Quality Report

Generated with Pix4Dmapper version 4.5.6

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	210303_Kulvert_Eskil
Processed	2021-03-04 09:34:08
Camera Model Name(s)	FC6310R_8.8_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	2.16 cm / 0.85 in
Area Covered	0.085 km^2 / 8.5178 ha / 0.03 sq. mi. / 21.0588 acres

Quality Check

Images	median of 56385 keypoints per image	✓
Dataset	168 out of 169 images calibrated (99%), all images enabled	✓
Camera Optimization	0.07% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 29537.3 matches per calibrated image	✓
Georeferencing	yes, 4 GCPs (4 3D), mean RMS error = 0.01 m	✓

Preview

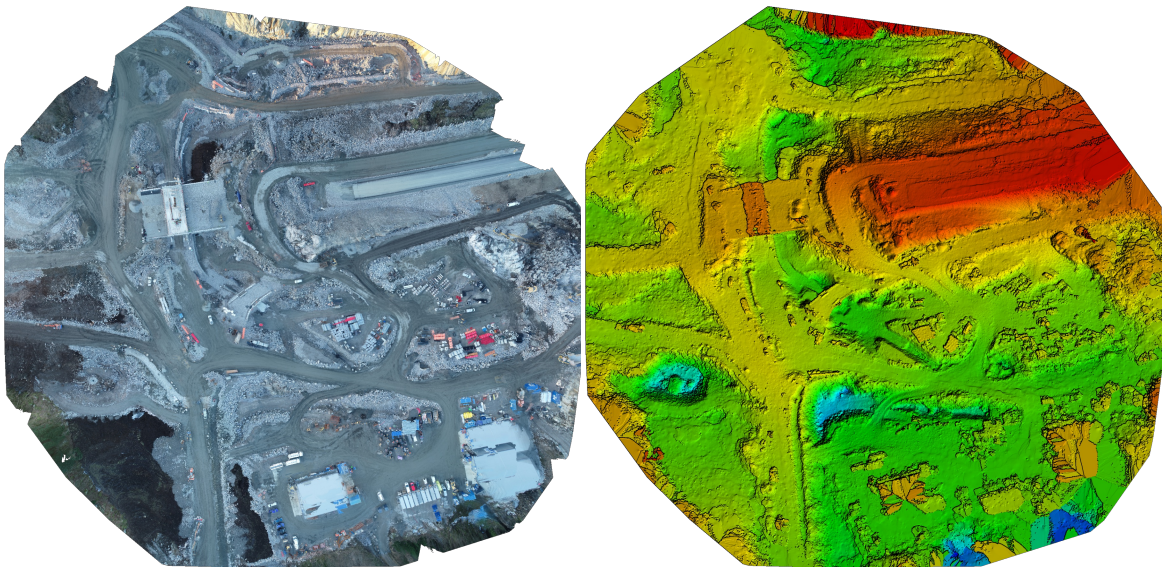


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	168 out of 169
Number of Geolocated Images	169 out of 169

Initial Image Positions

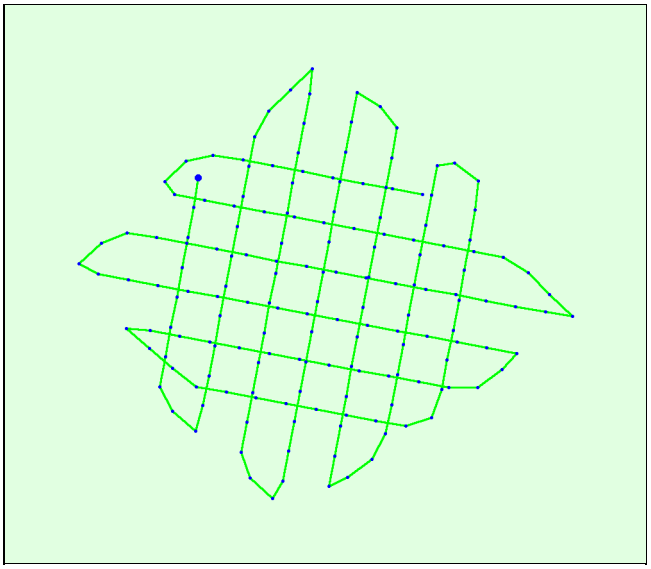
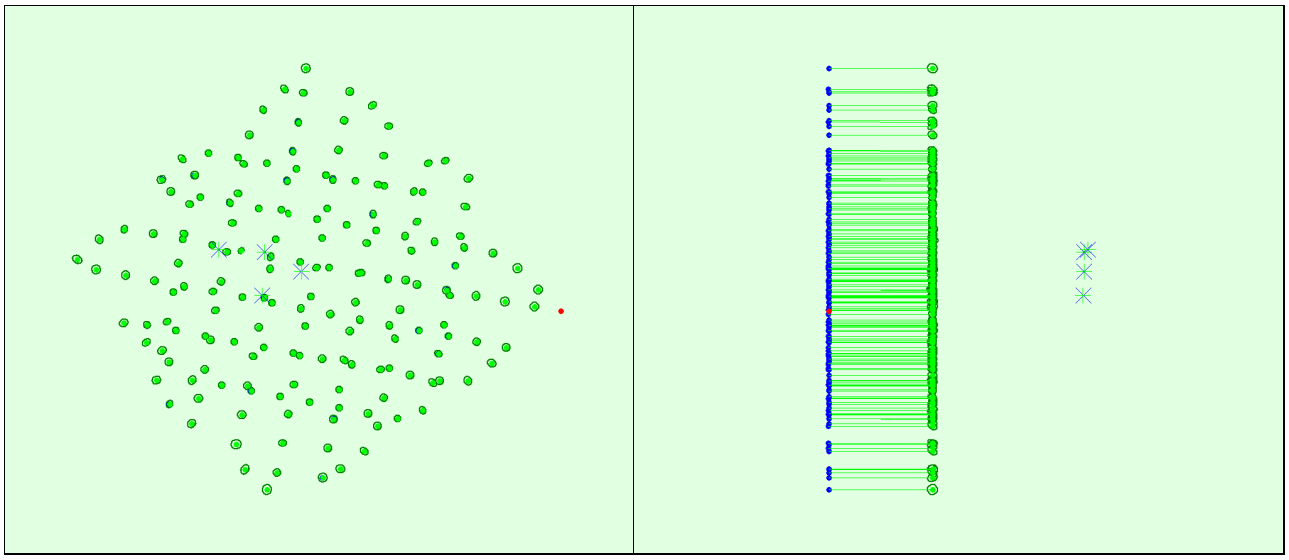
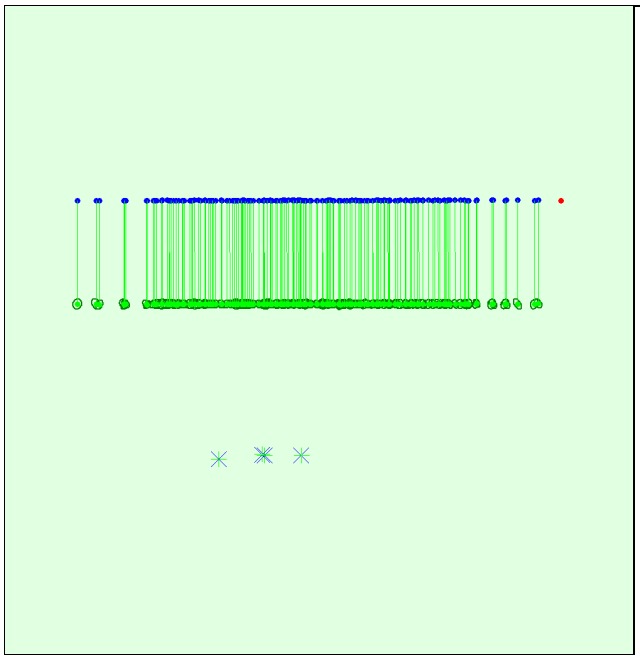


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions





Uncertainty ellipses 1000x 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). Red dots indicate disabled or uncalibrated images. 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	0.002	0.001	0.002	0.001	0.001	0.001
Sigma	0.000	0.000	0.000	0.000	0.000	0.000

Overlap

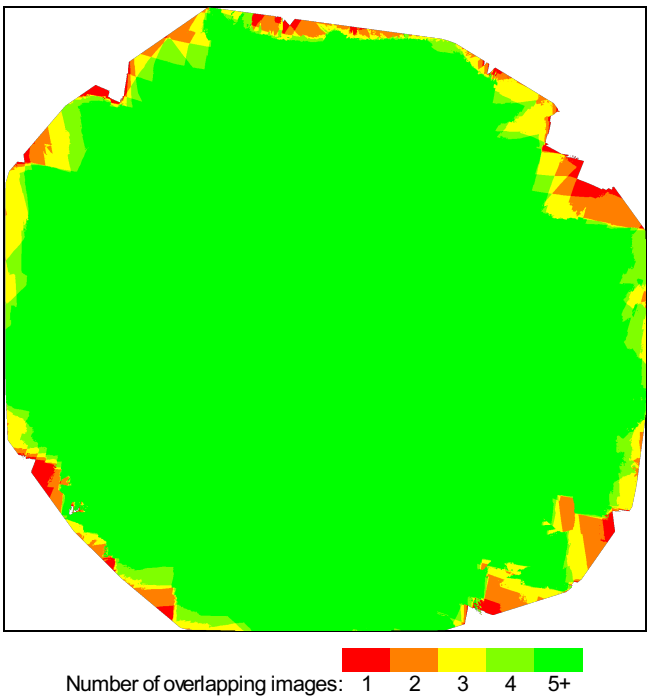


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

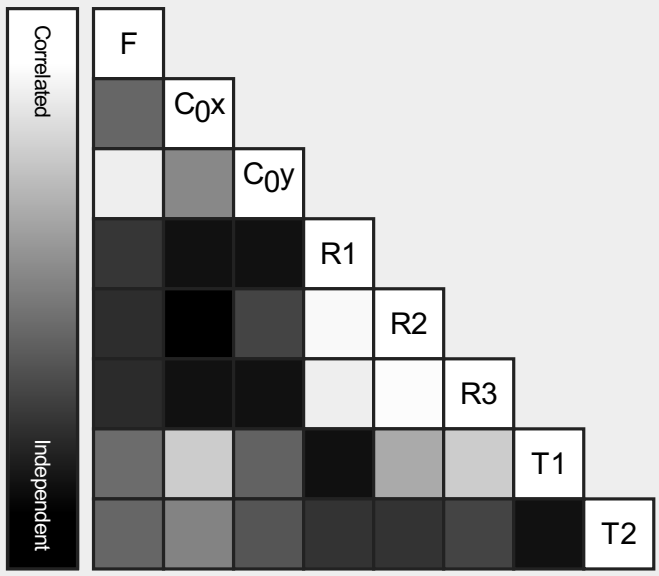
Number of 2D Keypoint Observations for Bundle Block Adjustment	4927459
Number of 3D Points for Bundle Block Adjustment	1548618
Mean Reprojection Error [pixels]	0.150

Internal Camera Parameters

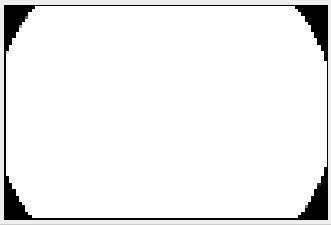
FC6310R_8.8_5472x3648 (RGB). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

EXIF ID: FC6310R_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3658.300 [pixel] 8.580 [mm]	2722.500 [pixel] 6.385 [mm]	1835.100 [pixel] 4.304 [mm]	-0.269	0.112	-0.033	0.000	-0.001
Optimized Values	3655.659 [pixel] 8.574 [mm]	2720.223 [pixel] 6.380 [mm]	1849.728 [pixel] 4.338 [mm]	-0.266	0.109	-0.032	0.001	-0.001
Uncertainties (Sigma)	0.069 [pixel] 0.000 [mm]	0.035 [pixel] 0.000 [mm]	0.079 [pixel] 0.000 [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	56385	29537
Min	47697	18059
Max	67112	37536
Mean	56639	29330

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	889659
In 3 Images	295591

In 4 Images	139365
In 5 Images	76561
In 6 Images	45288
In 7 Images	28616
In 8 Images	19190
In 9 Images	13098
In 10 Images	9483
In 11 Images	6890
In 12 Images	5173
In 13 Images	3865
In 14 Images	3058
In 15 Images	2399
In 16 Images	1854
In 17 Images	1523
In 18 Images	1236
In 19 Images	980
In 20 Images	814
In 21 Images	676
In 22 Images	564
In 23 Images	456
In 24 Images	393
In 25 Images	312
In 26 Images	266
In 27 Images	197
In 28 Images	166
In 29 Images	156
In 30 Images	126
In 31 Images	99
In 32 Images	88
In 33 Images	93
In 34 Images	61
In 35 Images	61
In 36 Images	38
In 37 Images	38
In 38 Images	29
In 39 Images	33
In 40 Images	22
In 41 Images	16
In 42 Images	19
In 43 Images	17
In 44 Images	11
In 45 Images	9
In 46 Images	3
In 47 Images	7
In 48 Images	7
In 49 Images	4
In 50 Images	2
In 51 Images	2
In 52 Images	1
In 56 Images	1
In 57 Images	1
In 63 Images	1

2D Keypoint Matches

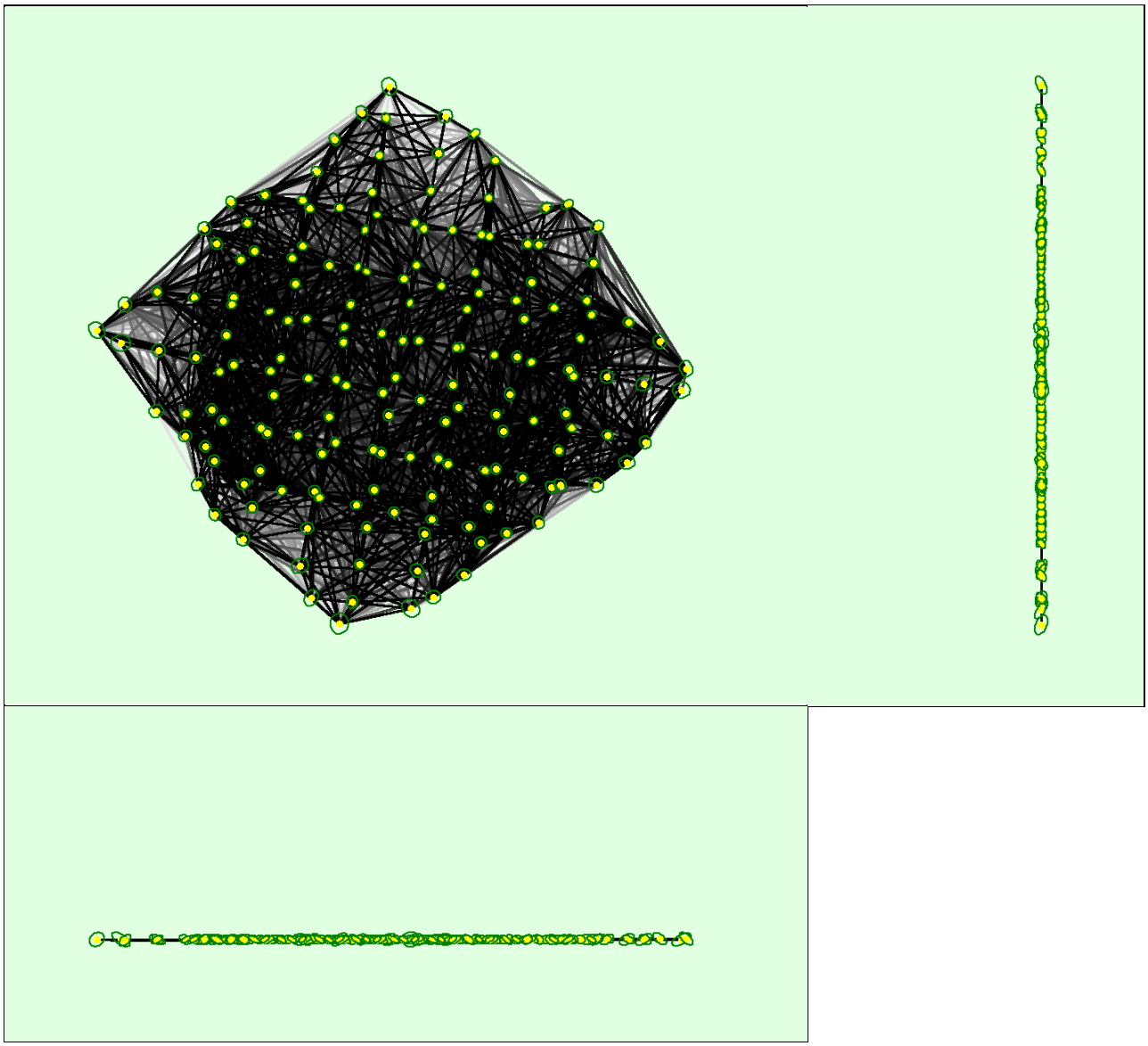


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty 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	0.002	0.002	0.001	0.002	0.002	0.001
Sigma	0.000	0.000	0.000	0.000	0.000	0.000

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
0001 (3D)	0.020/ 0.020	-0.002	-0.009	0.013	0.963	9 / 9
0002 (3D)	0.020/ 0.020	-0.007	0.000	-0.000	0.821	9 / 9

0003 (3D)	0.020/ 0.020	-0.002	-0.003	0.005	0.939	9 / 9
0004 (3D)	0.020/ 0.020	0.012	0.013	-0.030	0.776	9 / 9
Mean [m]		0.000334	0.000562	-0.003134		
Sigma [m]		0.007182	0.008093	0.016436		
RMS Error [m]		0.007190	0.008113	0.016732		

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 [%]
-	-0.05	0.00	0.00	0.00
-0.05	-0.04	0.00	0.00	0.00
-0.04	-0.03	0.00	0.00	0.00
-0.03	-0.02	0.00	0.00	1.19
-0.02	-0.01	0.60	0.60	10.71
-0.01	0.00	45.24	50.60	39.29
0.00	0.01	54.17	44.64	36.31
0.01	0.02	0.00	4.17	12.50
0.02	0.03	0.00	0.00	0.00
0.03	0.04	0.00	0.00	0.00
0.04	0.05	0.00	0.00	0.00
0.05	-	0.00	0.00	0.00
Mean [m]		-0.018995	0.009127	41.234933
Sigma [m]		0.003909	0.005283	0.008555
RMS Error [m]		0.019393	0.010546	41.234934

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]	-0.018942	0.009041	41.235313

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	99.40	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]	0.014561	0.014561	0.029570
Sigma of Geolocation Accuracy [m]	0.000429	0.000429	0.001504

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

Geolocation Orientational Variance	RMS [degree]
Omega	2.079
Phi	2.114
Kappa	6.013

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) Xeon(R) CPU E5-2690 v4 @ 2.60GHz RAM: 256GB GPU: NVIDIA Tesla M10 (Driver: 24.21.14.1181)
Operating System	Windows Server 2016 Datacenter, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84
Ground Control Point (GCP) Coordinate System	ETRS89 / NTM zone 7
Output Coordinate System	ETRS89 / NTM zone 7

Processing Options

Detected Template	Runde 2*
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

Results

Number of Generated Tiles	1
Number of 3D Densified Points	16598276
Average Density (per m^3)	385.88

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (2.16 [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