

# Sheboygan\_Sept2018 Photoscan Report

Processing Report

27 June 2019



# Survey Data

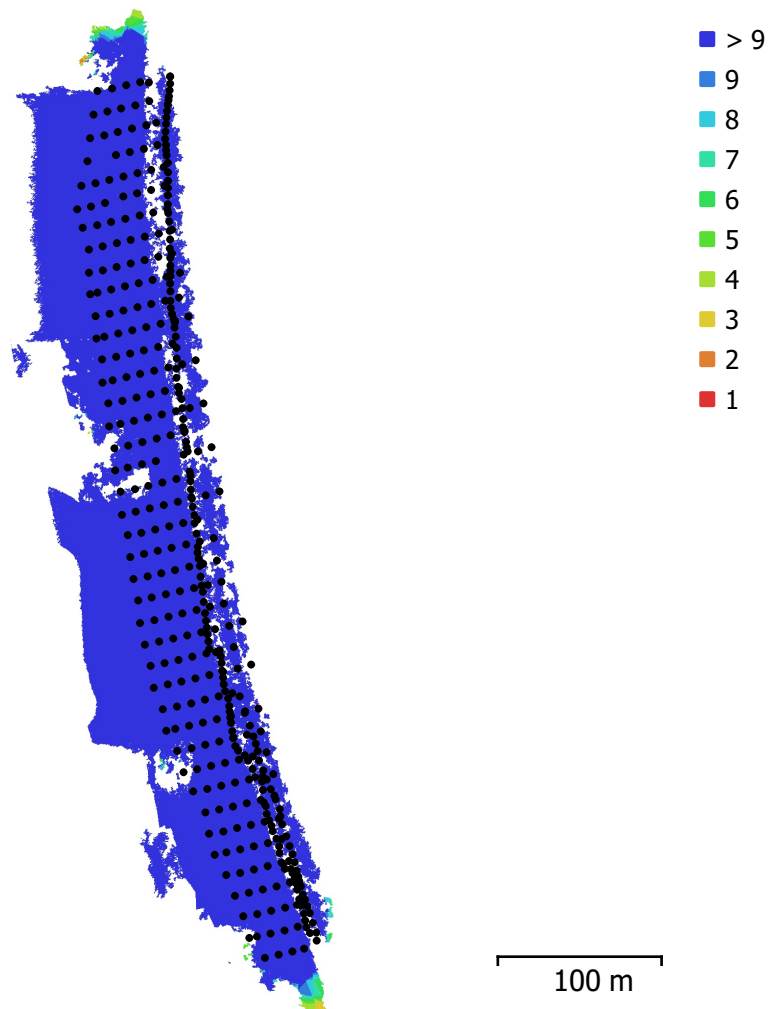


Fig. 1. Camera locations and image overlap.

Number of images:	418	Camera stations:	417
Flying altitude:	44.4 m	Tie points:	605,111
Ground resolution:	1.06 cm/pix	Projections:	2,305,736
Coverage area:	0.0451 km <sup>2</sup>	Reprojection error:	0.594 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC6310 (8.8mm)	5464 x 3640	8.8 mm	2.42 x 2.42 $\mu$ m	No
FC6310 (8.8mm)	5464 x 3640	8.8 mm	2.42 x 2.42 $\mu$ m	No

Table 1. Cameras.

# Camera Calibration

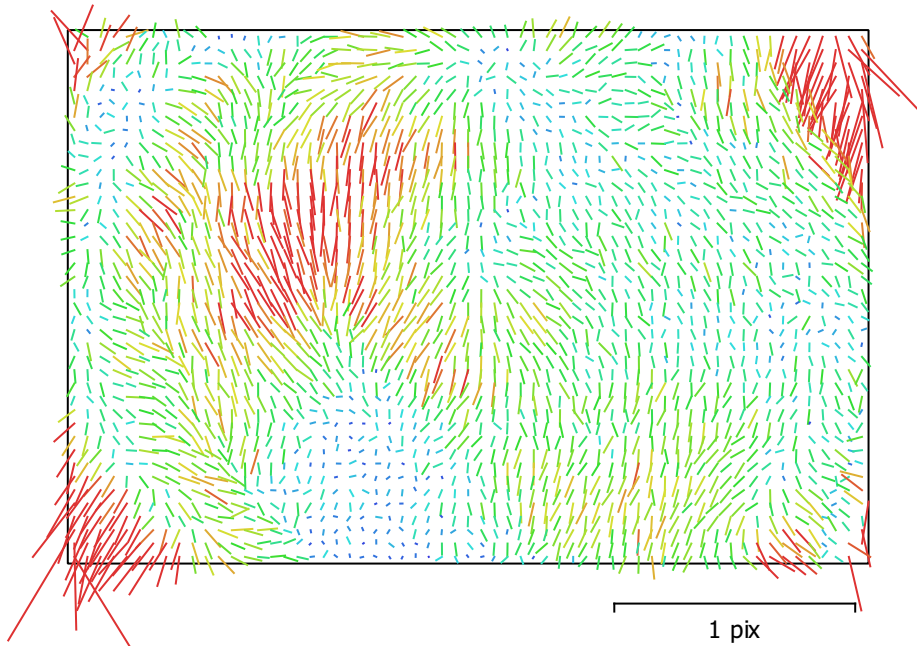


Fig. 2. Image residuals for FC6310 (8.8mm).

## FC6310 (8.8mm)

270 images

Type Resolution Focal Length Pixel Size  
**Frame 5464 x 3640 8.8 mm 2.42 x 2.42  $\mu$ m**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2	P3	P4
<b>F</b>	<b>3658.58</b>	0.11	1.00	0.00	-0.05	-0.09	0.07	-0.73	0.30	-0.17	0.13	0.05	0.08	-0.03	0.02
<b>Cx</b>	<b>-8.43477</b>	0.015		1.00	0.03	-0.23	-0.04	0.01	0.00	-0.00	0.00	0.13	0.15	-0.13	0.09
<b>Cy</b>	<b>40.2498</b>	0.0098			1.00	0.02	-0.18	0.02	-0.01	0.00	-0.00	0.26	0.06	-0.27	0.25
<b>B1</b>	<b>0.231753</b>	0.014				1.00	-0.05	0.00	-0.03	0.03	-0.03	0.06	-0.01	0.01	-0.01
<b>B2</b>	<b>-0.0899652</b>	0.013					1.00	-0.05	0.01	-0.00	-0.00	0.03	0.11	-0.02	0.01
<b>K1</b>	<b>-0.27102</b>	2.2e-05						1.00	-0.85	0.75	-0.68	-0.06	-0.06	0.04	-0.04
<b>K2</b>	<b>0.128479</b>	5.6e-05							1.00	-0.98	0.94	0.05	0.03	-0.04	0.04
<b>K3</b>	<b>-0.0600565</b>	7.3e-05								1.00	-0.99	-0.04	-0.02	0.04	-0.04
<b>K4</b>	<b>0.0142378</b>	3.3e-05									1.00	0.04	0.02	-0.04	0.05
<b>P1</b>	<b>0.000218323</b>	8.9e-07										1.00	0.84	-0.86	0.75
<b>P2</b>	<b>0.000275786</b>	1.1e-06											1.00	-0.88	0.76
<b>P3</b>	<b>-0.0756123</b>	0.0095												1.00	-0.96
<b>P4</b>	<b>0.124929</b>	0.0067													1.00

Table 2. Calibration coefficients and correlation matrix.

# Camera Calibration

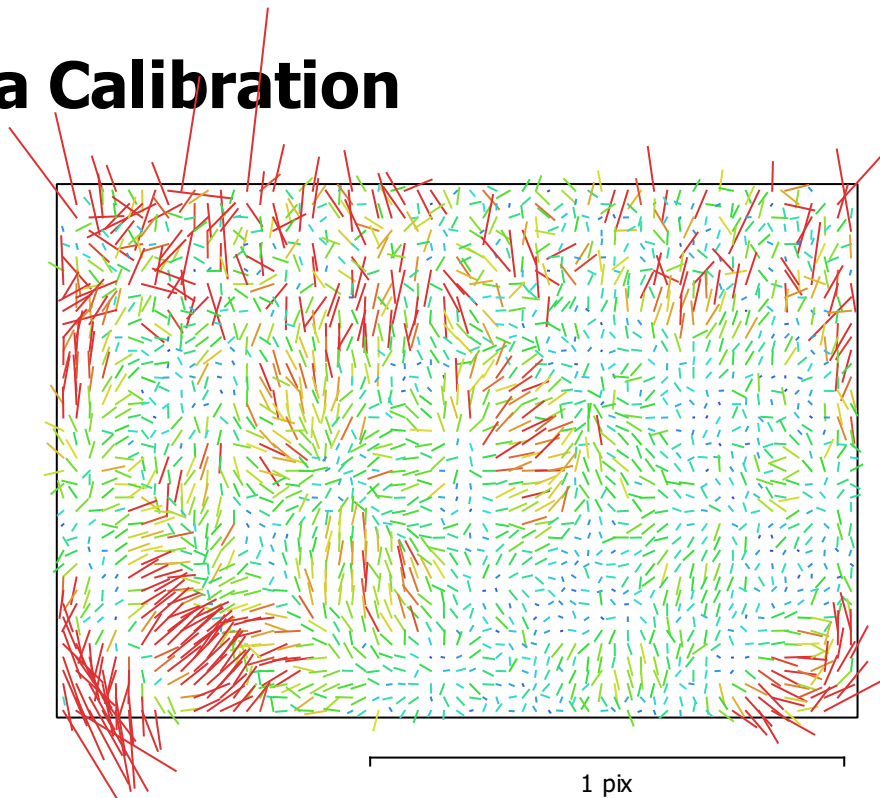


Fig. 3. Image residuals for FC6310 (8.8mm).

## FC6310 (8.8mm)

148 images

Type  
Frame

Resolution  
**5464 x 3640**

Focal Length  
**8.8 mm**

Pixel Size  
**2.42 x 2.42  $\mu$ m**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2	P3	P4
<b>F</b>	<b>3656.44</b>	0.12	1.00	0.05	0.02	-0.83	-0.01	-0.58	0.20	-0.12	0.08	-0.04	-0.04	0.03	0.01
<b>Cx</b>	<b>-9.442</b>	0.058		1.00	0.32	-0.24	0.68	0.06	-0.02	0.01	-0.00	-0.71	-0.53	0.46	0.04
<b>Cy</b>	<b>42.0474</b>	0.038			1.00	-0.35	0.29	0.02	0.07	-0.08	0.10	-0.46	-0.85	0.33	0.01
<b>B1</b>	<b>-0.461703</b>	0.054				1.00	-0.19	0.37	-0.14	0.09	-0.07	0.27	0.38	-0.19	-0.01
<b>B2</b>	<b>-0.427754</b>	0.021					1.00	0.08	-0.03	0.01	-0.01	-0.66	-0.49	0.47	-0.02
<b>K1</b>	<b>-0.270016</b>	2.1e-05						1.00	-0.88	0.80	-0.74	-0.09	-0.07	0.10	-0.07
<b>K2</b>	<b>0.127251</b>	6.7e-05							1.00	-0.98	0.95	0.04	-0.03	-0.08	0.10
<b>K3</b>	<b>-0.0594528</b>	9.7e-05								1.00	-0.99	-0.03	0.05	0.07	-0.10
<b>K4</b>	<b>0.0141651</b>	4.8e-05									1.00	0.02	-0.07	-0.06	0.09
<b>P1</b>	<b>0.000225292</b>	3.7e-06										1.00	0.78	-0.85	0.23
<b>P2</b>	<b>8.26669e-05</b>	1.9e-06											1.00	-0.66	0.16
<b>P3</b>	<b>0.186137</b>	0.02												1.00	-0.69
<b>P4</b>	<b>0.296201</b>	0.01													1.00

Table 3. Calibration coefficients and correlation matrix.

# Ground Control Points

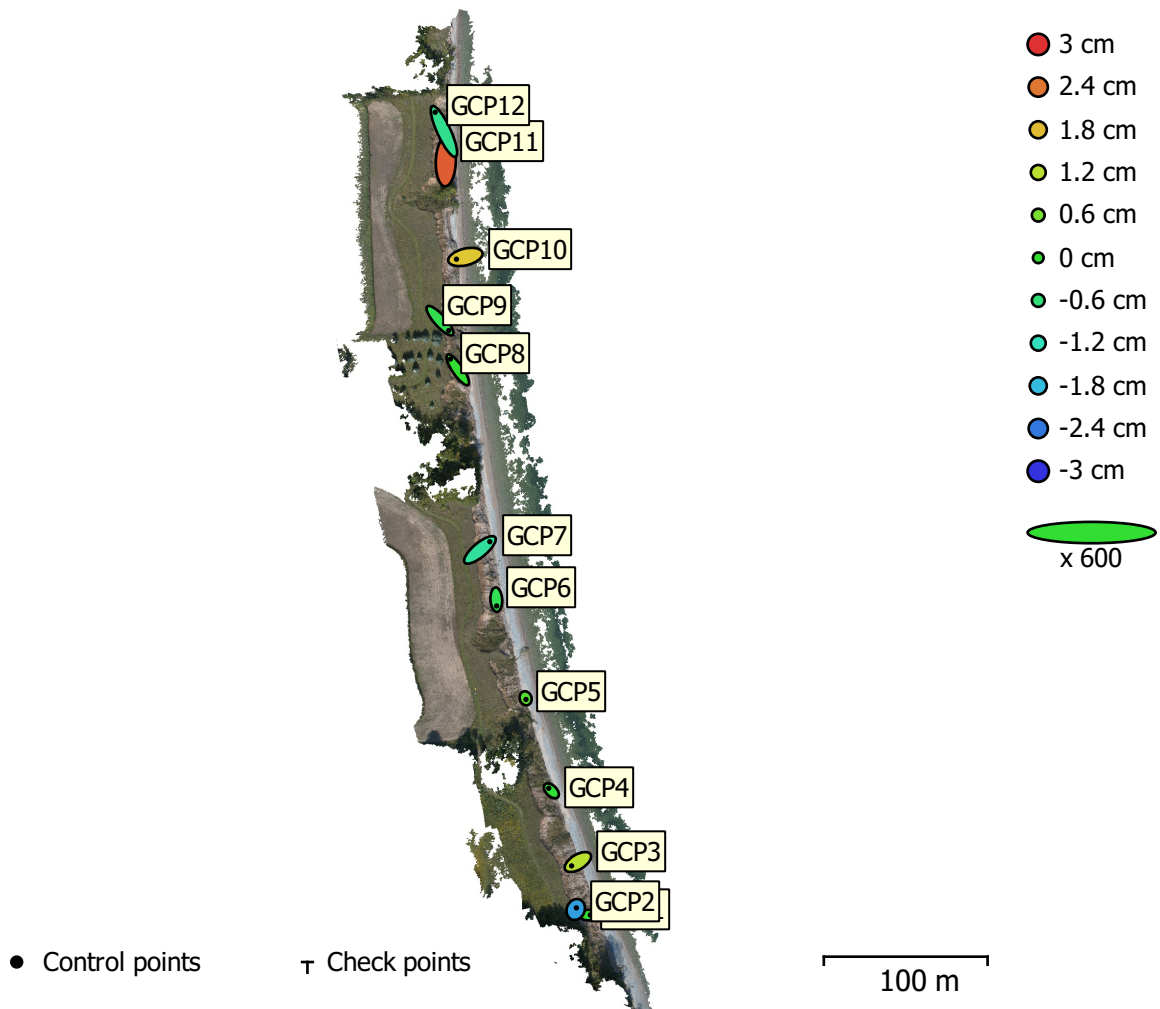


Fig. 4. GCP locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated GCP locations are marked with a dot or crossing.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
12	1.23536	1.80143	1.19634	2.18432	2.49048

Table 4. Control points RMSE.

X - Longitude, Y - Latitude, Z - Altitude.

<b>Label</b>	<b>X error (cm)</b>	<b>Y error (cm)</b>	<b>Z error (cm)</b>	<b>Total (cm)</b>	<b>Image (pix)</b>
GCP1	0.495421	0.0212146	-0.00777534	0.495936	0.218 (50)
GCP2	0.137307	0.328966	-2.05349	2.0842	0.204 (47)
GCP3	-1.28436	-0.784308	1.1778	1.911	0.231 (51)
GCP4	-0.538534	0.523194	-0.0411976	0.751963	0.253 (44)
GCP5	0.0816882	-0.237977	0.333591	0.417838	0.275 (57)
GCP6	0.0737435	-1.29028	-0.30976	1.32899	0.357 (41)
GCP7	2.00441	1.67396	-0.925951	2.77077	0.244 (47)
GCP8	-1.50374	2.18655	0.00765083	2.65373	0.279 (36)
GCP9	1.80385	-2.00722	-0.252151	2.71042	0.310 (39)
GCP10	-1.82123	-0.448815	1.70208	2.53286	0.259 (52)
GCP11	0.0981562	3.03335	2.62942	4.01556	0.340 (44)
GCP12	-1.79946	3.89975	-0.793548	4.36759	0.205 (33)
<b>Total</b>	<b>1.23536</b>	<b>1.80143</b>	<b>1.19634</b>	<b>2.49048</b>	<b>0.267</b>

Table 5. Control points.  
X - Longitude, Y - Latitude, Z - Altitude.

# Digital Elevation Model

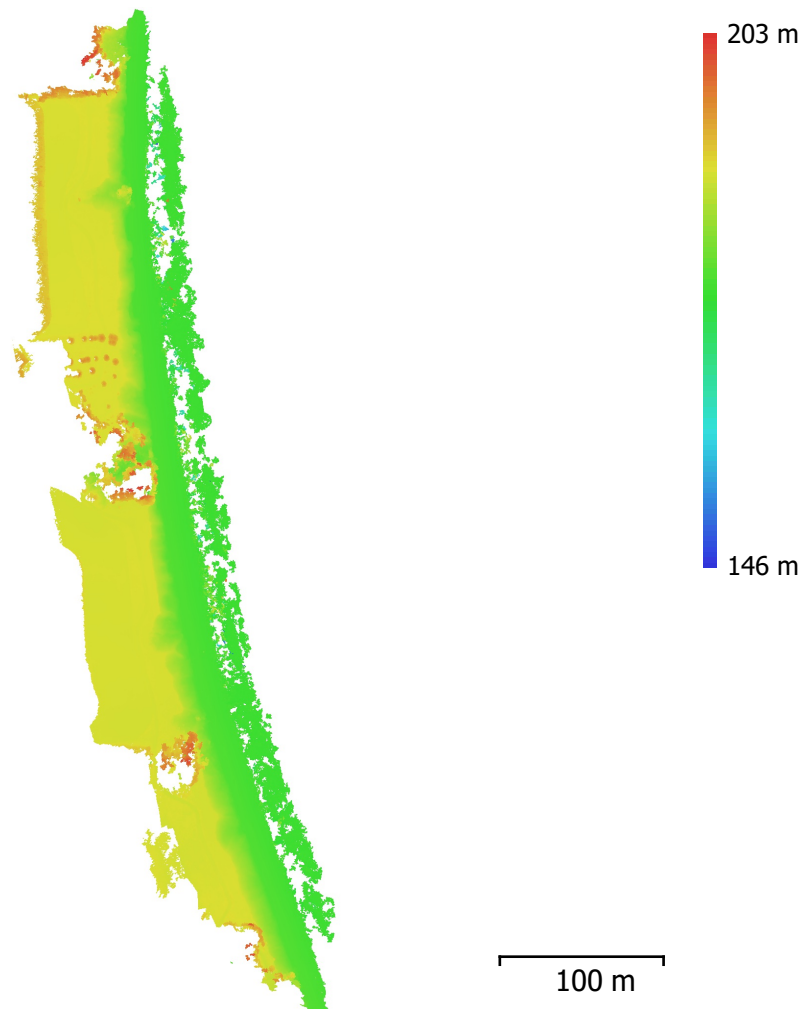


Fig. 5. Reconstructed digital elevation model.

Resolution: unknown

Point density: unknown

# Processing Parameters

## General

Cameras	418
Aligned cameras	417
Markers	12
Coordinate system	WGS 84 (EPSG::4326)
Rotation angles	Yaw, Pitch, Roll

## Point Cloud

Points	605,111 of 674,097
RMS reprojection error	0.120965 (0.594219 pix)
Max reprojection error	0.863612 (26.9587 pix)
Mean key point size	3.66593 pix
Point colors	3 bands, uint16
Key points	No
Average tie point multiplicity	4.50082

## Alignment parameters

Accuracy	High
Generic preselection	Yes
Reference preselection	Yes
Key point limit	40,000
Tie point limit	10,000
Adaptive camera model fitting	No
Matching time	35 minutes 31 seconds
Alignment time	6 minutes 40 seconds

## Optimization parameters

Parameters	f, b1, b2, cx, cy, k1-k4, p1-p4
Adaptive camera model fitting	No
Optimization time	16 seconds

## Depth Maps

Count	417
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## Reconstruction parameters

Quality	High
Filtering mode	Aggressive
Processing time	9 hours 53 minutes

## Dense Point Cloud

Points	116,483,586
Point colors	3 bands, uint16

## Reconstruction parameters

Quality	High
Depth filtering	Aggressive
Depth maps generation time	9 hours 53 minutes
Dense cloud generation time	6 hours 56 minutes

## Software

Version	1.4.3 build 6529
Platform	Windows 64