Processing Report

Generated with Drone2Map for ArcGIS

Summary

Project	Park Road - Grid 90-200'_2
Processed	2018-08-15 11:38:02
Camera Model Name(s)	FC2103_4.5_4056x3040 (RGB)
Average Ground Sampling Distance (GSD)	2.04 cm / 0.80 in
Area Covered	0.047 km^2 / 4.7307 ha / 0.02 sq. mi. / 11.6960 acres
Time for Initial Processing (without report)	10m:02s

Quality Check

Images	median of 60509 keypoints per image	✓
Dataset	133 out of 133 images calibrated (100%), all images enabled	✓
Camera Optimization	9.53% relative difference between initial and optimized internal camera parameters	⚠
Matching	median of 17536.1 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

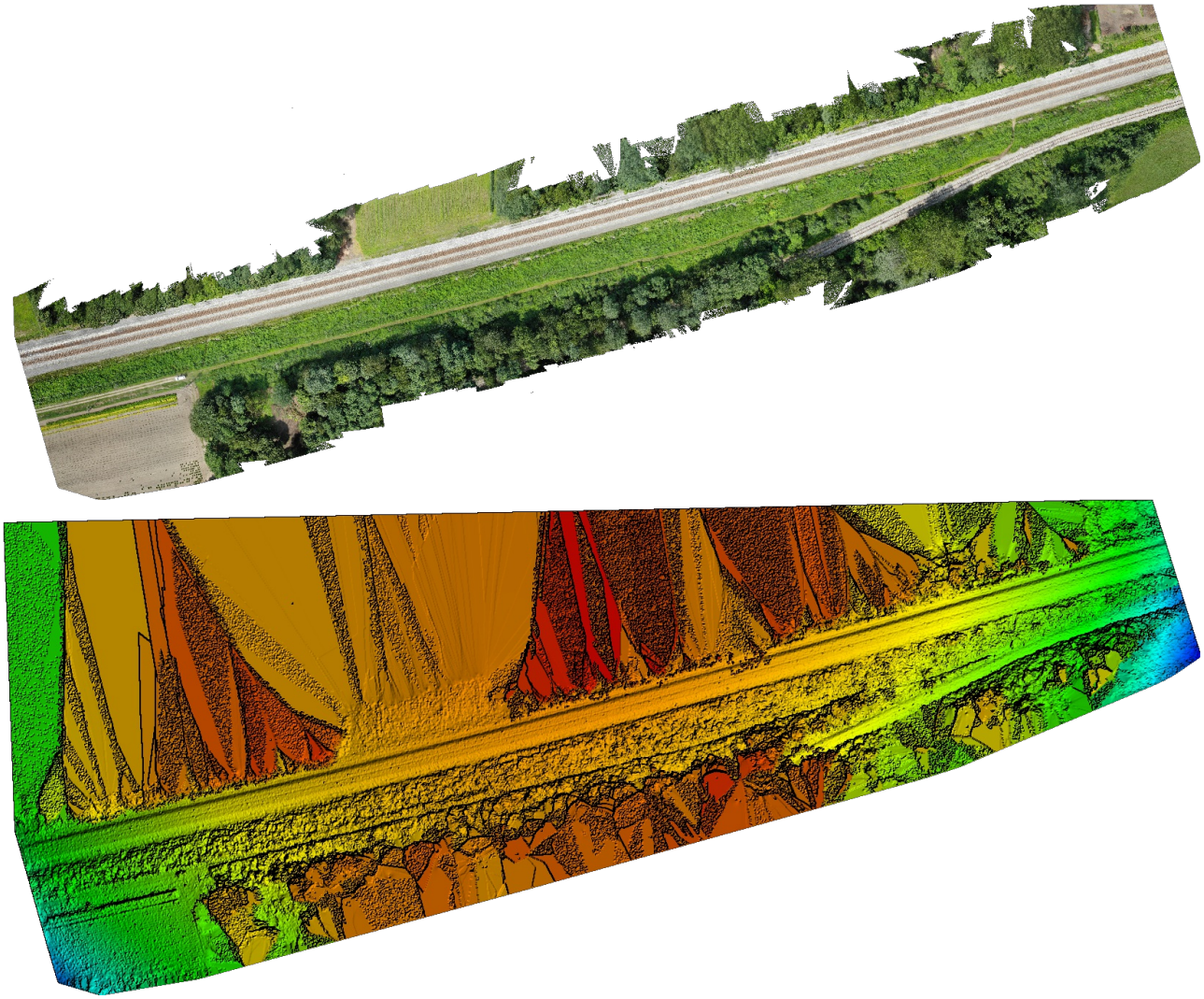


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	133 out of 133
Number of Geolocated Images	133 out of 133

Initial Image Positions

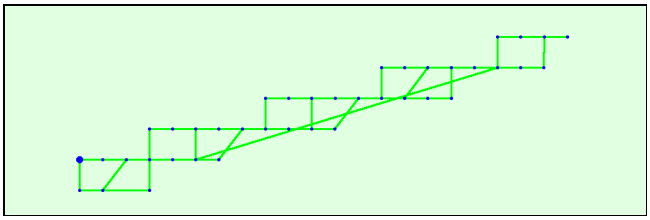
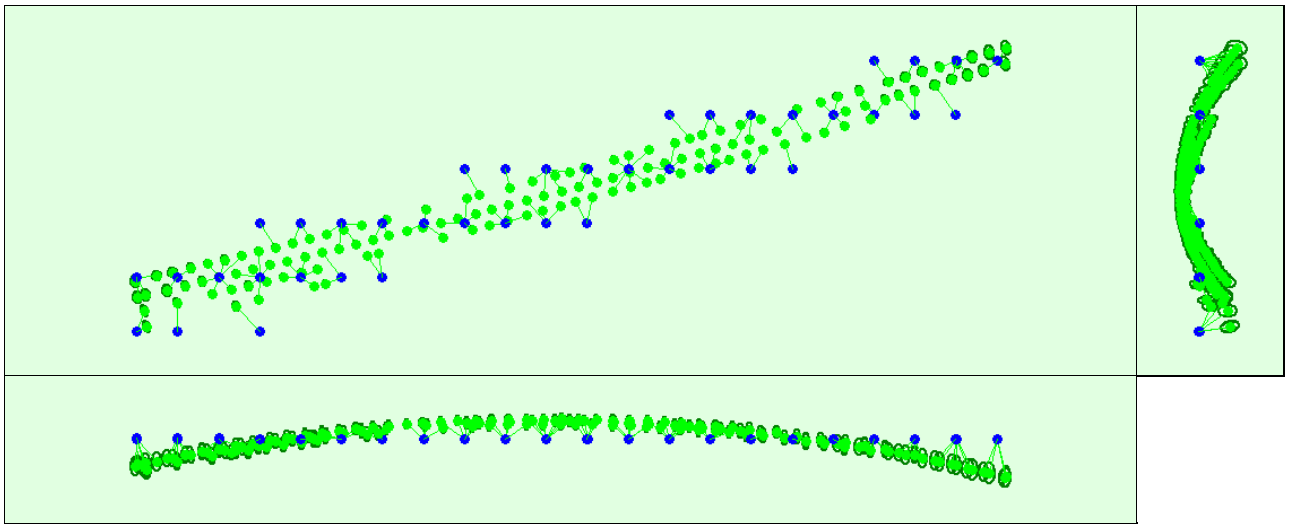


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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]
Mean	0.182	0.210	0.373	0.742	0.219	0.111
Sigma	0.041	0.054	0.080	0.013	0.043	0.025

Overlap

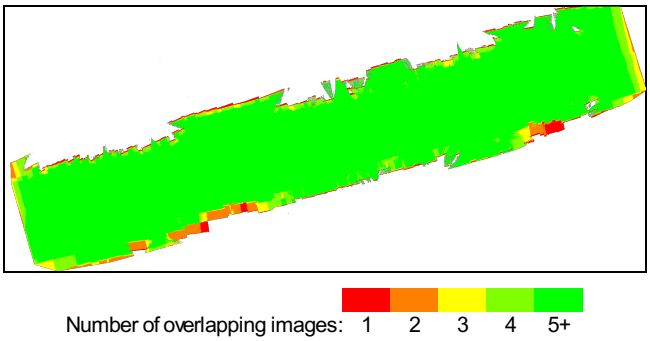


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

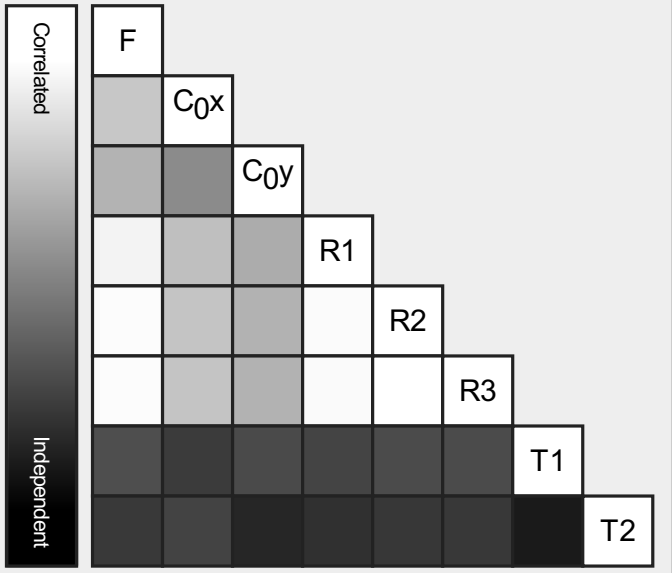
Number of 2D Keypoint Observations for Bundle Block Adjustment	2442415
Number of 3D Points for Bundle Block Adjustment	790740
Mean Reprojection Error [pixels]	0.256

Internal Camera Parameters

FC2103_4.5_4056x3040 (RGB). Sensor Dimensions: 6.071 [mm] x 4.550 [mm]

EXIF ID: FC2103_4.5_4056x3040

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	2972.320 [pixel] 4.449 [mm]	2036.890 [pixel] 3.049 [mm]	1449.140 [pixel] 2.169 [mm]	0.182	-0.593	0.418	0.001	-0.000
Optimized Values	2688.798 [pixel] 4.024 [mm]	1994.049 [pixel] 2.985 [mm]	1470.962 [pixel] 2.202 [mm]	0.193	-0.417	0.231	-0.000	0.000
Uncertainties (Sigma)	4.432 [pixel] 0.007 [mm]	0.107 [pixel] 0.000 [mm]	0.109 [pixel] 0.000 [mm]	0.001	0.003	0.002	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.

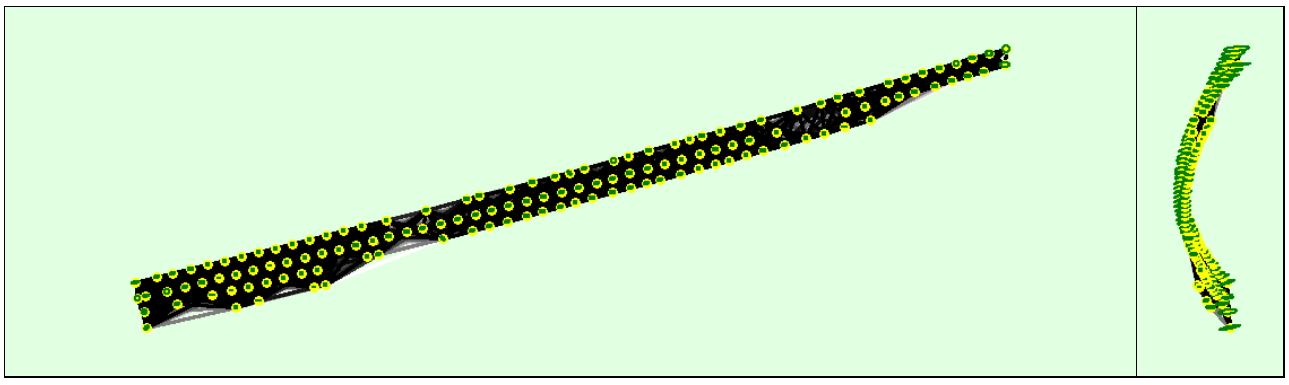
2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	60509	17536
Min	51249	10622
Max	64139	33278
Mean	60038	18364

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	522855
In 3 Images	116541
In 4 Images	48679
In 5 Images	26791
In 6 Images	17479
In 7 Images	12253
In 8 Images	9390
In 9 Images	7368
In 10 Images	6057
In 11 Images	5013
In 12 Images	4331
In 13 Images	3298
In 14 Images	2386
In 15 Images	1932
In 16 Images	1647
In 17 Images	1492
In 18 Images	1365
In 19 Images	986
In 20 Images	404
In 21 Images	231
In 22 Images	154
In 23 Images	60
In 24 Images	28

2D Keypoint Matches



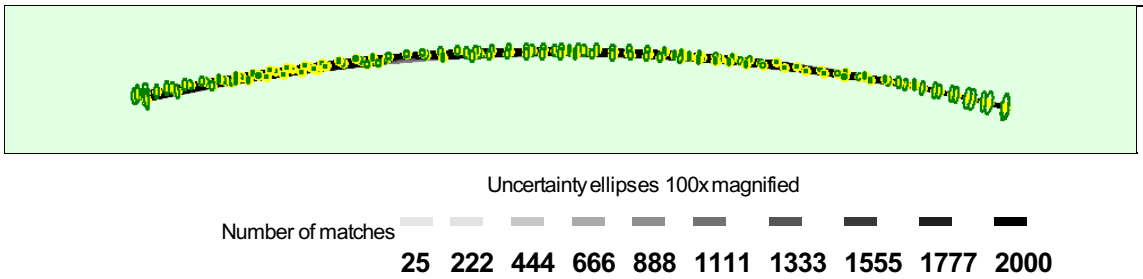


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty 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	0.011	0.008	0.025	0.021	0.023	0.007
Sigma	0.003	0.002	0.014	0.003	0.010	0.003

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	1.50	0.00
-15.00	-12.00	2.26	9.77	0.00
-12.00	-9.00	6.77	8.27	15.04
-9.00	-6.00	14.29	9.02	21.05
-6.00	-3.00	14.29	9.77	12.78
-3.00	0.00	13.53	11.28	7.52
0.00	3.00	13.53	11.28	9.02
3.00	6.00	11.28	9.77	7.52
6.00	9.00	12.78	9.02	7.52
9.00	12.00	8.27	10.53	6.02
12.00	15.00	3.01	7.52	5.26
15.00	-	0.00	2.26	8.27
Mean [m]		-0.003108	-0.007862	0.013778
Sigma [m]		6.827630	8.844542	8.875455
RMS Error [m]		6.827631	8.844546	8.875466

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]	43.61	34.59	75.94
[-2.00, 2.00]	86.47	65.41	98.50
[-3.00, 3.00]	100.00	96.24	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.

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Xeon(R) CPU E5-1650 v4 @ 3.60GHz RAM: 72GB GPU: NVIDIA Quadro P4000 (Driver: 23.21.13.9133)
Operating System	Windows 10 Pro, 64-bit

Coordinate Systems

Image Coordinate System	GCS_WGS_1984 (EGM96 Geoid)
Output Coordinate System	WGS_1984_UTM_Zone_17N (EGM96 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: 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	no
LOD	Generated: no
Advanced: Image Groups	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	12m:43s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	NA

Results

Number of Generated Tiles	1
Number of 3D Densified Points	10178453
Average Density (per m^3)	346.9

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (2.04 [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
Raster DTM	Generated: yes Merge Tiles: yes
DTM Resolution	5 x GSD (2.04 [cm/pixel])
Time for DSM Generation	07m:59s
Time for Orthomosaic Generation	07m:52s
Time for DTM Generation	05m:07s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s