Quality Report

Generated with Pix4Dmapper Pro version 4.2.27

Important: Click on the different icons for:

Help to analyze the results in the Quality Report

Additional information about the sections

Click here for additional tips to analyze the Quality Report

Summary

Project	Drone Flight - Harelbeke - 190912
Processed	2019-09-12 21:21:37
Camera Model Name(s)	FC6310_8.8_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	1.16 cm / 0.46 in
Area Covered	0.059 km^2 / 5.9025 ha / 0.02 sq. mi. / 14.5929 acres
Time for Initial Processing (without report)	01h:37m:30s

Quality Check

Images	median of 51892 keypoints per image	✓
Dataset	261 out of 261 images calibrated (100%), all images enabled	✓
Camera Optimization	0.22% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 16044.4 matches per calibrated image	✓
Georeferencing	yes, 9 GCPs (9 3D), mean RMS error = 0.009 m	✓

Preview

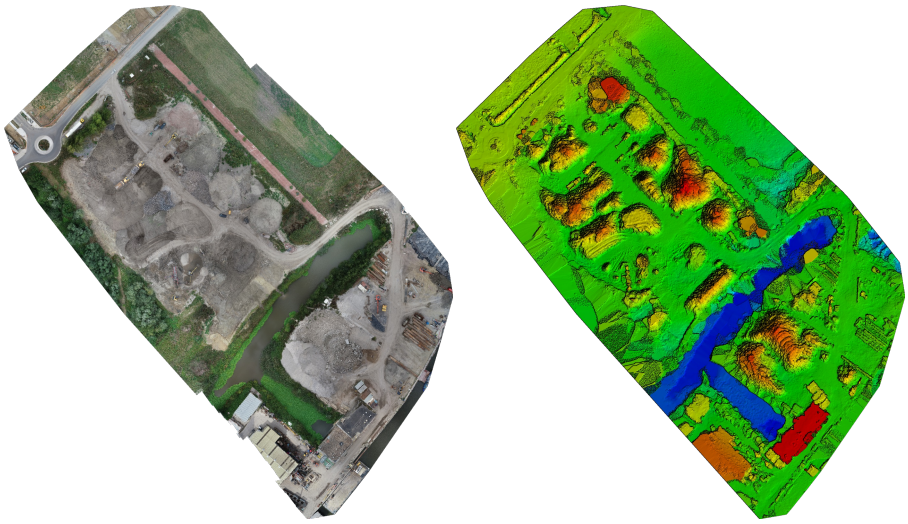


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	261 out of 261
Number of Geolocated Images	261 out of 261

Initial Image Positions

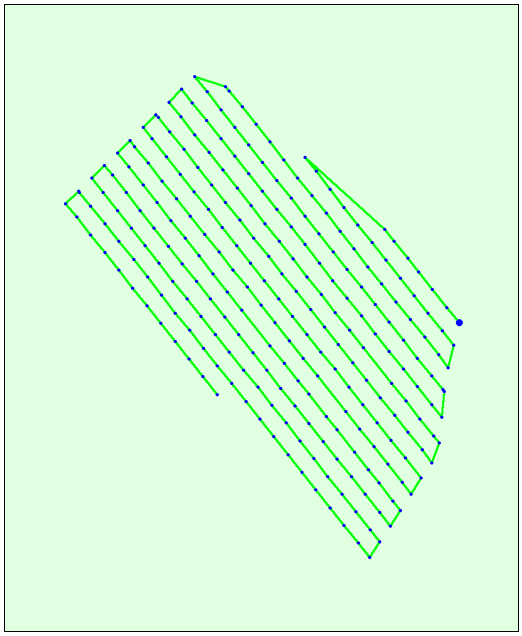


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

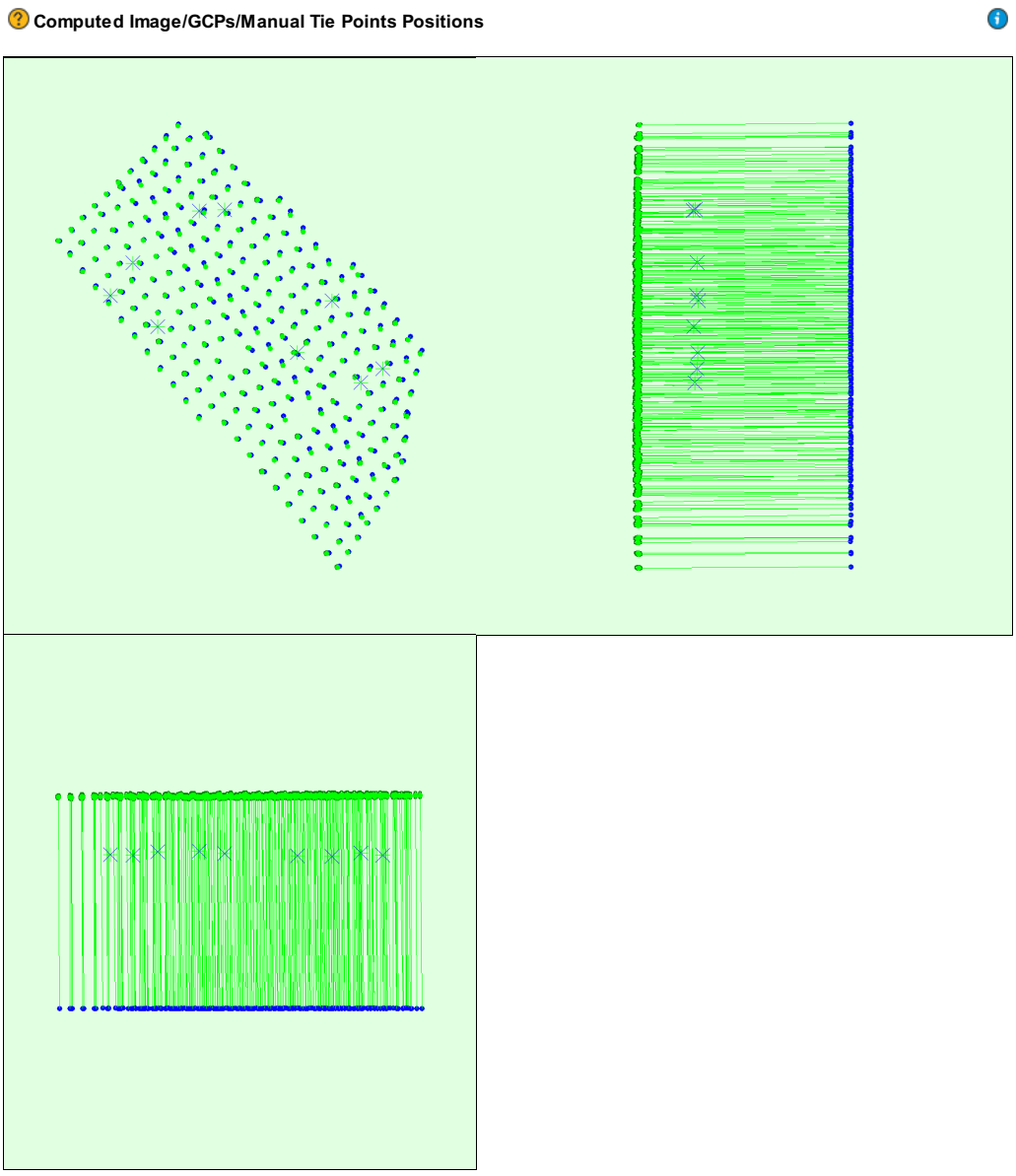


Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Dark green ellipses indicate the absolute position uncertainty of the bundle block adjustment result.

Absolute camera position and orientation uncertainties

	X [m]	Y [m]	Z [m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.014	0.014	0.024	0.004	0.005	0.002
Sigma	0.000	0.000	0.000	0.001	0.001	0.001

Overlap

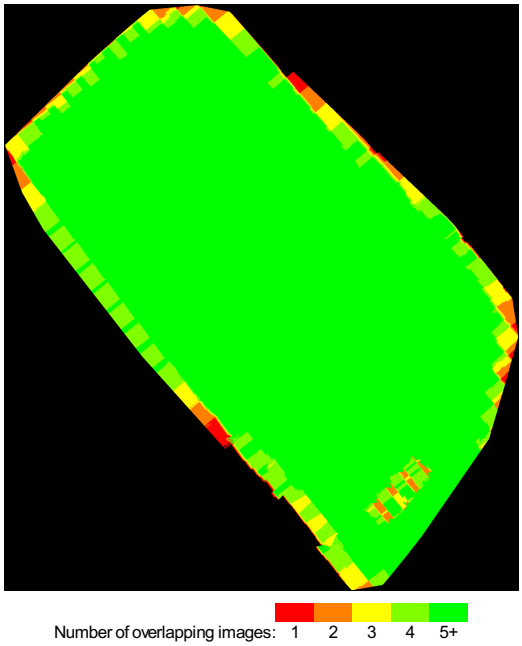


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint matches is also sufficient for these areas (see Figure 5 for keypoint matches).

Bundle Block Adjustment Details

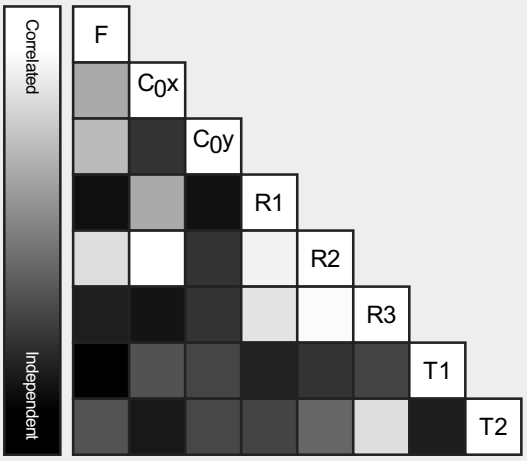
Number of 2D Keypoint Observations for Bundle Block Adjustment	4232331
Number of 3D Points for Bundle Block Adjustment	1442803
Mean Reprojection Error [pixels]	0.159

Internal Camera Parameters

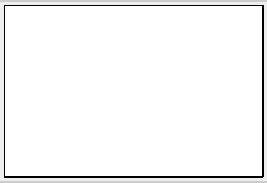
FC6310_8.8_5472x3648 (RGB). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

EXIF ID: FC6310_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3668.759 [pixel] 8.604 [mm]	2736.001 [pixel] 6.417 [mm]	1823.999 [pixel] 4.278 [mm]	0.003	-0.008	0.008	-0.000	0.000
Optimized Values	3660.438 [pixel] 8.585 [mm]	2708.768 [pixel] 6.353 [mm]	1843.112 [pixel] 4.323 [mm]	-0.004	-0.005	0.006	0.000	-0.004
Uncertainties (Sigma)	2.113 [pixel] 0.005 [mm]	1.238 [pixel] 0.003 [mm]	1.177 [pixel] 0.003 [mm]	0.000	0.000	0.000	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.



The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	51892	16044
Min	31156	3392
Max	79567	37834
Mean	53513	16216

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	932998
In 3 Images	237784
In 4 Images	102037
In 5 Images	54542
In 6 Images	33745
In 7 Images	22676
In 8 Images	16121
In 9 Images	11638
In 10 Images	8609
In 11 Images	6743
In 12 Images	5342
In 13 Images	3603
In 14 Images	2606
In 15 Images	1845
In 16 Images	1396
In 17 Images	708
In 18 Images	319
In 19 Images	86
In 20 Images	5

2D Keypoint Matches

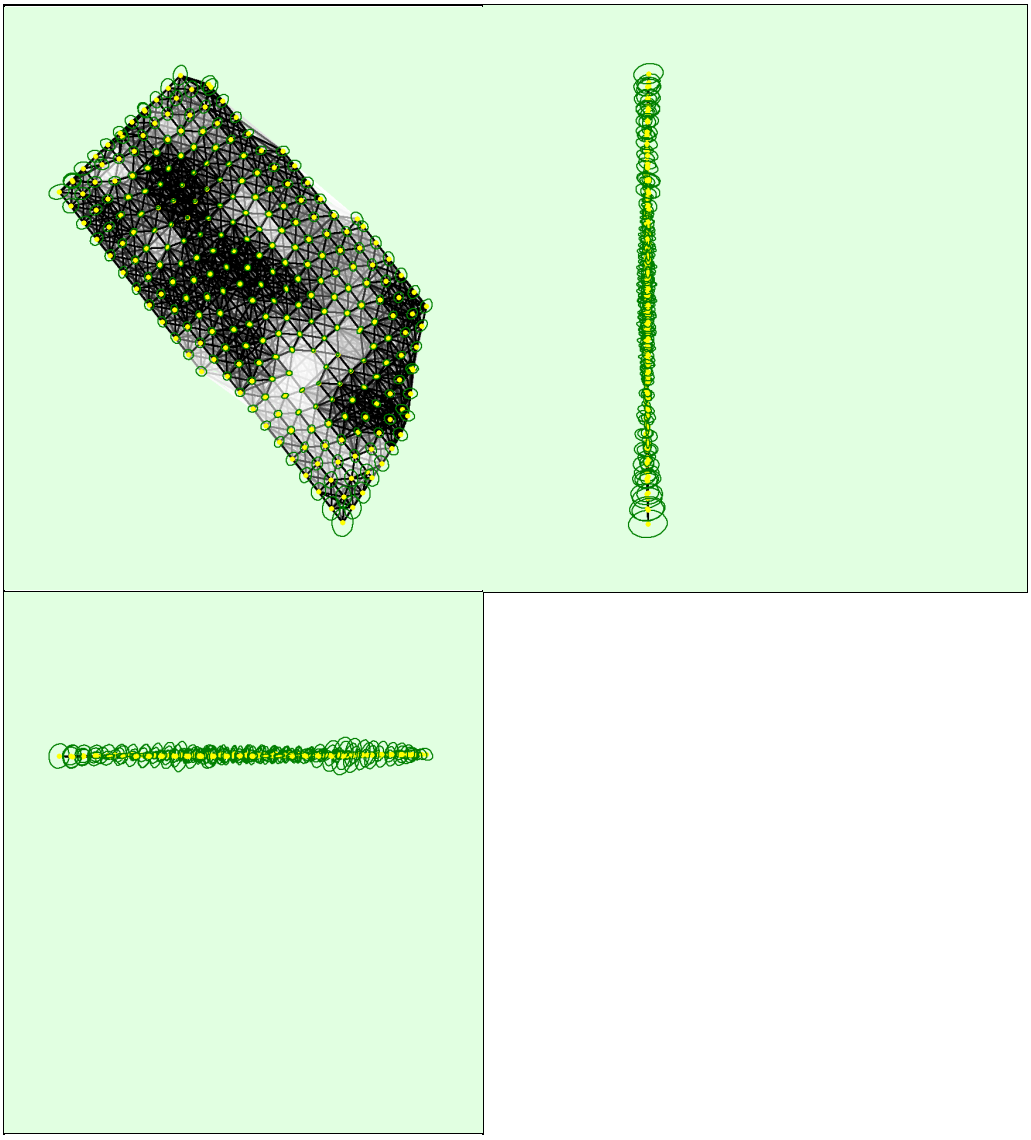


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty of the bundle block adjustment result.

Relative camera position and orientation uncertainties

	X [m]	Y [m]	Z [m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.006	0.006	0.008	0.011	0.010	0.006
Sigma	0.002	0.003	0.005	0.005	0.005	0.002

Geolocation Details

Ground Control Points

GCP Name	Accuracy XY/Z [m]	Error X [m]	Error Y [m]	Error Z [m]	Projection Error [pixel]	Verified/Marked
gcp-01 (3D)	0.020/ 0.020	-0.000	-0.025	-0.003	0.300	10 / 10
gcp-02 (3D)	0.020/ 0.020	-0.003	0.002	0.016	0.377	10 / 10
gcp-03 (3D)	0.020/ 0.020	-0.005	0.006	-0.015	0.213	10 / 10
gcp-04 (3D)	0.020/ 0.020	0.007	0.009	0.004	0.417	10 / 10
gcp-05 (3D)	0.020/ 0.020	0.006	-0.002	0.002	0.374	10 / 10
gcp-06 (3D)	0.020/ 0.020	-0.004	-0.016	-0.004	0.315	10 / 10
gcp-07 (3D)	0.020/ 0.020	-0.015	0.022	0.002	0.270	10 / 10
gcp-08 (3D)	0.020/ 0.020	0.004	-0.009	-0.001	0.391	10 / 10
gcp-09 (3D)	0.020/ 0.020	0.010	0.012	0.002	0.436	10 / 10
Mean [m]		0.000015	-0.000059	0.000182		

Sigma [m]		0.007372	0.013791	0.007706		
RMS Error [m]		0.007372	0.013791	0.007708		

Localisation accuracy per GCP and mean errors in the three coordinate directions. The last column counts the number of calibrated images where the GCP has been automatically verified vs. manually marked.

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.00	0.00
-15.00	-12.00	0.00	0.00	0.00
-12.00	-9.00	0.00	0.00	0.00
-9.00	-6.00	0.00	0.00	0.00
-6.00	-3.00	0.00	0.00	0.00
-3.00	0.00	53.26	54.41	50.19
0.00	3.00	46.74	45.59	49.81
3.00	6.00	0.00	0.00	0.00
6.00	9.00	0.00	0.00	0.00
9.00	12.00	0.00	0.00	0.00
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.00	0.00
Mean [m]		1.019185	0.571077	-152.248745
Sigma [m]		0.930914	1.333133	0.541355
RMS Error [m]		1.380340	1.450301	152.249707

Min Error and Max Error represent geolocation error intervals between -1.5 and 1.5 times the maximum accuracy of all the images. Columns X, Y, Z show the percentage of images with geolocation errors within the predefined error intervals. The geolocation error is the difference between the initial and computed image positions. Note that the image geolocation errors do not correspond to the accuracy of the observed 3D points.

Geolocation Bias	X	Y	Z
Translation [m]	1.019185	0.571077	-152.248745

Bias between image initial and computed geolocation given in output coordinate system.

Relative Geolocation Variance

Relative Geolocation Error	Images X [%]	Images Y [%]	Images Z [%]
[-1.00, 1.00]	100.00	100.00	100.00
[-2.00, 2.00]	100.00	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
Mean of Geolocation Accuracy [m]	5.000000	5.000000	10.000000
Sigma of Geolocation Accuracy [m]	0.000000	0.000000	0.000000

Images X, Y, Z represent the percentage of images with a relative geolocation error in X, Y, Z.

Geolocation Orientational Variance	RMS [degree]
Omega	0.769
Phi	0.259
Kappa	1.432

Geolocation RMS error of the orientation angles given by the difference between the initial and computed image orientation angles.

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Core(TM) i7-6820HQ CPU @ 2.70GHz RAM: 16GB GPU: Intel(R) HD Graphics 530 (Driver: 23.20.16.5018), Citrix Indirect Display Adapter (Driver: 12.40.44.247)
Operating System	Windows 10 Enterprise, 64-bit

Coordinate Systems

Image Coordinate System	WGS84 (egm96)
Ground Control Point (GCP) Coordinate System	Belge 1972 / Belgian Lambert 72 (egm96)
Output Coordinate System	Belge 1972 / Belgian Lambert 72 (egm96)

Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Full, Image Scale: 1
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: no
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Standard Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Auto, yes

Point Cloud Densification details

Processing Options

Image Scale	multiscale, 1/2 (Half image size, Default)
Point Density	Optimal
Minimum Number of Matches	3
3D Textured Mesh Generation	yes
3D Textured Mesh Settings:	Resolution: Medium Resolution (default) Color Balancing: no
LOD	Generated: no
Advanced: 3D Textured Mesh Settings	Sample Density Divider: 1
Advanced: Image Groups	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	01h:04m:08s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	23m:55s

Results

Number of Generated Tiles	4
Number of 3D Densified Points	33555572
Average Density (per m^3)	1719.25

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	5 x GSD (1.16 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Inverse Distance Weighting Merge Tiles: yes
Orthomosaic	Generated: yes Merge Tiles: yes GeoTIFF Without Transparency: no Google Maps Tiles and KML: no
Grid DSM	Generated: yes, Spacing [cm]: 10
Raster DTM	Generated: yes Merge Tiles: yes
DTM Resolution	5 x GSD (1.16 [cm/pixel])
Time for DSM Generation	03m:12s
Time for Orthomosaic Generation	22m:52s
Time for DTM Generation	29m:12s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s