



Beyond The Blast

How 3D Data Capture is Reshaping Tunnel Construction

Outline

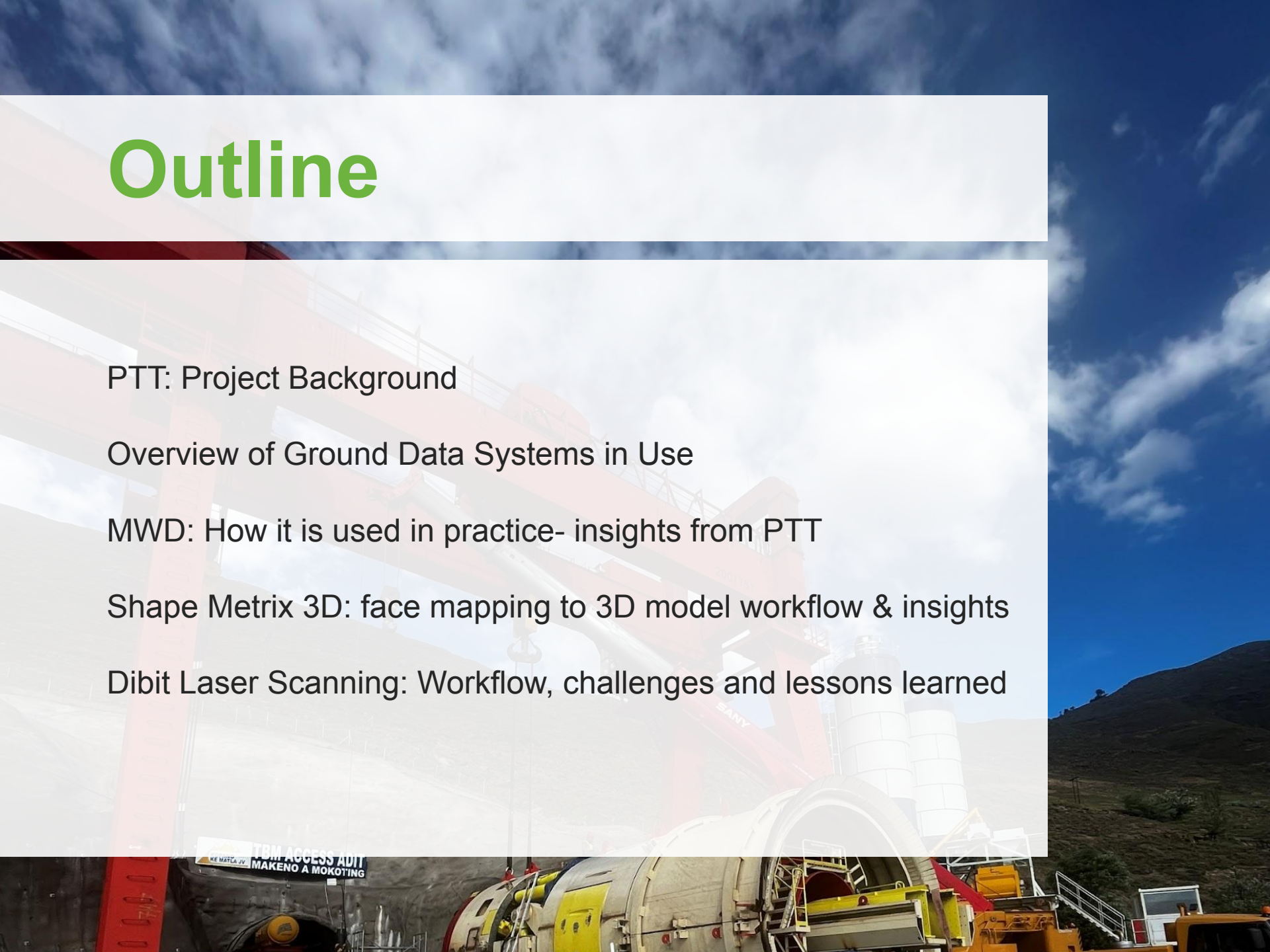
PTT: Project Background

Overview of Ground Data Systems in Use

MWD: How it is used in practice- insights from PTT

Shape Metrix 3D: face mapping to 3D model workflow & insights

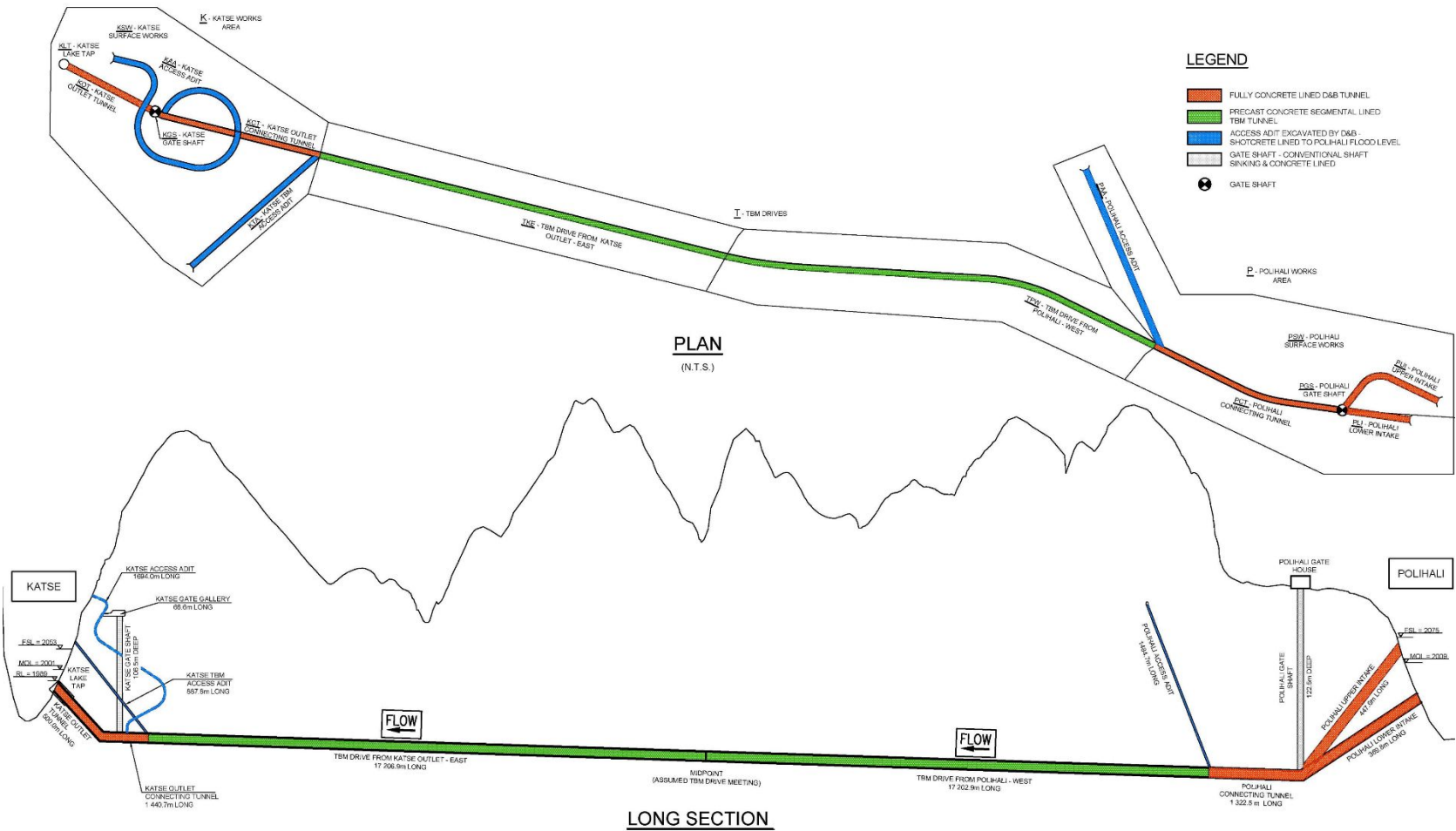
Dibit Laser Scanning: Workflow, challenges and lessons learned



Project Background



Tunnel Site Layout



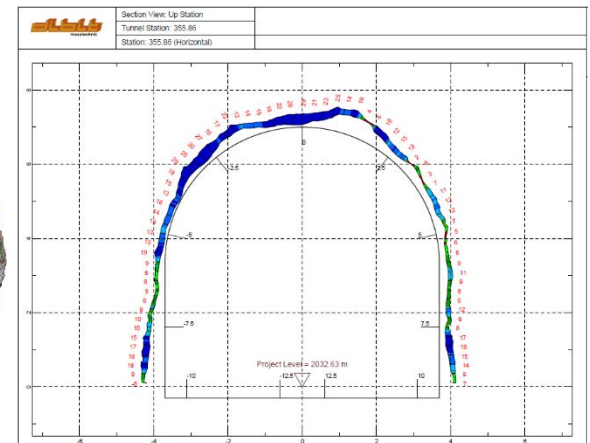
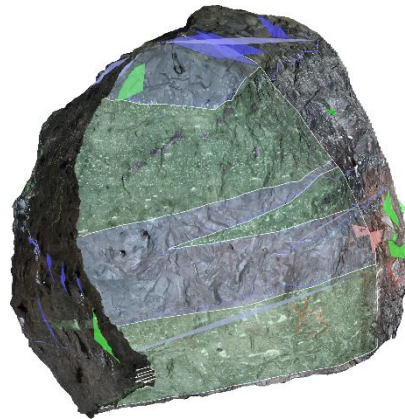
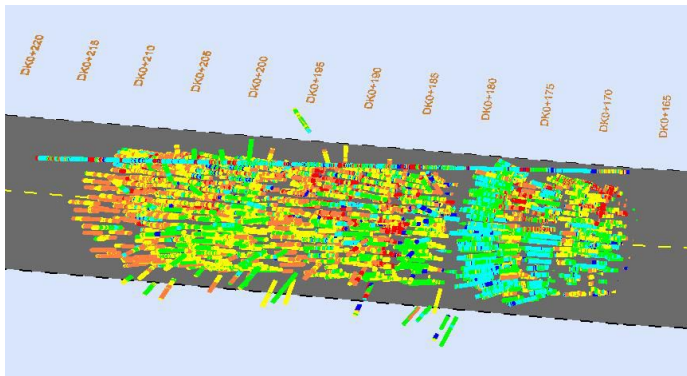
3D Data Systems Used



Digital Ground Data Systems In Use

3D ground data systems in use on the project:

- Measurement While Drilling (MWD) - guided drilling and drill response logging using the drill jumbo's in-built guidance and control systems (manufactured by CRCHI)
- Photogrammetric geological face mapping - using Shape Metrix 3D
- Surface laser scanning for blast profile and shotcrete thickness verification – using Dibat
- 3D deformation and displacement monitoring – using EUPALINOS
- Cloud-based tunnelling data management - using TUNNEL:SUITE



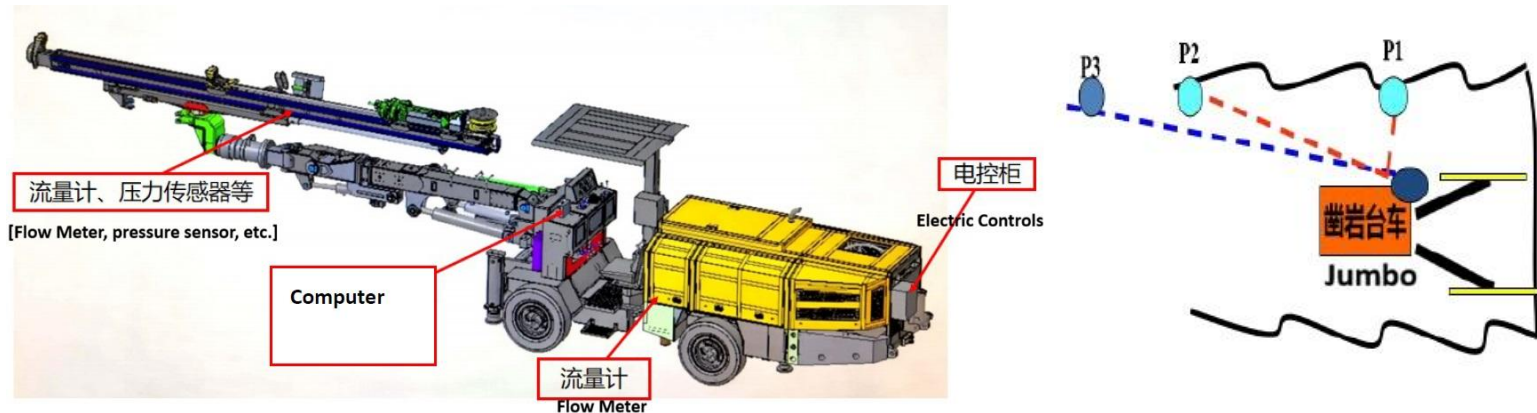
Measurement While Drilling



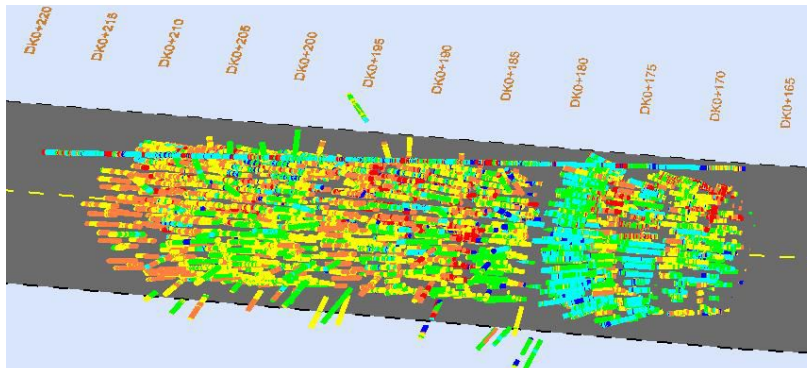
Measuring While Drilling (MWD)

Components:

- 1. In-built computerized drilling guidance and positioning system.



- 2. Drill-response logging and 3D geological Modelling system



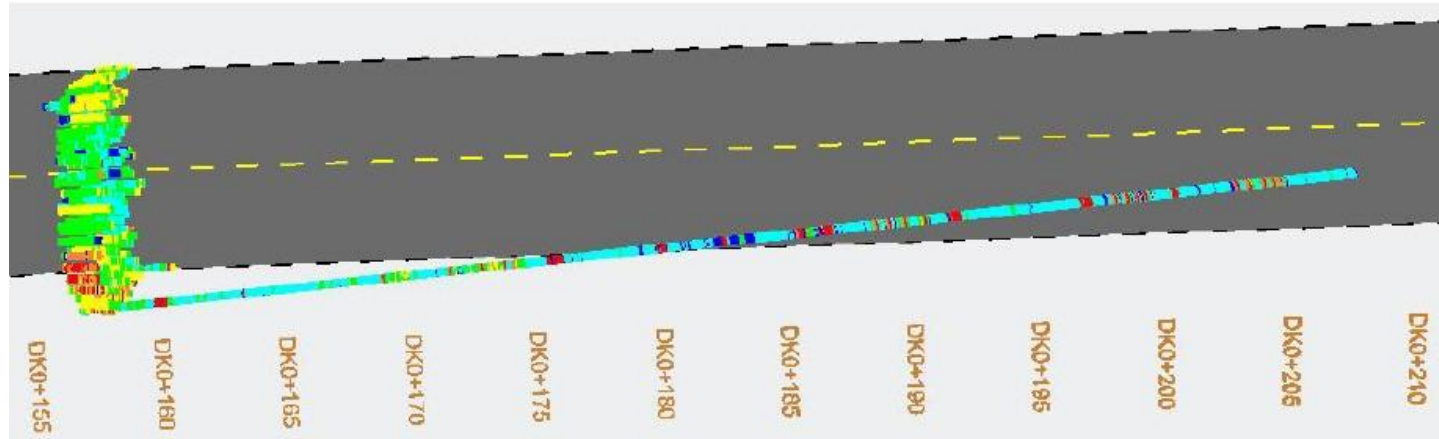
机编号\Rig number: B-276118-1-6

明\Explain

孔号 Hole number	孔类型 Hole type	孔深 Hole depth (m)	钻孔 时间\Time	外偏角 Lookout angle (°)	偏距 Offset (m)	平均推 进速度 Average penetration speed	平均冲 击压力 Average impact pressure	平均推 进压力 Average propulsion pressure
1	轮廓孔	3.767	00:01:36	0.152	0.01	2.778	144.921	78.971
2	轮廓孔	3.323	00:01:16	0.672	0.039	3.164	156.706	80.84

Measuring While Drilling (MWD)

Drill Data and Geological Model



- While drilling, the system continuously records the drilling response for each hole.
- Recorded parameters: hole length, penetration speed, impact pressure, feed pressure, rotation pressure, water pressure and water flow
- Specialists process the data to generate 3D models of interpreted rock hardness and rock fracturing over the drilled area-

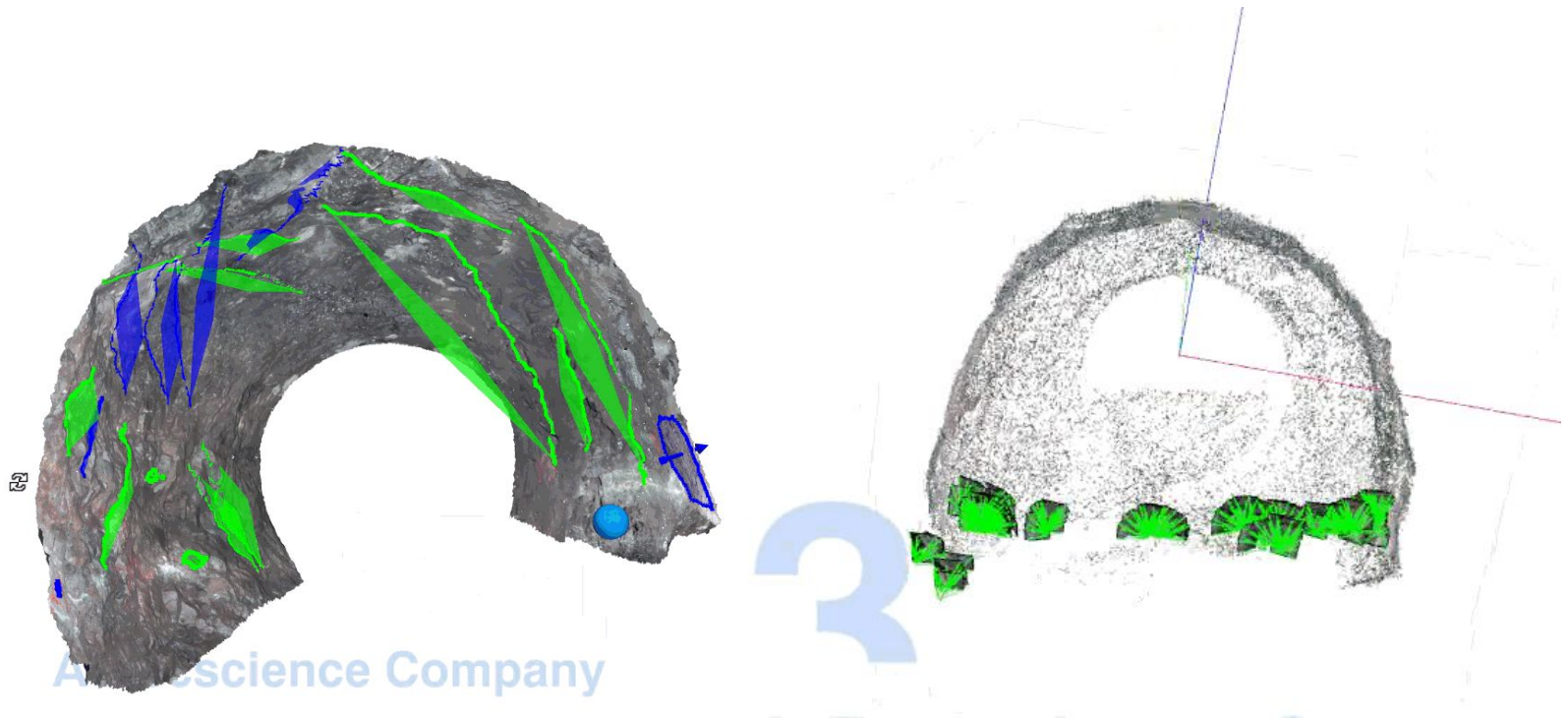
ShapeMetriX 3D



ShapeMetriX 3D

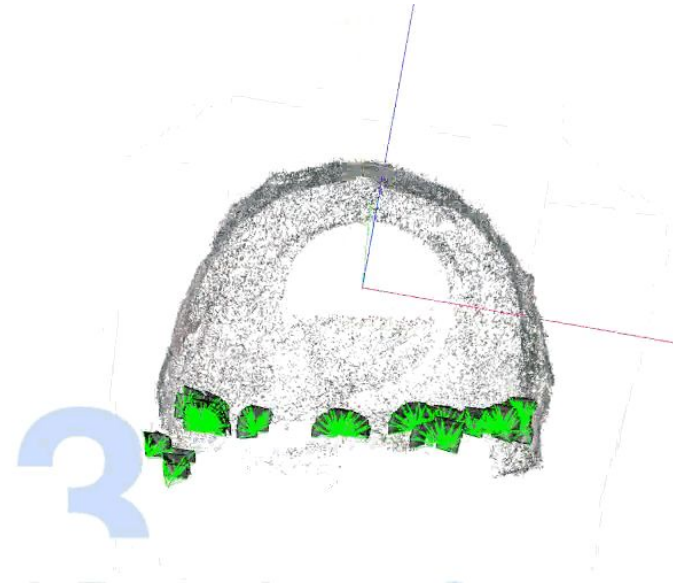
Photogrammetric Face Mapping

- Uses high quality photos of the rock face to generate 3D geological models



ShapeMetriX 3D

Geological Mapping Workflow



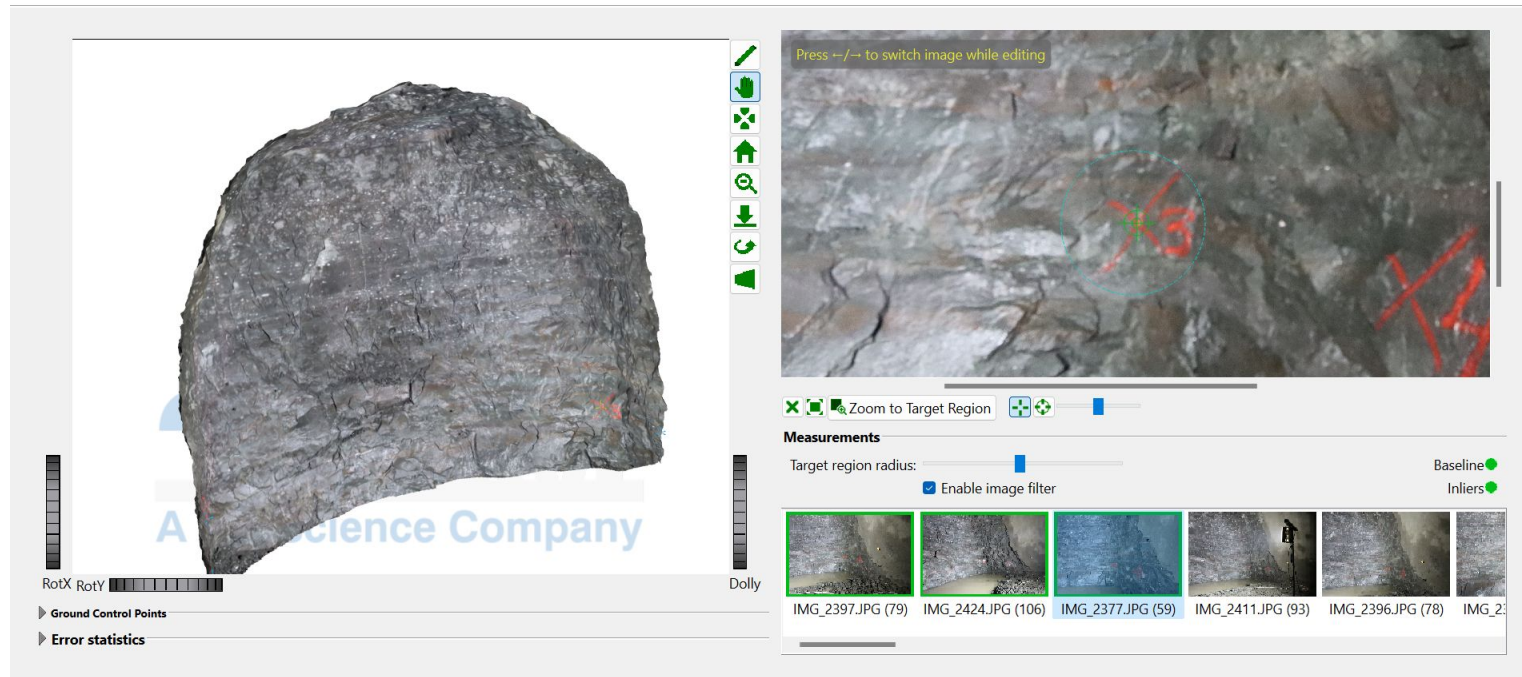
ShapeMetriX 3D

Geological Mapping Workflow



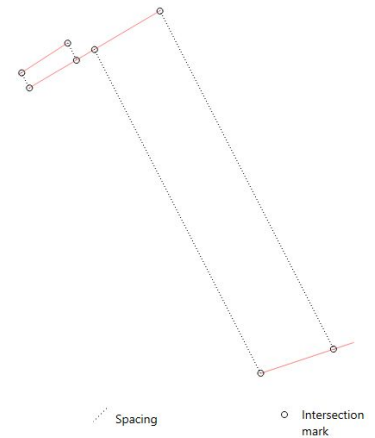
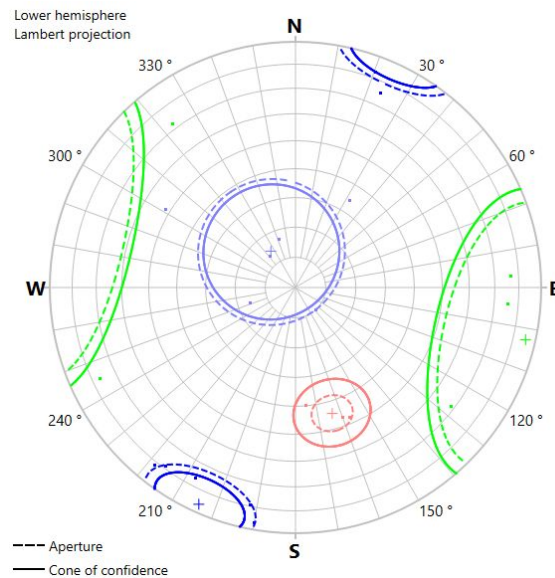
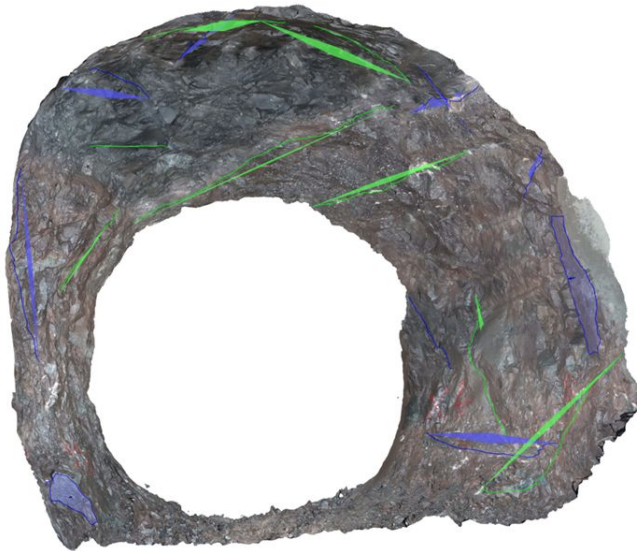
Referencing

Reference the 3D model using Ground Control Points and corresponding image locations



ShapeMetriX 3D

Geological Mapping Workflow



ShapeMetriX 3D

Geological Mapping Workflow

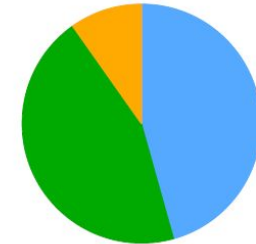
JMX Analyst Report

Project name: Poliheli Transfer Tunnel
Map name: KST CH 0+007.12 - 0+010.60
Acquisition: Sun Mar 15 19:11:56 2026
Company: MSKC-JV
Editor: F. Phamotse
Notes: Ground Type: GT3 Behaviour Type: BT2



Lithologic Region

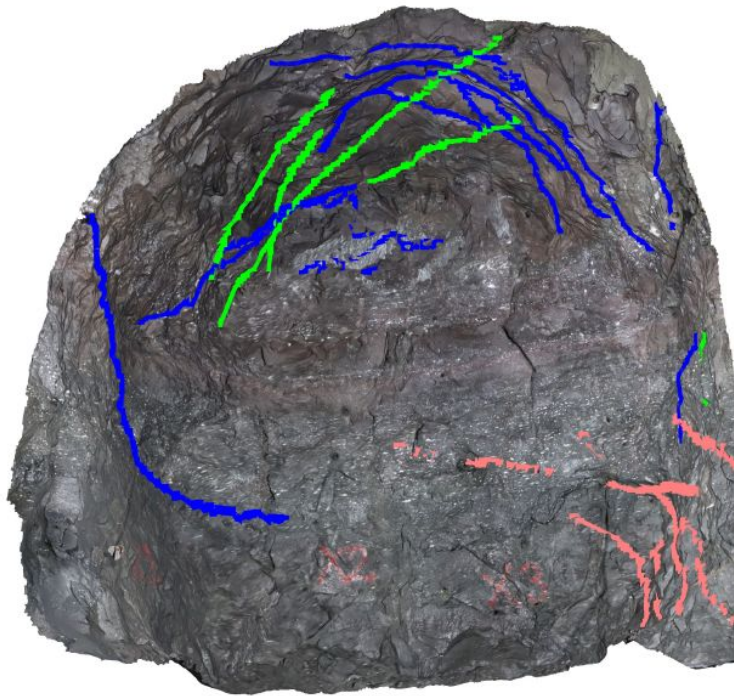
Lithologic Region
Total Area: 27.871 m²



Type
NAB (Non-Amygdaloidal Basalt)
HAB (Highly Amygdaloidal Basalt)
MAB (Moderately Amygdaloidal Basalt)

Area
12.730 m ²
12.425 m ²
2.716 m ²

Relative Area
45.68 %
44.58 %
9.74 %



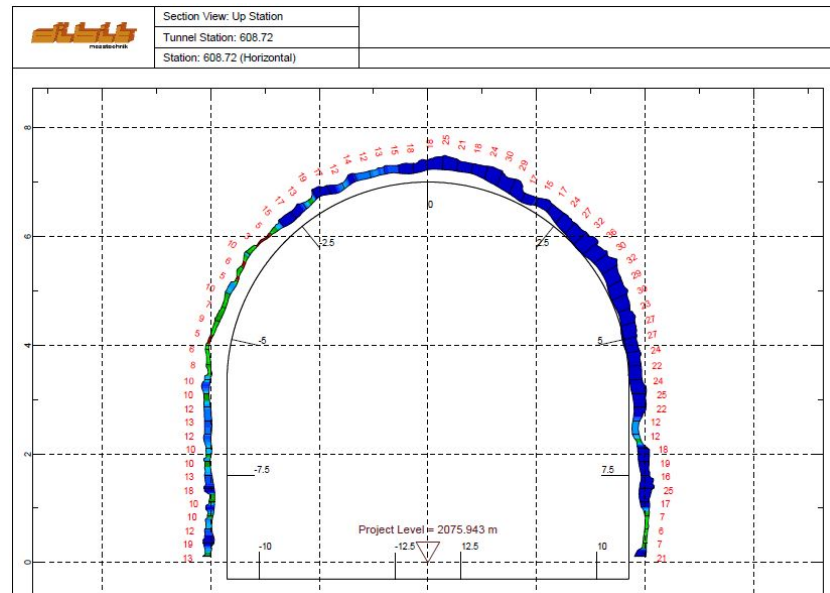
Dibit Laser Scanning



DIBIT – Laser Surface Scanning

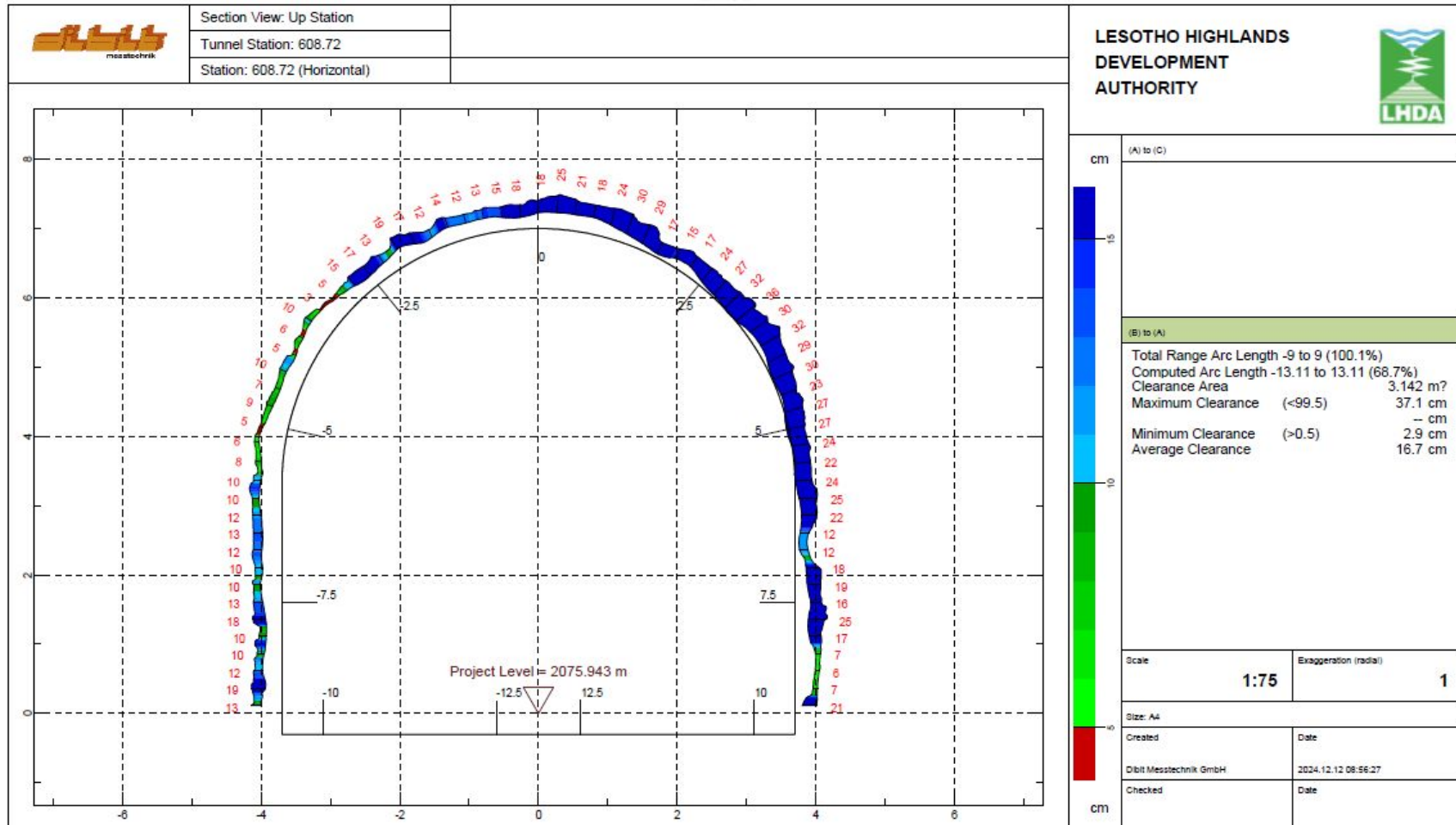
Surface Scanning and Georeferencing

- A tunnel laser-scanning system used to capture the as-built excavation and support surfaces.
- Primarily used for Shotcrete Thickness Evaluation and to Document the As-built profile



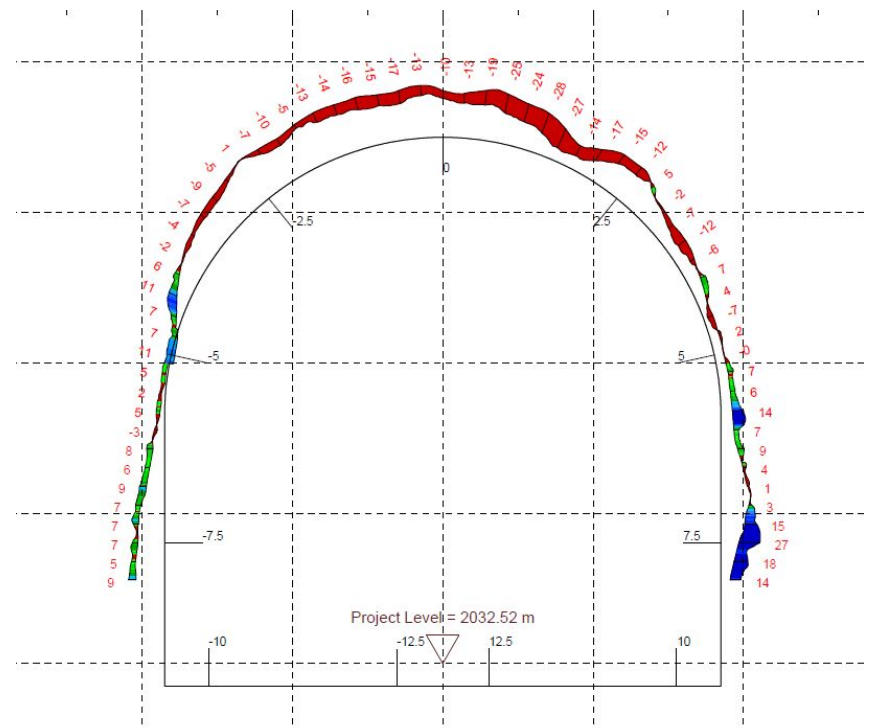
DIBIT – Laser Surface Scanning

Dibit Results-Cross Section





Technical Challenges and Lessons Learned



- Localized -ive thickness values
- Surface offset error

Dibit

Mitigation Measures





Q&A

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An aerial photograph of a large, curved concrete dam situated in a deep, arid canyon. The dam is light gray and stretches across the width of the canyon. Behind the dam, a reservoir of murky, brownish water is visible. The surrounding landscape is rugged and brown, with steep, eroded cliffs. A few small buildings and a road are visible on the right side of the dam.

THANK YOU

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