Quality Report

Generated with Pix4Denterprise version 4.4.12

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	tw_taichung_fengyuan_beikeng-river_20190409
Processed	2020-01-18 17:25:01
Camera Model Name(s)	L1D-20c_10.3_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	3.02 cm / 1.19 in
Area Covered	0.301 km^2 / 30.1115 ha / 0.12 sq. mi. / 74.4457 acres
Time for Initial Processing (without report)	01h:33m:29s

Quality Check

Images	median of 69120 keypoints per image	✓
Dataset	490 out of 490 images calibrated (100%), all images enabled	✓
Camera Optimization	3.94% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 17661.9 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

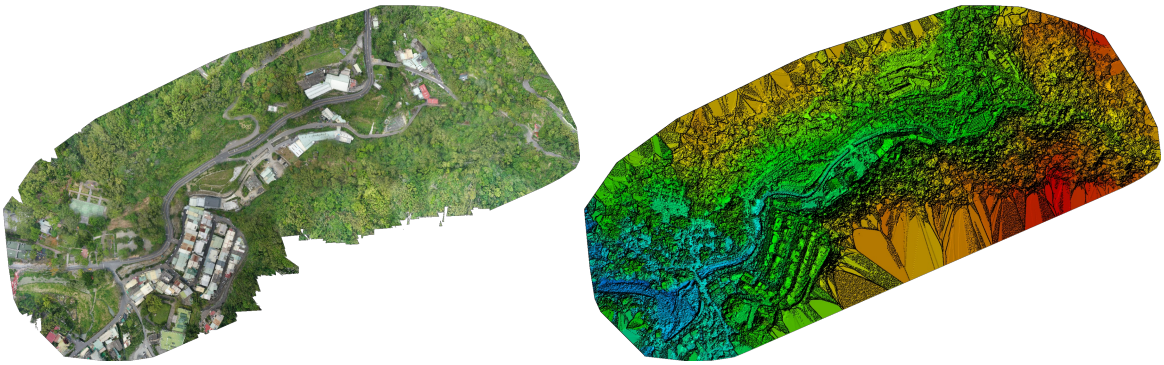


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	490 out of 490
Number of Geolocated Images	490 out of 490

Initial Image Positions

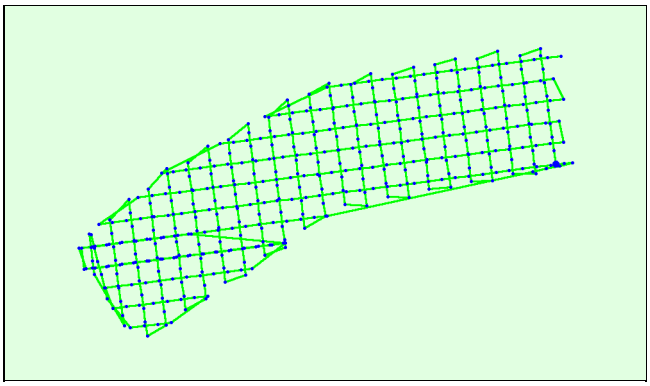
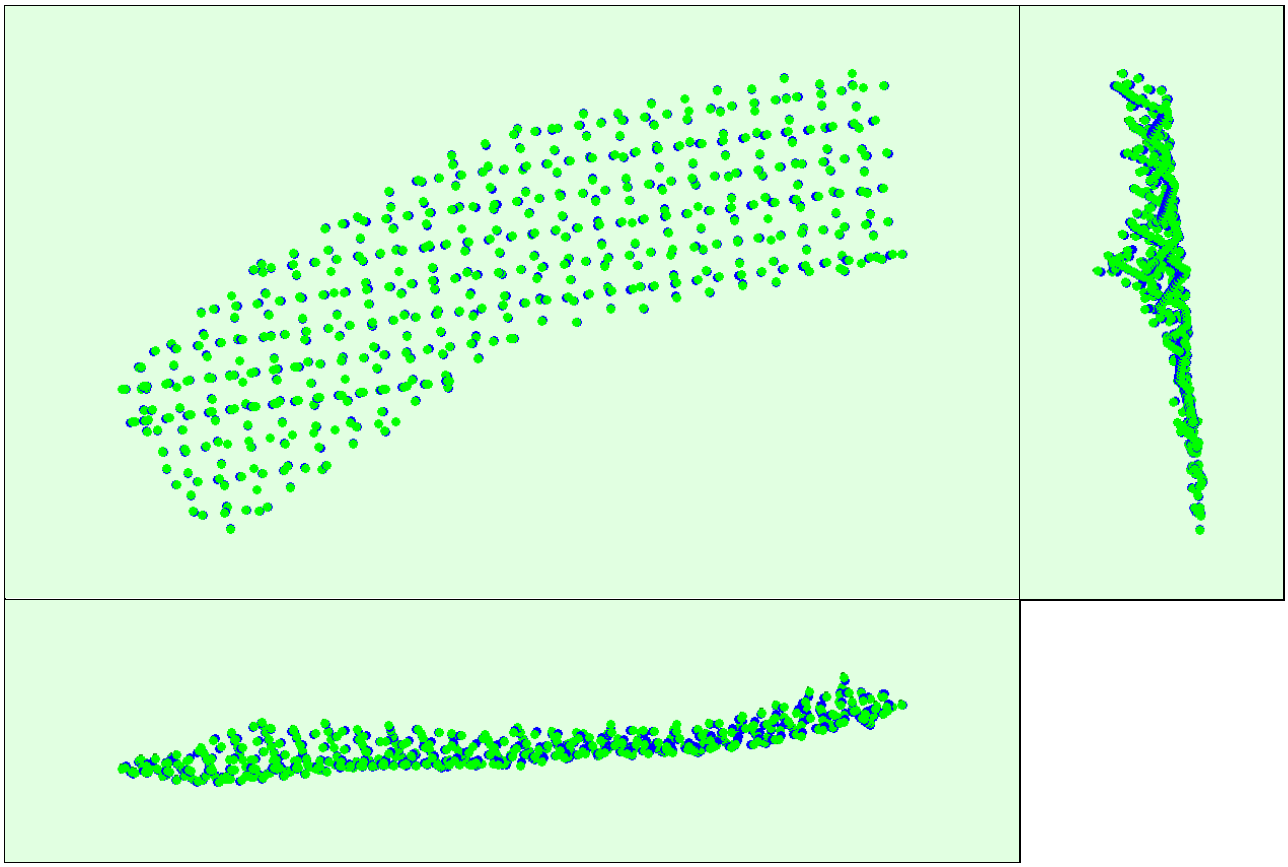


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions



Uncertainty ellipses 10x magnified

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]	Camera Displacement X [m]	Camera Displacement Y [m]	Camera Displacement Z [m]
Mean	0.137	0.136	0.257	0.066	0.045	0.030	0.006	0.007	0.016
Sigma	0.027	0.026	0.042	0.002	0.004	0.002	0.003	0.003	0.006

Overlap

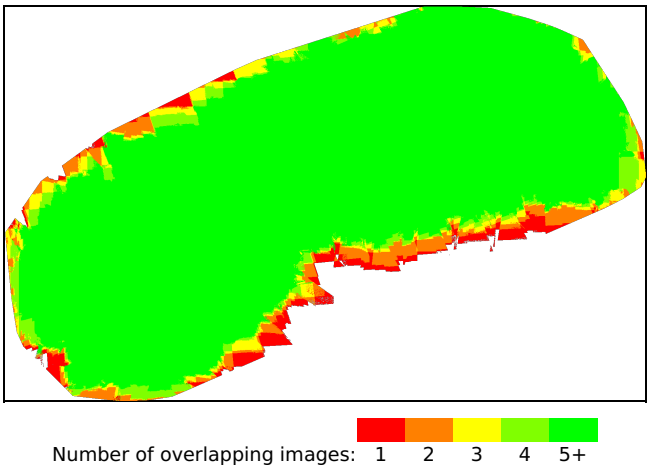


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

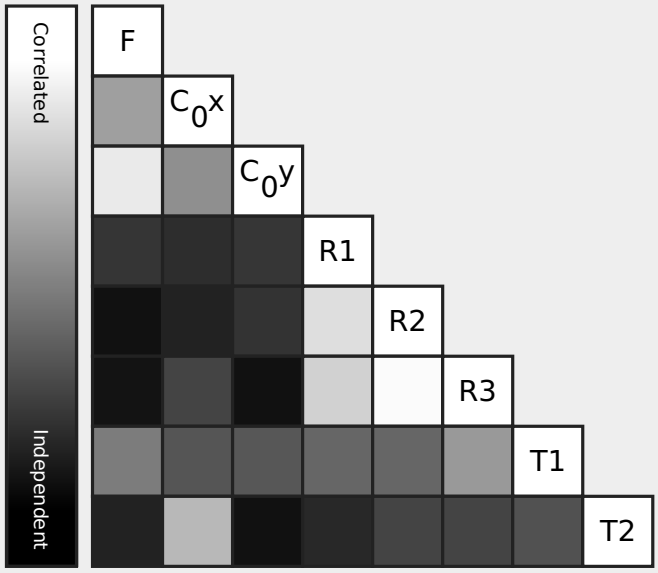
Number of 2D Keypoint Observations for Bundle Block Adjustment	8428920
Number of 3D Points for Bundle Block Adjustment	2885482
Mean Reprojection Error [pixels]	0.244

Internal Camera Parameters

L1D-20c_10.3_5472x3648 (RGB). Sensor Dimensions: 12.825 [mm] x 8.550 [mm]

EXIF ID: L1D-20c_10.3_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4470.830 [pixel] 10.479 [mm]	2770.870 [pixel] 6.494 [mm]	1698.700 [pixel] 3.981 [mm]	0.009	0.040	-0.050	-0.003	0.002
Optimized Values	4294.270 [pixel] 10.065 [mm]	2705.277 [pixel] 6.340 [mm]	1841.518 [pixel] 4.316 [mm]	-0.006	0.011	-0.010	0.001	-0.001
Uncertainties (Sigma)	1.101 [pixel] 0.003 [mm]	0.151 [pixel] 0.000 [mm]	0.795 [pixel] 0.002 [mm]	0.000	0.000	0.001	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

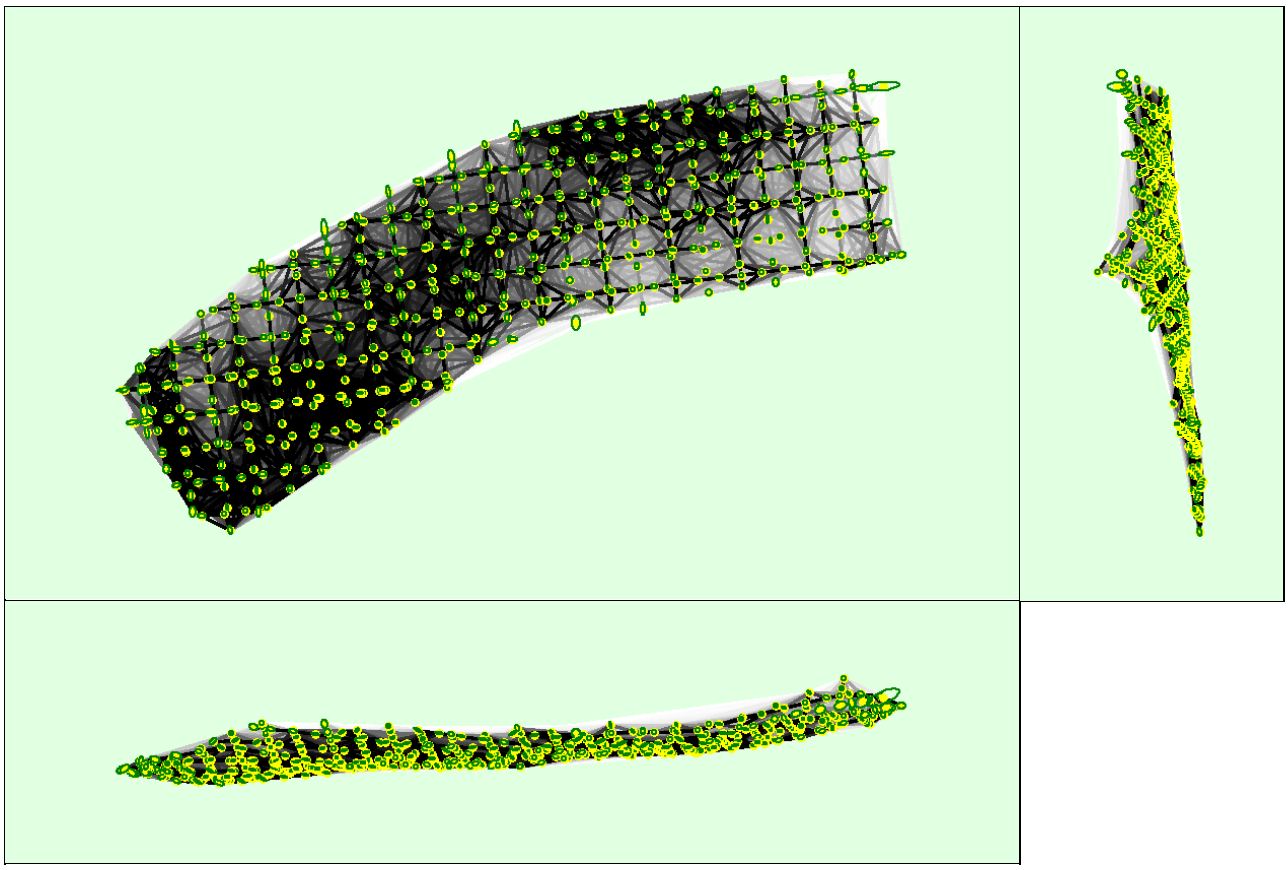
	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	69120	17662
Min	43111	1943
Max	79950	32713
Mean	67368	17202

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	1962998
In 3 Images	440466
In 4 Images	189458
In 5 Images	97534
In 6 Images	57244
In 7 Images	35102
In 8 Images	23576
In 9 Images	16344
In 10 Images	11930
In 11 Images	8836
In 12 Images	6904
In 13 Images	5370
In 14 Images	4390
In 15 Images	3393
In 16 Images	2835
In 17 Images	2414
In 18 Images	1987
In 19 Images	1825
In 20 Images	1496
In 21 Images	1225
In 22 Images	1078
In 23 Images	893
In 24 Images	850
In 25 Images	711
In 26 Images	653
In 27 Images	597
In 28 Images	489
In 29 Images	474
In 30 Images	421
In 31 Images	367
In 32 Images	320
In 33 Images	292
In 34 Images	281
In 35 Images	230
In 36 Images	188
In 37 Images	172
In 38 Images	198
In 39 Images	159
In 40 Images	140

In 41 Images	131
In 42 Images	120
In 43 Images	96
In 44 Images	124
In 45 Images	95
In 46 Images	95
In 47 Images	119
In 48 Images	101
In 49 Images	100
In 50 Images	74
In 51 Images	81
In 52 Images	72
In 53 Images	70
In 54 Images	69
In 55 Images	51
In 56 Images	43
In 57 Images	46
In 58 Images	37
In 59 Images	28
In 60 Images	25
In 61 Images	18
In 62 Images	12
In 63 Images	11
In 64 Images	7
In 65 Images	3
In 66 Images	7
In 67 Images	4
In 68 Images	1
In 69 Images	1
In 70 Images	1

2D Keypoint Matches



Uncertainty ellipses 100x magnified

Number of matches

25 222 444 666 888 1111 1333 1555 1777 2000

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]	Camera Displacement X [m]	Camera Displacement Y [m]	Camera Displacement Z [m]
Mean	0.023	0.024	0.020	0.013	0.013	0.007	0.006	0.007	0.016
Sigma	0.010	0.011	0.007	0.006	0.006	0.003	0.003	0.003	0.006

Geolocation Details

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	0.20	0.00	2.04
-3.00	0.00	41.22	55.92	54.49
0.00	3.00	58.57	44.08	36.53
3.00	6.00	0.00	0.00	6.94
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]		-0.000000	0.000000	0.000000
Sigma [m]		1.178014	0.687601	1.642848
RMS Error [m]		1.178014	0.687601	1.642848

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.

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	1.361

Phi	2.042
Kappa	2.484

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

Rolling Shutter Statistics

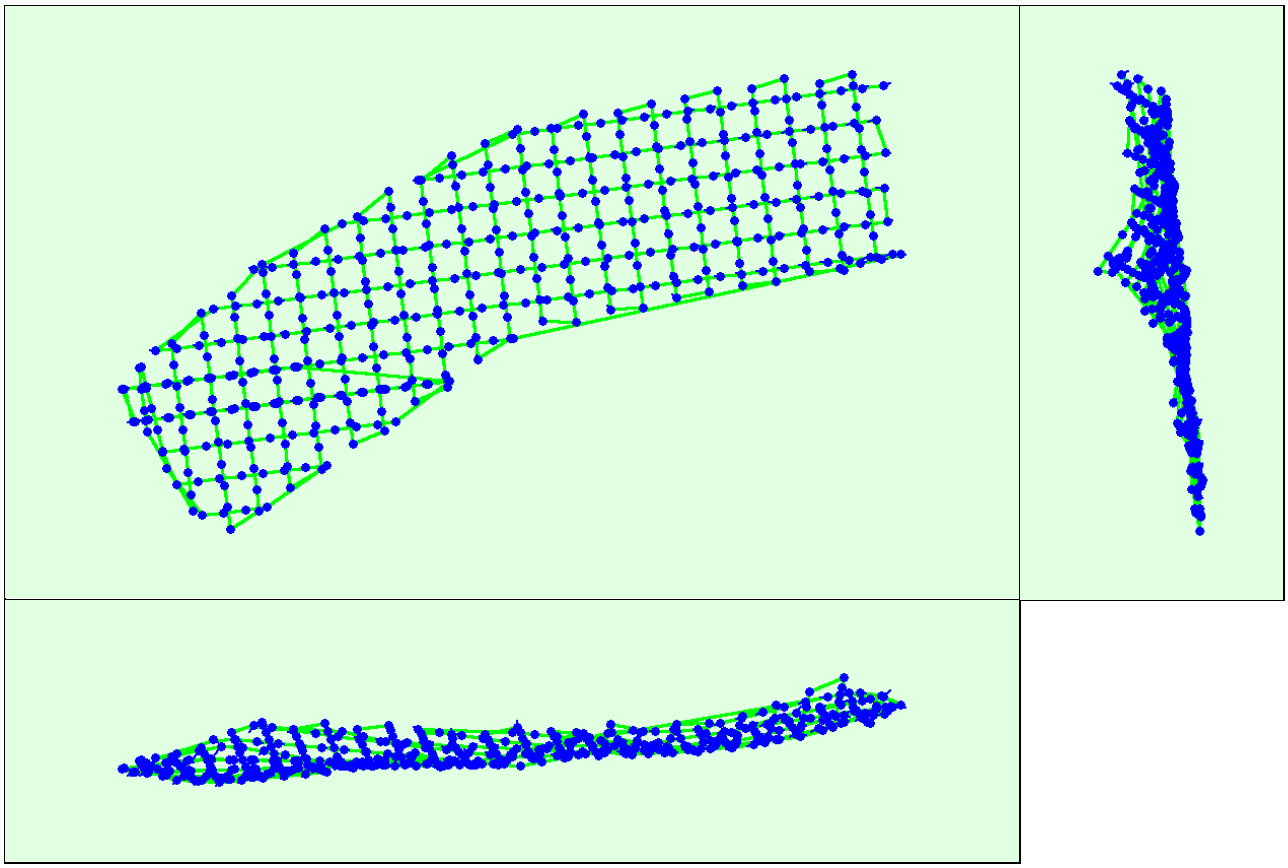


Figure 6: Camera movement estimated by the rolling shutter camera model. The green line follows the computed image positions. The blue dots represent the camera position at the start of the exposure. The blue lines represent the camera motion during the rolling shutter readout, re-scaled by a project dependant scaling factor for better visibility.

Median Camera Speed	4.139 [m/s]
Median Camera Displacement During Sensor Readout)	0.3884 [m]
Median Rolling Shutter Readout Time	76.6913 [ms]

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Xeon(R) Platinum 8124M CPU @ 3.00GHz RAM: 69GB GPU: no info (Driver: unknown)
Operating System	Linux 4.15.0-1057-aws x86_64

Coordinate Systems

Image Coordinate System	WGS 84 (EGM 96 Geoid)
Output Coordinate System	TWD97 / TM2 zone 121 (EGM 96 Geoid)

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: yes
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: yes
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:19m:21s
Time for Point Cloud Classification	02m:48s
Time for 3D Textured Mesh Generation	30m:06s

Results

Number of Generated Tiles	3
Number of 3D Densified Points	51577361
Average Density (per m^3)	91.92

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (3.02 [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
Raster DTM	Generated: yes Merge Tiles: yes
DTM Resolution	10 x GSD (3.02 [cm/pixel])
Time for DSM Generation	11m:11s
Time for Orthomosaic Generation	20m:44s
Time for DTM Generation	01m:07s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s