Session GI1.3

COMBINED AERIAL AND GROUND-BASED SFM MODELING FOR A VERTICAL ROCK WALL FACE TO ESTIMATE VOLUME OF FAILURE

Helge C. Smebye, Sean E. Salazar, Asgeir O.K. Lysdahl
Norwegian Geotechnical Institute, Oslo

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Rock wall failure on E18 highway between Oslo and Kristiansand

Following Dec. 13, 2019 failure

Cleanup and securing operation closed two lanes of traffic for many weeks

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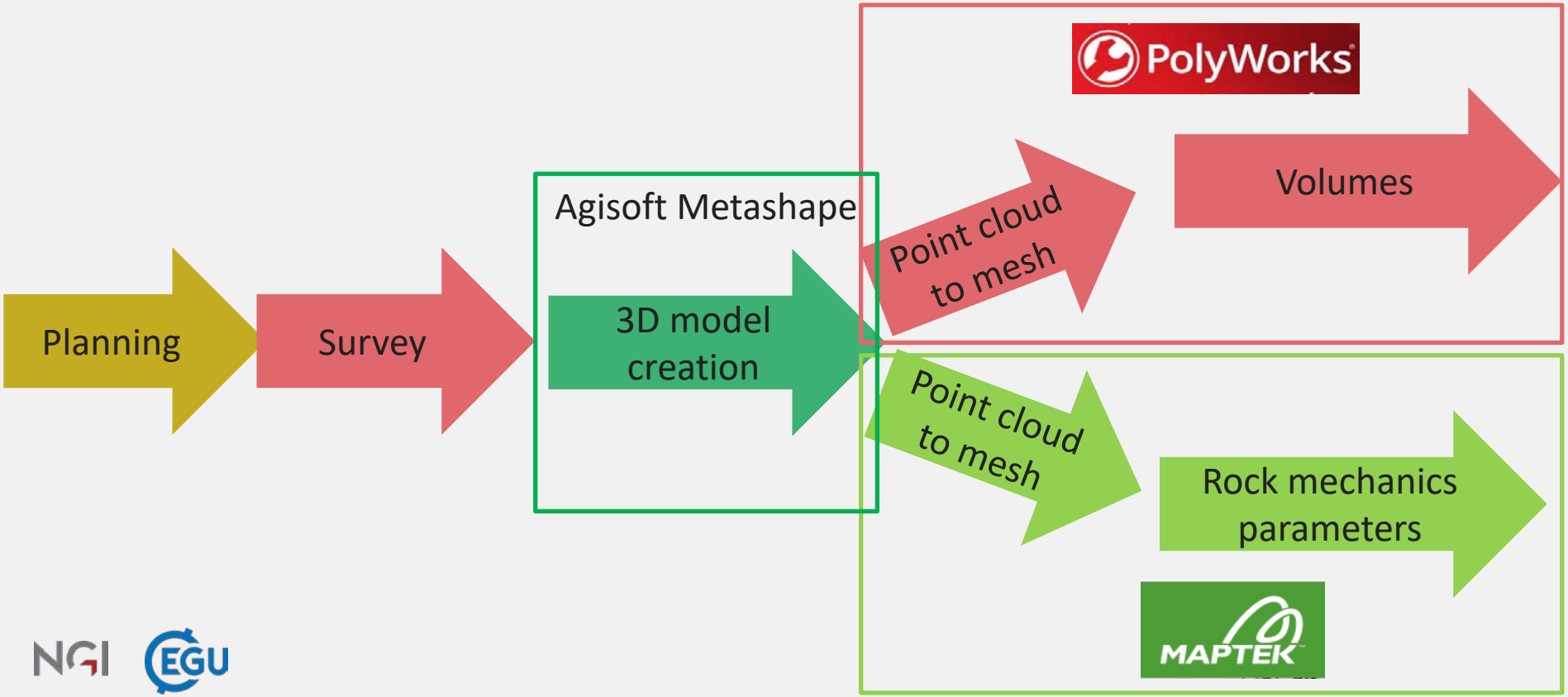
NGI contribution to post-failure needs

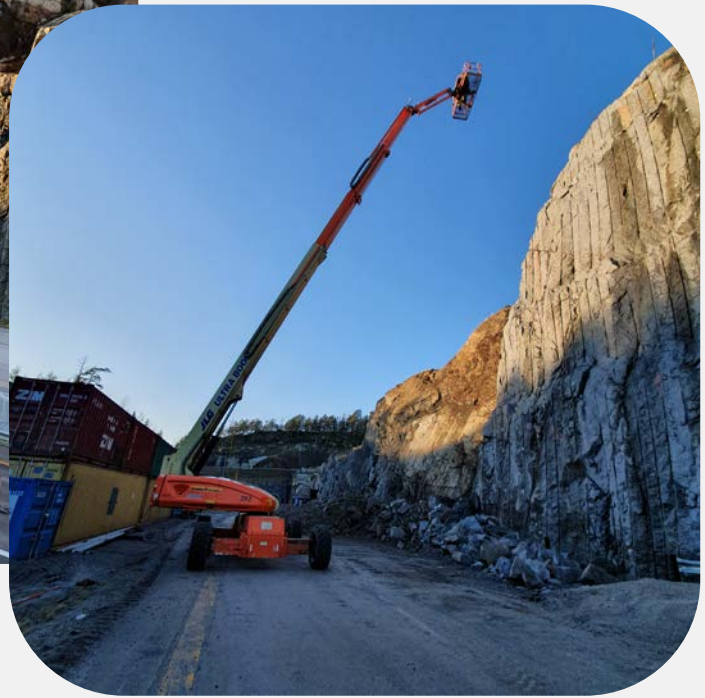
Terje Bendiksby / NTB scanpix

- NGI part of expert group established to determine cause and suggest mitigation measures
- Needed a 3D model with colors
- Identify structures in the model
- Calculate rock volumes
- Find strike and dip, waviness and other parameters for stability calculation
- 3D model before and after failure
- Combination of DSLR images and RPAS images due to traffic on road

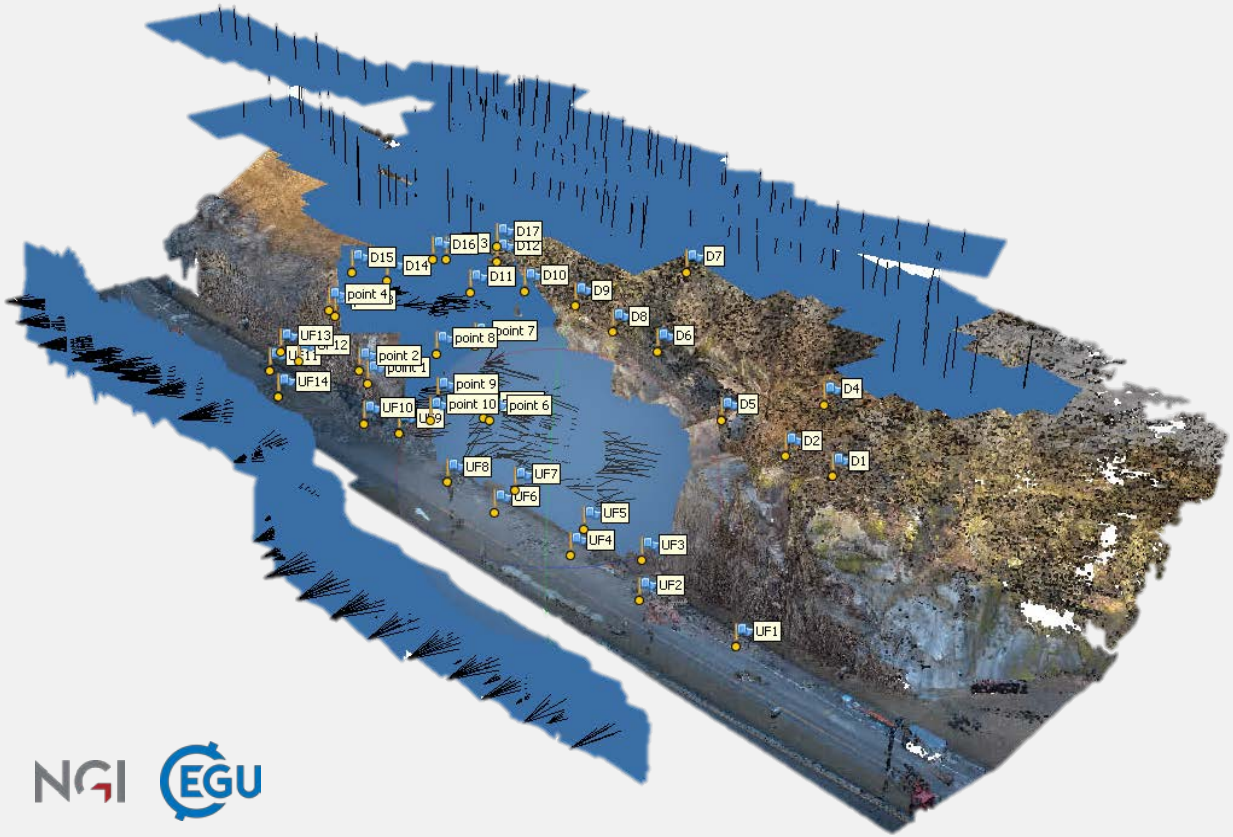
From survey to product



Data collection (Jan. 2020)



Photogrammetric products



- Model using images from RPAS and GNSS-enabled DSLR from ground and lift, adjusted using all control points
- Meshing in Maptek Pointstudio created meshes with holes
- Exluded «lift photos» from model

Accuracy assessment within software

Indirectly georeferenced using ground control points

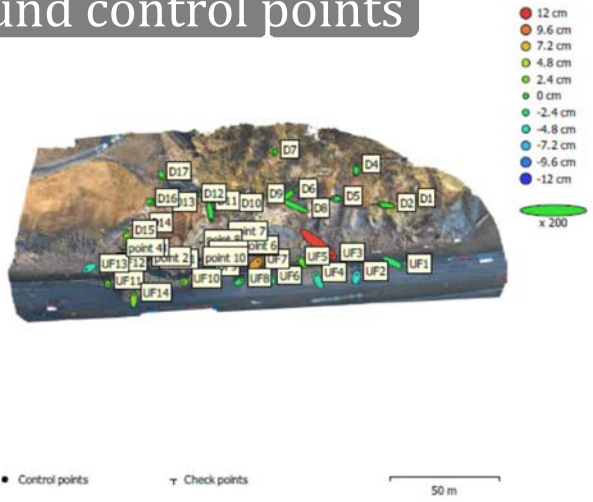
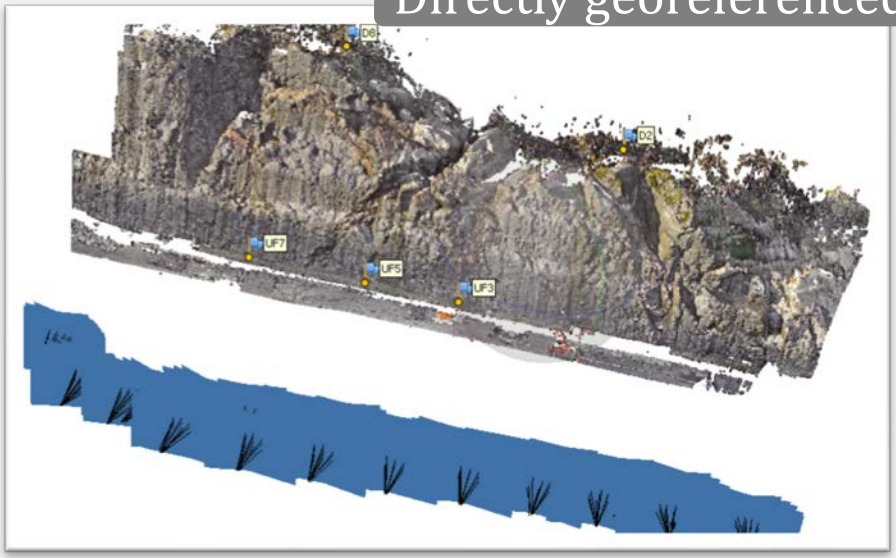


Fig. 6. GCP locations and error estimates.
Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
Estimated GCP locations are marked with a dot or crossing.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
30	2.25003	1.81795	3.41385	2.89268	4.47459

Table 3. Control points RMSE.
X - Easting, Y - Northing, Z - Altitude.

Directly georeferenced



Markers	East err (m)	North err (m)	Alt. err (m)	Accuracy (m)	Error (m)
D2	-0.031301	0.373859	0.393822	0.005000	0.543917
D8	-0.214544	0.133164	0.471260	0.005000	0.534647
UF3	-0.042946	0.207126	0.334552	0.005000	0.395816
UF5	-0.154715	0.229877	0.226325	0.005000	0.357775
UF7	-0.197362	0.150106	0.264179	0.005000	0.362317
Total Error					
Control points					
Check points	0.149493	0.234853	0.349319		0.446686

Post-failure reconstruction
(Jan. 2020)

Pre-failure reconstruction
(historical imagery)

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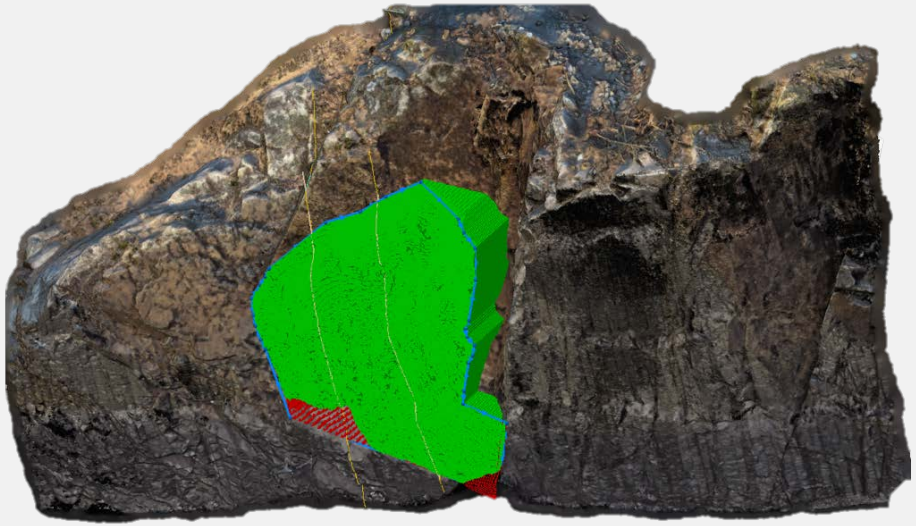
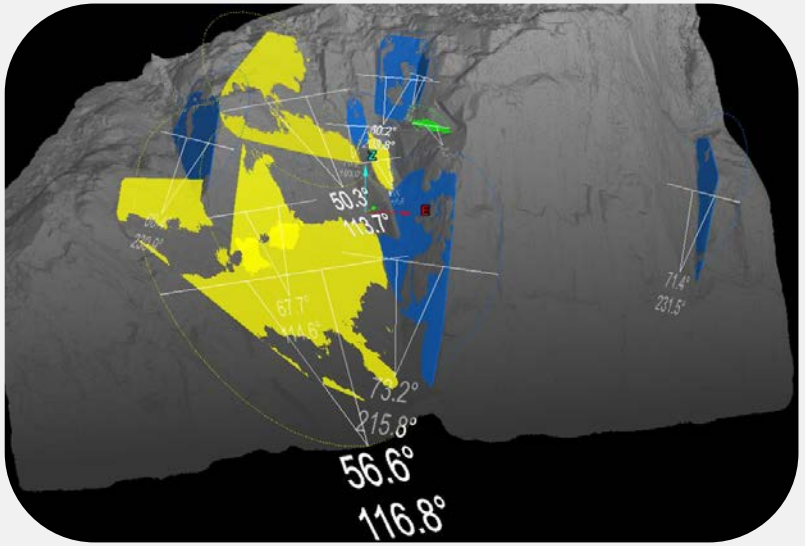
Deriving parameters for stability calculation

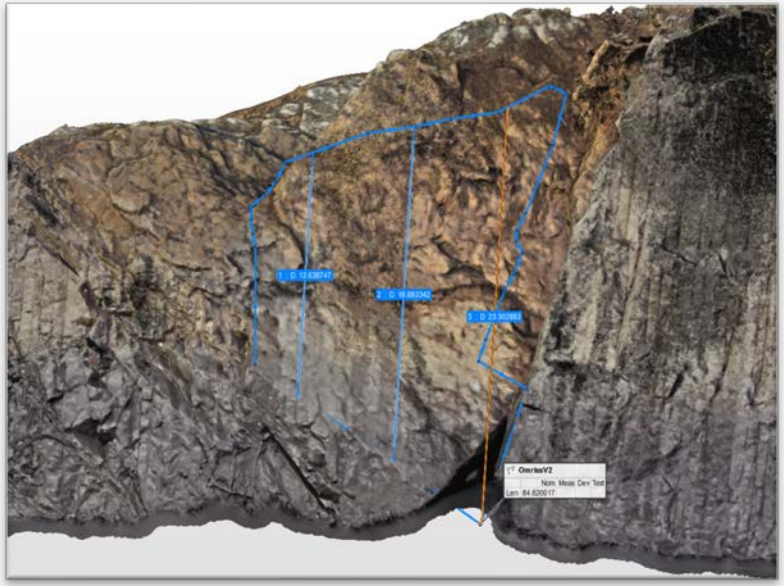
Failure volume estimate





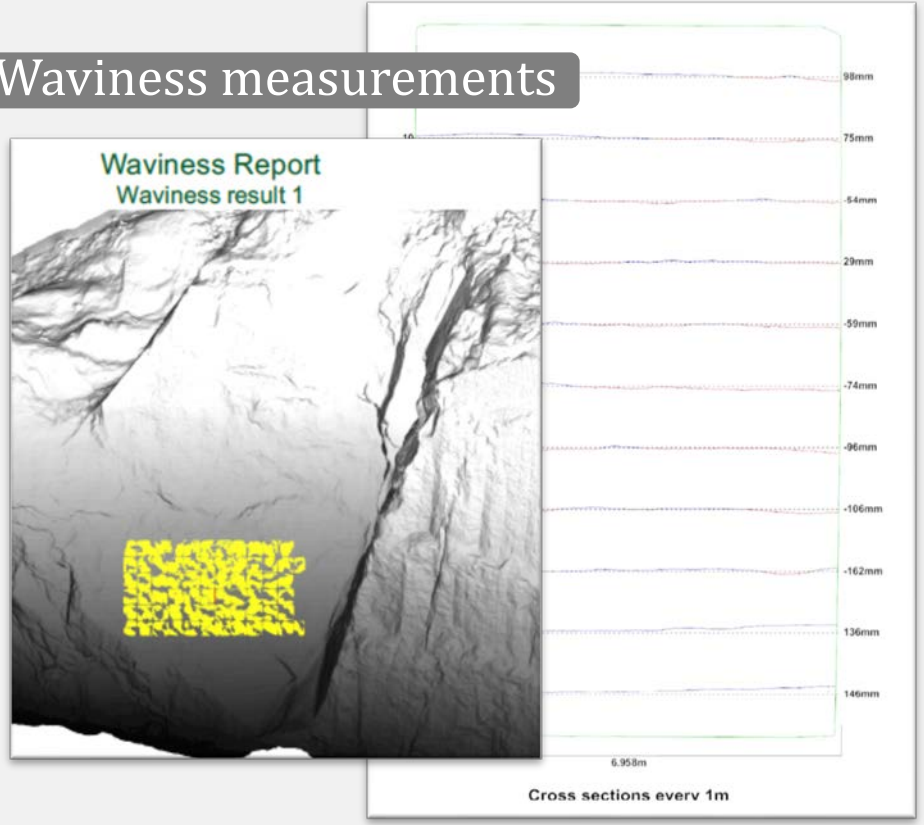
Strike and dip measurements

More parameters for stability calculation



Height measurements

Waviness measurements



Conclusions

- Compared directly georeferenced vs. indirectly georeferenced SfM-MVS processing strategies
- Reconstructed 3D models of pre- and post-failure condition of rock wall
- Derived stability calculation parameters during post-processing

#onsafeground

#påsikkergrunn

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