reconstruction parameters	
Blending mode	Mosaic
Surface	DEM
Enable hole filling	Yes
Processing time	1 hours 35 minutes
Memory usage	3.88 GB
Date created	2025:01:21 12:49:17
Software version	1.6.1.10009
File size	14.92 GB
System	
Software name	Agisoft Metashape Professional
Software version	2.2.0 build 19890
OS	Windows 64 bit
RAM	15.81 GB
CPU	Intel(R) Core(TM) i5-6300U CPU @ 2.40GHz
GPU(s)	Intel(R) HD Graphics 520

Data pengukuran di lapangan

		di Lapangan (m)		di Model 3D (m)	
No	Objek	XLebar	XTinggi	XLebar	XTinggi
1	Fasad Depan	13.96	2.85	14.50	4.02
2	Fasad Samping Kanan	28.13	4.33	29.70	4.32
3	Pintu Depan Gereja	2.25	2.70	2.27	2.65
4	Jendela Depan Kiri	1.42	3.99	1.33	3.92
5	Jendela Samping Kanan	0.92	2.85	1.01	2.84

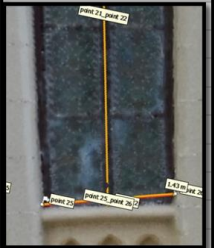
No	Objek	Lebar (m)	Tinggi (m)
1	Fasad Depan Kiri	4.76	2.85
2	Fasad Tengah Pintu	4.40	2.85
3	Fasad Depan Kanan	4.80	2.85
4	Jendela Depan Kiri	1.42	3.99
5	Jendela Samping Kanan	0.92	2.85
6	Pintu Gereja	2.25	2.70
No	Objek	Lebar (m)	Tinggi (m)
1	Fasad 1 Bangunan Kanan	3.54	4.33
2	Fasad 2 Bangunan Kanan	4.40	4.33
3	Fasad 3 Bangunan Kanan	3.50	4.33
4	Fasad 4 Bangunan Kanan	3.24	4.33
5	Fasad 5 Bangunan Kanan	4.56	4.33
6	Fasad 6 Bangunan Kanan	3.63	4.33
7	Fasad 7 Bangunan Kanan	3.23	4.33

No	Objek	Tinggi (m)	Panjang (m)	Lebar (m)
1	Fasad Bangunan Utama + Menara depan	31.00	4.65	13,96
2	Fasad Bangunan Utama Tampak Samping kanan	13.00	28,13	-

Ketelitian *Horizontal* dan *Vertical*

No	Objek	di Lapangan (m)		di Model 3D (m)					
		XLebar	XTinggi	XLebar	XTinggi	X (m)	Y (m)	X ² (m) ²	Y ² (m) ²
1	Fasad Depan	13.96	2.85	14.50	4.02	-0.54	-1.17	0.29160000	1.36890000
2	Fasad Samping Kanan	28.13	4.33	29.70	4.32	-1.57	0.01	2.46490000	0.00010000
3	Pintu Depan Gereja	2.25	2.70	2.27	2.65	-0.02	0.05	0.00040000	0.00250000
4	Jendela Depan Kiri	1.42	3.99	1.33	3.92	0.09	0.07	0.00810000	0.00490000
5	Jendela Samping Kanan	0.92	2.85	1.01	2.84	-0.09	0.01	0.00810000	0.00010000
							Jumlah	2.77310000	1.37650000
							Mean	0.55462000	0.27530000
							MSE	0.55462	0.2753
							RMSE	0.74472814	0.5246904

Data Ketelitian Jarak

Foto Udara (m)	Dilapangan	Foto Udara (m)	Dilapangan	Selisih (m)
		4.52	4.4	0.12
		4.64	4.56	0.08
		1.02	0.92	0.1
		1.43	1.42	0.01

Perhitungan *Ground Sampling Distance*

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC3170 (4.5 mm)	8000 x 6000	4.5 mm	0.811 x 0.811 μm	No
L1D-20c (10.26 mm)	5472 x 3078	10.26 mm	2.53 x 2.53 μm	No

Dari hasil data pemotretan foto udara didapatkan data survey dari Agisoft Methashape sebagai berikut:

- *Flying Altitude*: 14.4 m
- *Coverage Area*: 137984 m²
- *Ground Resolution*: 0.0590 m/pix m/pix

Sehingga didapatkan hasil perhitungan dengan rumus *Ground Sampling Distance* (GSD, sebagai berikut:

$$\text{GSD} = \frac{14.4 \text{ m}}{4.5 \text{ mm}} \times 0.000811 = 0,002 \text{ cm/pix}$$

$$\text{GSD} = \frac{14.4 \text{ m}}{10.26 \text{ mm}} \times 0.000253 = 0,0035 \text{ cm/pix}$$

Perhitungan Pengukuran Menara dengan *Phytagoras*

$$c^2 = a^2 + b^2$$

- Tinggi menara (a) = 13 m
- Lebar menara (b) = 2.22 m
- Panjang kemiringan (c) = ?

maka panjang kemiringan **c** bisa dihitung sebagai berikut:

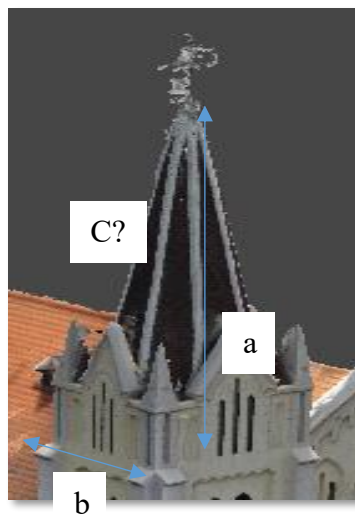
$$c = \sqrt{a^2 + b^2}$$

$$c = \sqrt{13^2 + 2,22^2}$$

$$c = \sqrt{169 + 4,9284}$$

$$c = \sqrt{173,9284} \quad c = 13.19 \text{ m}$$

Jadi, panjang kemiringan **c** adalah **13,19 m**



Dokumentasi Data di lapangan

Fasad 1 depan



Fasad 2 tengah depan



Fasad 3 kiri depan



Pintu depan Gereja



Fasad 1 samping kanan



Fasad 2 samping kanan



Fasad 3 samping kanan



Fasad 4 samping kanan



Fasad 5 samping kanan



Fasad 6 samping kanan



Fasad 7 samping kanan



Pintu Gereja depan



LAMPIRAN LEMBAR ASISTENSI



**LEMBAR ASISTENSI PROPOSAL SKRIPSI
PROGRAM STUDI TEKNIK GEODESI S-1
INSTITUT TEKNOLOGI NASIONAL MALANG**

Nama : David Wirayuda N.Daya
 NIM : 19.25.004
 Program Studi : Teknik Geodesi S-1
 Dosen Pengarah : Martinus Edwin Tjahjadi, ST.,M.Geom.Se.,PH.

No	Tanggal	Catatan / Keterangan	Tanda tangan
	9/1 '24	ACC Seminar Kumpul	f.
	16/1 '24	1. Pengambilan data drone di studi kasus pengolahan point cloud dan orthophoto. 2. Data GPS pengamatan dan data GPS statik.	
	19/01/24	1. RMSE Ekst Masin besar Pas hasil 3D 2. Persebaran kemmali Pas data GCP	
		1. Hitung RMSE ICP 2. Detail tinggi bangunan dan luas bangunan	



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No	Tanggal	Catatan / Keterangan	Tanda tangan
	15/10 '24	Fokus pembangunan dengan membuat 3D model detail	f.
		Saran untuk menambah data kamera DSLR dan memilah data yang lama	f.
	14/01 '2024	Data Pengamatan dan Data RTK dihapus Data kamera Drone Zsm Fix (Pemasat) Fokus pada model	f.
		Pengurutan data Foto dan dikomper	f.
		Gabung data pertama dan data kedua	f.
	17/01 '2024	Lanjut tahap Pengolahan, lalu pengambilan data lapangan Pemasat menggunakan meteran untuk ketelitian jarak	f.
	3/2 '25	AEL Seminar Hasil	f.

Note : - cari referensi cara mengecikan data di Agisoft agar bisa scaling di software
- kuatkan pembuktian untuk mengskalakan pada Data 3D Model



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NIM : 19.25.004
Program Studi : Teknik Geodesi S-1
Dosen Pengarah : Martinus Edwin Tjahjadi, ST.,M.Geom.Se.,PH.

No	Tanggal	Catatan / Keterangan	Tanda tangan
	21/01 25	- Antena di munculkan <u>Pembahasan bab 4</u> - scaling objek di Agisoft	
	28/01 25	- Tentukan jarak dan membuat koordinat lokal dalam bangunan (Titik kontrol Dummy)	
	30/01 25	- Dikorkan sampel jarak yang diukur di skala model dengan cara scaling - Dimasukkan rektifikasi model pada langkah kerja	



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Dosen Pengarah : Martinus Edwin Tjahjadi, ST.,M.Geom.Se.,PH.

No	Tanggal	Catatan / Keterangan	Tanda tangan
	24/1 - 2024	- Sketch up dihapuskan diganti dengan data lapangan - Pada generate report yang dicetak hanya GCP saja - uji validasi sertakan tinggi bangunan, panjang bangunan dan luasan bangunan	f.
	31/1 '24	ACC Seminar ltrahil	f.



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NIM : 19.25.004
Program Studi : Teknik Geodesi S-1
Dosen Pengarah : Fransisca Dwi Agustina, ST.,M.Eng.

No	Tanggal	Catatan / Keterangan	Tanda tangan
1.	9/1/24	- cek penulisan sesuai dgn buku panduan. - cek langkah uji validasi (menganalisa uji apa?)	
	10/1/24	Acc ok komprehensif 	



**LEMBAR ASISTENSI SKRIPSI PROGRAM STUDI
TEKNIK GEODESI S-1 INSTITUT TEKNOLOGI
NASIONAL MALANG**

Nama : David Wirayuda N.Daya
NIM : 19.25.004
Program Studi : Teknik Geodesi S-1
Dosen Pengarah : Fransisca Dwi Agustina, ST.,M.Eng.

No	Tanggal	Catatan / Keterangan	Tanda tangan
1.	23/1/24	- Perbaiki sesuai dgn <u>revisi</u> - sesuaikan format penulisannya dgn buku panduan - Hasil & langkah sesuaikan dgn penelitiannya! - Perbaiki flowchart uji validasi dgn koord. dr GPS <u>tidak nampak</u>. - kesimpulan (inti) menjawab rumusan masalah. Acc Seminar Hasil. Pando 5/2/24	f.



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TEKNIK GEODESI S-1 INSTITUT TEKNOLOGI
NASIONAL MALANG**

Nama : David Wirayuda N.Daya
NIM : 19.25.004
Program Studi : Teknik Geodesi S-1
Dosen Pengarah : Fransisca Dwi Agustina, ST.,M.Eng.

No	Tanggal	Catatan / Keterangan	Tanda tangan
1.	6/feb 25	Hasil belum tertera pada Bab IV masih belum sesuai dgn penelitian	
2.	10/2 25	ACC Ok semhas. 	
3.	20/8 25	ACC judul ok	