Quality Report

> **Important**: Click on the different icons for:
>
> ? Help to analyze the results in the Quality Report
>
> ℹ Additional information about the sections

> 💡 Click here for additional tips to analyze the Quality Report

Summary

Project	2016_07_19_etagniere_4
Processed	2016-07-21 13:53:53
Average Ground Sampling Distance (GSD)	3.95 cm / 1.55 in
Area Covered	0.179 km^2 / 17.9005 ha / 0.0691 sq. mi. / 44.256 acres

Quality Check

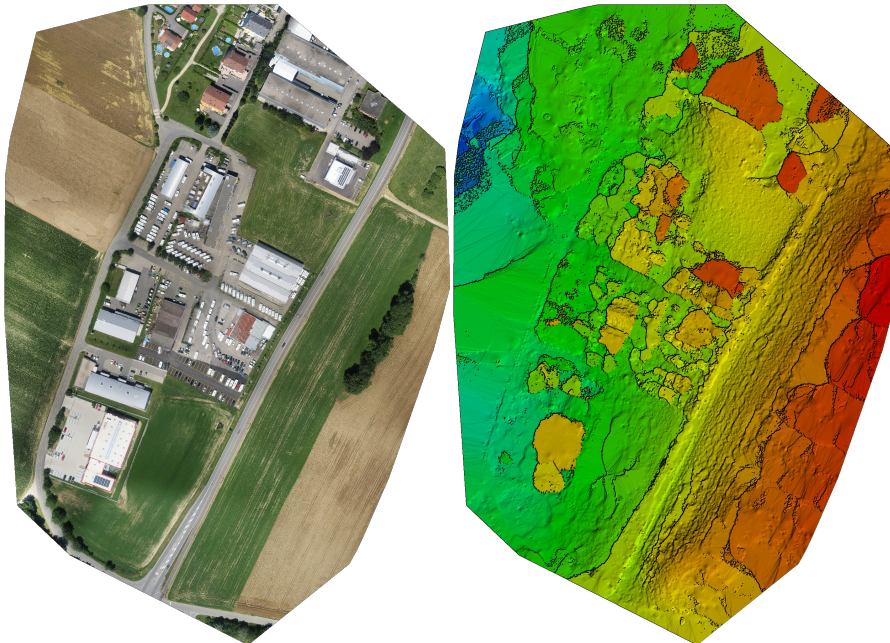|		
? **Images**	median of 51420 keypoints per image	✓
? **Dataset**	32 out of 32 images calibrated (100%), all images enabled	✓
? **Camera Optimization**	1.02% relative difference between initial and optimized internal camera parameters	✓
? **Matching**	median of 9203.3 matches per calibrated image	✓
? **Georeferencing**	yes, 4 GCPs (4 3D), mean RMS error = 0.006 m	✓

? Preview

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

Calibration Details

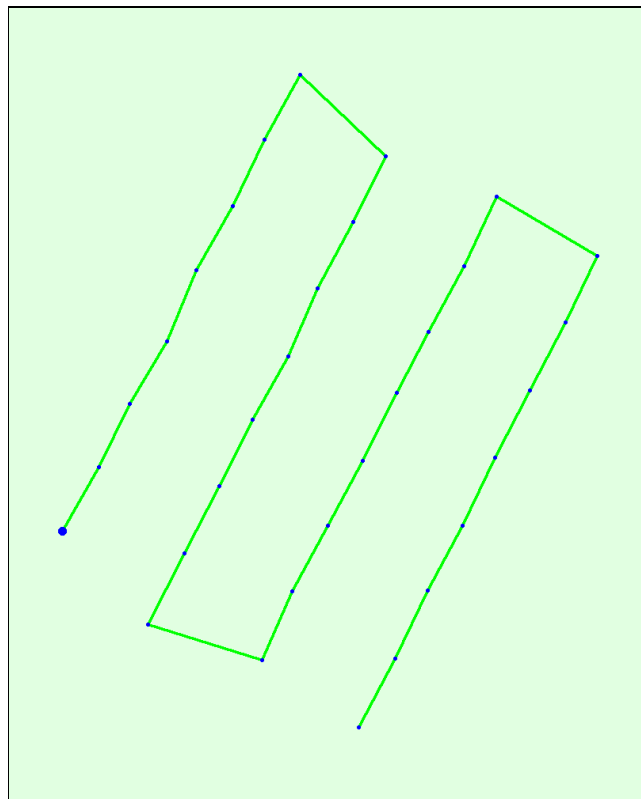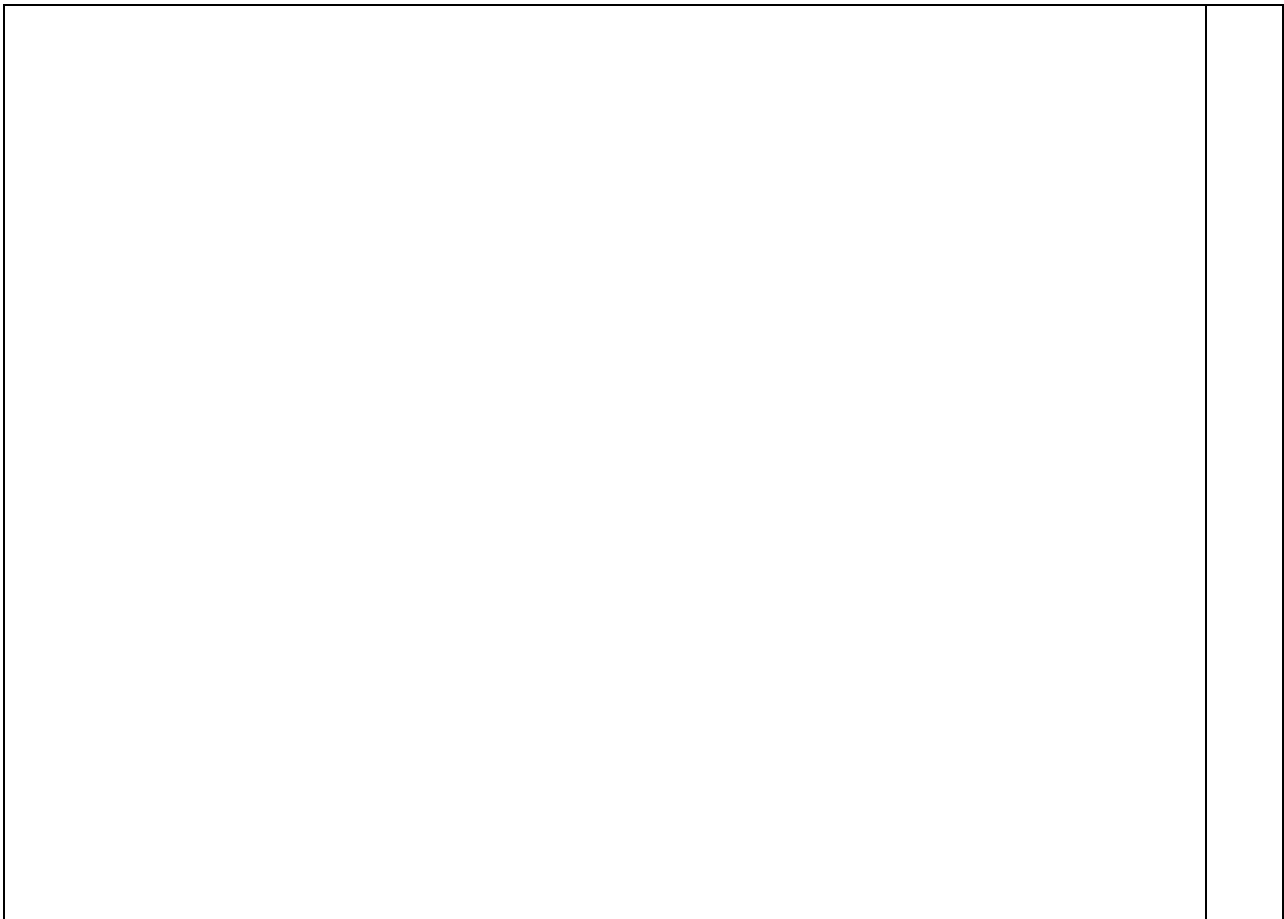| Number of Calibrated Images	32 out of 32
Number of Geolocated Images	32 out of 32

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.

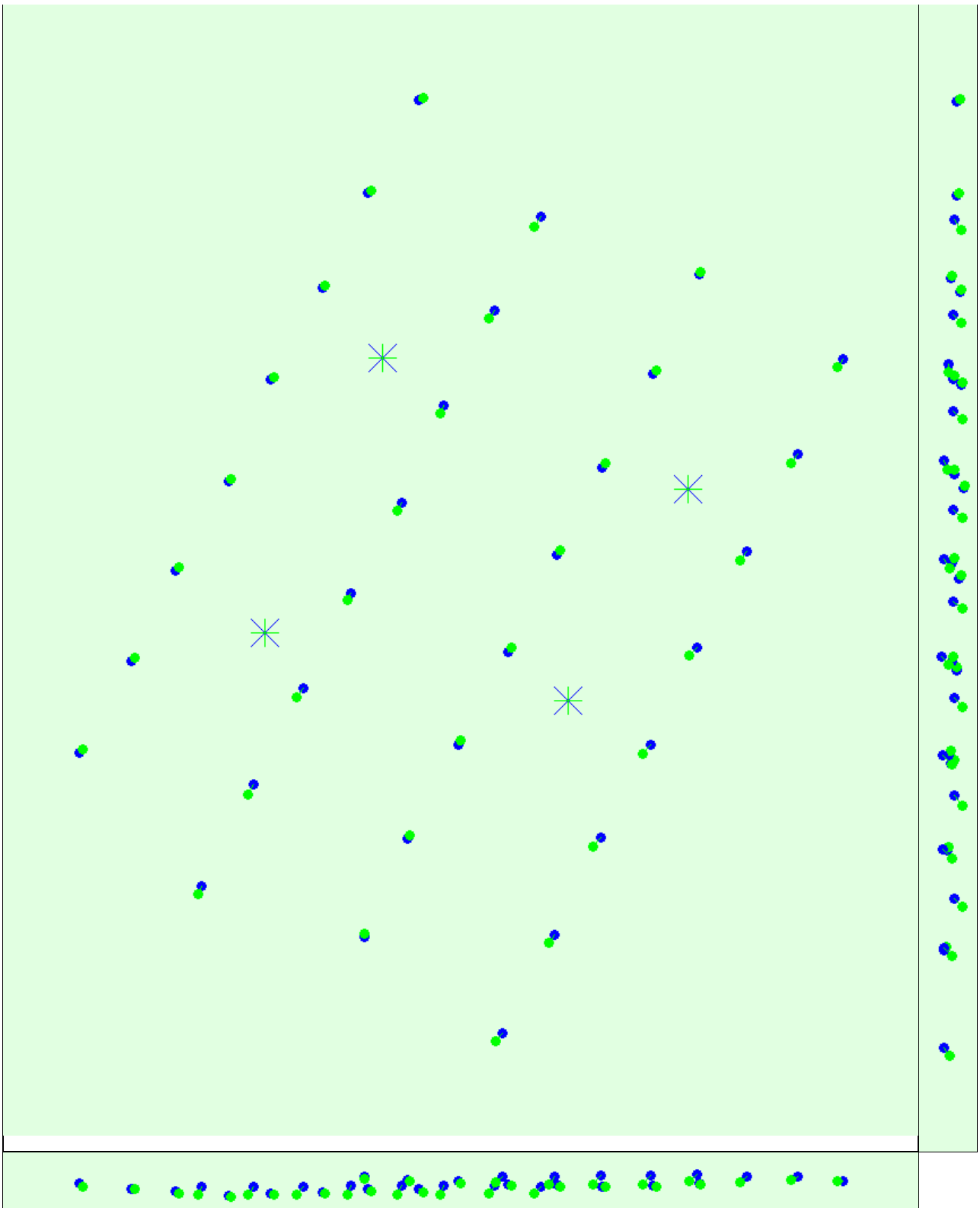## Computed Image/GCPs/Manual Tie Points Positions

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).
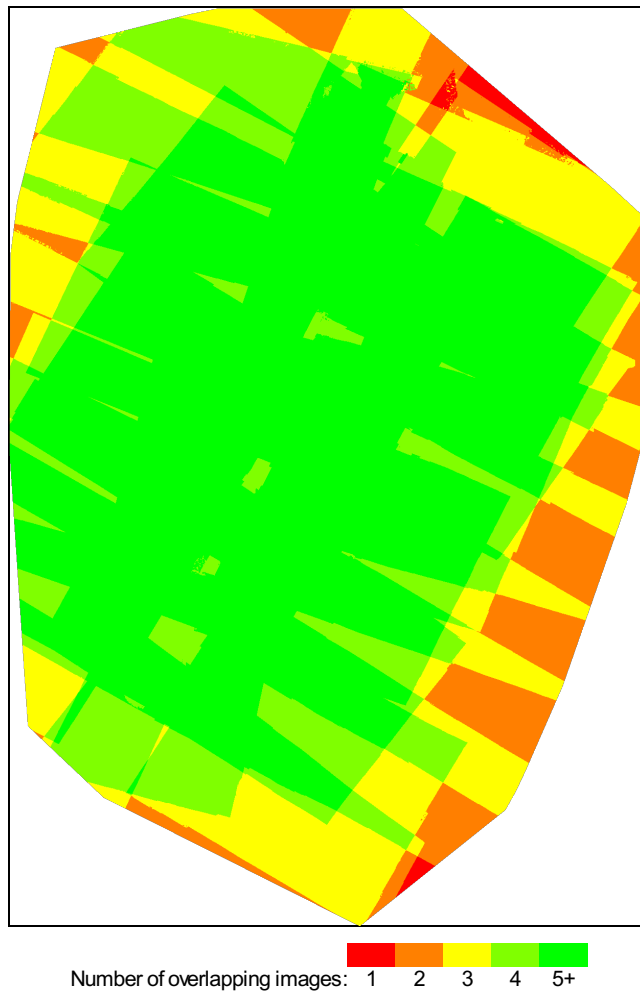
Overlap

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	350265
Number of 3D Points for Bundle Block Adjustment	150296
Mean Reprojection Error [pixels]	0.163745

Internal Camera Parameters

CanonPowerShotG9X_10.2_5472x3648 (RGB). Sensor Dimensions: 13.200 [mm] x 8.800 [mm]

EXIF ID: CanonPowerShotG9X_10.2_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4340.085 [pixel] 10.470 [mm]	2736.001 [pixel] 6.600 [mm]	1824.001 [pixel] 4.400 [mm]	-0.008	0.037	-0.036	-0.005	-0.001
Optimized Values	4295.396 [pixel] 10.362 [mm]	2682.609 [pixel] 6.471 [mm]	1815.747 [pixel] 4.380 [mm]	-0.009	0.024	-0.029	-0.003	-0.006
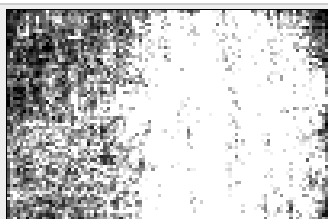
The number of Automatic Tie Points (ATPs) per pixel averaged over all images of the camera model is color coded between black and white. White indicates that, in average, more than 16 ATPs are extracted at this pixel location. Black indicates that, in average, 0 ATP has been extracted at this pixel location. Click on the image to the see the average direction and magnitude of the reprojection error for each pixel. Note that the vectors are scaled for better visualization.

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	51420	9203
Min	37535	2483
Max	77788	21461
Mean	55220	10946

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	117299
In 3 Images	21749
In 4 Images	7175
In 5 Images	3023
In 6 Images	792
In 7 Images	213
In 8 Images	43
In 9 Images	2

2D Keypoint Matches

Number of matches   25   222   444   666   888   1111   1333   1555   1777   2000
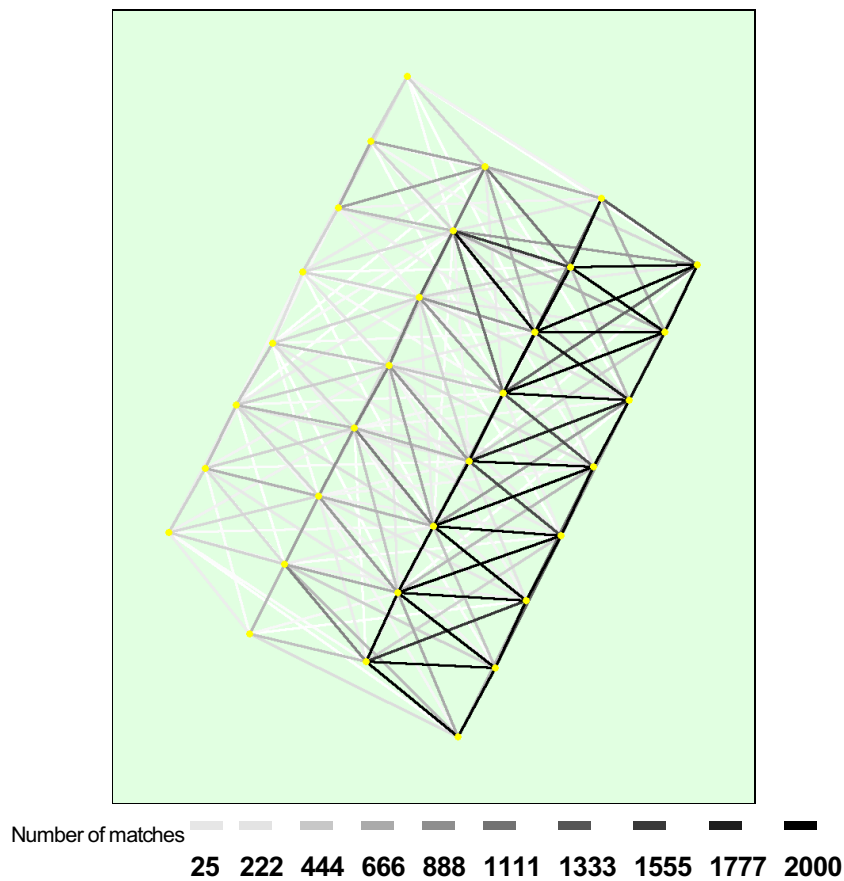
Figure 5: Top view of the image computed positions with a link between matching images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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
4 (3D)	0.020/ 0.020	0.014	0.002	-0.004	0.660	4 / 4
10 (3D)	0.020/ 0.020	-0.005	0.009	0.000	0.584	5 / 5
16 (3D)	0.020/ 0.020	-0.004	-0.013	-0.005	0.900	5 / 5
19 (3D)	0.020/ 0.020	-0.005	0.004	-0.004	1.279	4 / 4
Mean [m]		0.000001	0.000671	-0.003278		
Sigma [m]		0.007969	0.008131	0.002006		
RMS Error [m]		0.007969	0.008158	0.003843		

7 out of 15 check points have been labeled as inaccurate.

Check Point Name	Accuracy XY/Z [m]	Error X [m]	Error Y [m]	Error Z [m]	Projection Error [pixel]	Verified/Marked
2	0.0200/0.0200	0.0173	-0.0260	0.3481	0.9252	6 / 6
3	0.0200/0.0200	-0.0470	0.0361	-0.0121	0.6980	5 / 5
5	0.0200/0.0200	-0.0112	0.0282	0.1833	0.7969	3 / 3
8	0.0200/0.0200	0.0199	-0.0318	0.1223	0.5366	6 / 6
12	0.0200/0.0200	0.0229	-0.0031	0.1487	0.6027	7 / 7
13	0.0200/0.0200	-0.0148	0.1458	0.3174	0.6558	7 / 7
14	0.0200/0.0200	-0.0572	-0.0916	0.4081	1.2026	3 / 3
18	0.0200/0.0200	-0.0035	0.0081	0.2201	0.3403	8 / 8
Mean [m]		-0.009202	0.008213	0.216986		
Sigma [m]		0.028248	0.064197	0.127977		
RMS Error [m]		0.029709	0.064720	0.251915		

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

0 out of 32 geolocated and calibrated images have been labeled as inaccurate.

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-10.67	0.00	0.00	0.00
-10.67	-8.53	0.00	0.00	0.00
-8.53	-6.40	0.00	0.00	0.00
-6.40	-4.27	0.00	0.00	0.00
-4.27	-2.13	40.62	50.00	0.00
-2.13	0.00	9.38	0.00	56.25
0.00	2.13	21.88	0.00	28.12
2.13	4.27	28.12	50.00	15.62
4.27	6.40	0.00	0.00	0.00
6.40	8.53	0.00	0.00	0.00
8.53	10.67	0.00	0.00	0.00
10.67	-	0.00	0.00	0.00
Mean [m]		0.787192	1.327671	2.216327
Sigma [m]		2.389729	3.162149	1.753813
RMS Error [m]		2.516044	3.429562	2.826299

Min Error and Max Error represent geolocation error intervalsbetween -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 intial 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]	0.800159	1.355278	2.037621

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

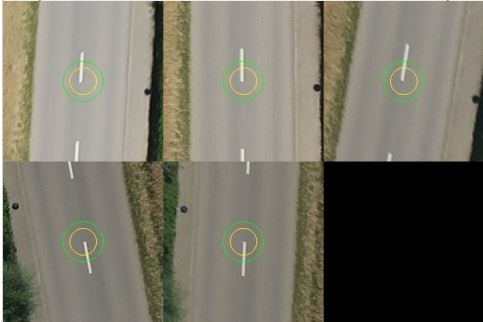|			
[-2.00, 2.00]	100.00	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
Mean of Geolocation Accuracy [m]	6.676094	6.676094	6.381188
Sigma of Geolocation Accuracy [m]	0.171867	0.171867	0.430151

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

Geolocation Orientational Variance	RMS [degree]
Omega	4.191698
Phi	4.235097
Kappa	5.471988

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

❓ Georeference Verification ℹ

GCP Name: 4
(316779.186030,5163025.275544,667.963612)

IMG_0079.JPG
IMG_0080.JPG
IMG_0090.JPG
IMG_0091.JPG

GCP 4 was not marked on the following images (only up to 6 images shown). If the circle is too far away from the initial GCP position, also measure the GCP in these images to improve the accuracy.

IMG_0078.JPG

GCP Name: 10
(316840.890182,5163169.719389,668.827285)

IMG_0081.JPG
IMG_0082.JPG
IMG_0083.JPG
IMG_0087.JPG
IMG_0088.JPG

GCP 10 was not marked on the following images (only up to 6 images shown). If the circle is too far away from the initial GCP position, also measure the GCP in these images to improve the accuracy.

IMG_0086.JPG

GCP Name: 16
(316938.707272,5162989.758627,675.048846)

IMG_0096.JPG
IMG_0097.JPG
IMG_0104.JPG
IMG_0105.JPG
IMG_0106.JPG

GCP Name: 19
(317001.789324,5163100.628477,676.543223)

IMG_0098.JPG
IMG_0099.JPG
IMG_0103.JPG
IMG_0104.JPG

GCP 19 was not marked on the following images (only up to 6 images shown). If the circle is too far away from the initial GCP position, also measure the GCP in these images to improve the accuracy.
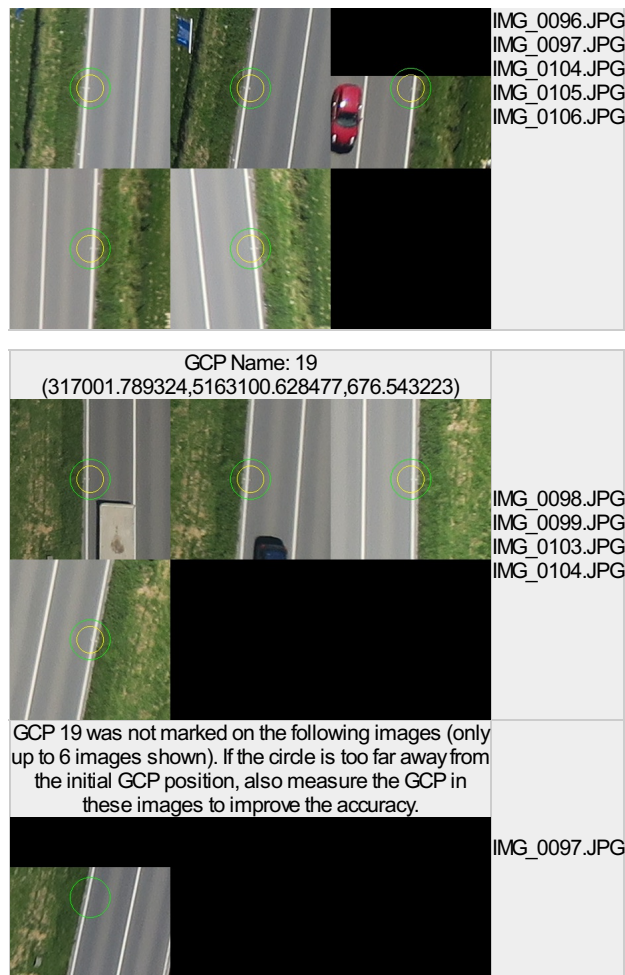
IMG_0097.JPG

Figure 7: Images in which GCPs have been marked (yellow circle) and in which their computed 3D points have been projected (green circle). A green circle outside of the yellow circle indicates either an accuracy issue or a GCP issue.

Processing Options

Hardware	CPU: Intel(R) Core(TM) i7-4790K CPU @ 4.00GHz RAM: 32GB GPU: NVIDIA GeForce GTX 780 Ti (Driver: 9.18.13.4709), Intel(R) HD Graphics 4600 (Driver: 10.18.10.3540)
Operating System	Windows 8.1 Pro, 64-bit
Camera Model Name	CanonPowerShotG9X_10.2_5472x3648 (RGB)
Image Coordinate System	WGS84
Ground Control Point (GCP) Coordinate System	WGS84
Output Coordinate System	WGS84 / UTM zone 32N
Detected template:	3D Maps
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, Maximum Number of Triangles: 1000000, Texture Size: 16384x16384
Advanced: Matching Window Size	7x7 pixels
Advanced: Image Groups	RGB
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Advanced: Limit Camera Depth Automatically	no
Time for Point Cloud Densification	04m:30s
Time for 3D Textured Mesh Generation	03m:06s

Results ⓘ

Number of Generated Tiles	1
Number of 3D Densified Points	3694204
Average Density (per m^3)	42.36

DSM, Orthomosaic and Index Details ⓘ

Processing Options ⓘ

DSM and Orthomosaic Resolution	4 [cm/pixel]
DSM Filters	Noise Filtering: yes, Surface Smoothing: yes, Sharp
DSM Generation	yes, Method: Inverse Distance Weighting, Merge Tiles: yes
Time for DSM Generation	02m:44s
Time for Orthomosaic Generation	04m:41s