AMBERG TUNNEL - Tutorial

Profiles

Amberg Tunnel version: 2.25

In this tutorial you will learn

This tutorial will go through import of profiles and various profile analyses and explain how to compare profiles against tunnel design, or two profiles against each other. The project structure allows easy import of the profile measurement, its modification, and the generation of comprehensive profile reports. Tutorial takes approximately 20 minutes.

Demo project includes tube and shaft

For more detailed information see manual → Amberg Tunnel → Help → Profile module

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Demo data

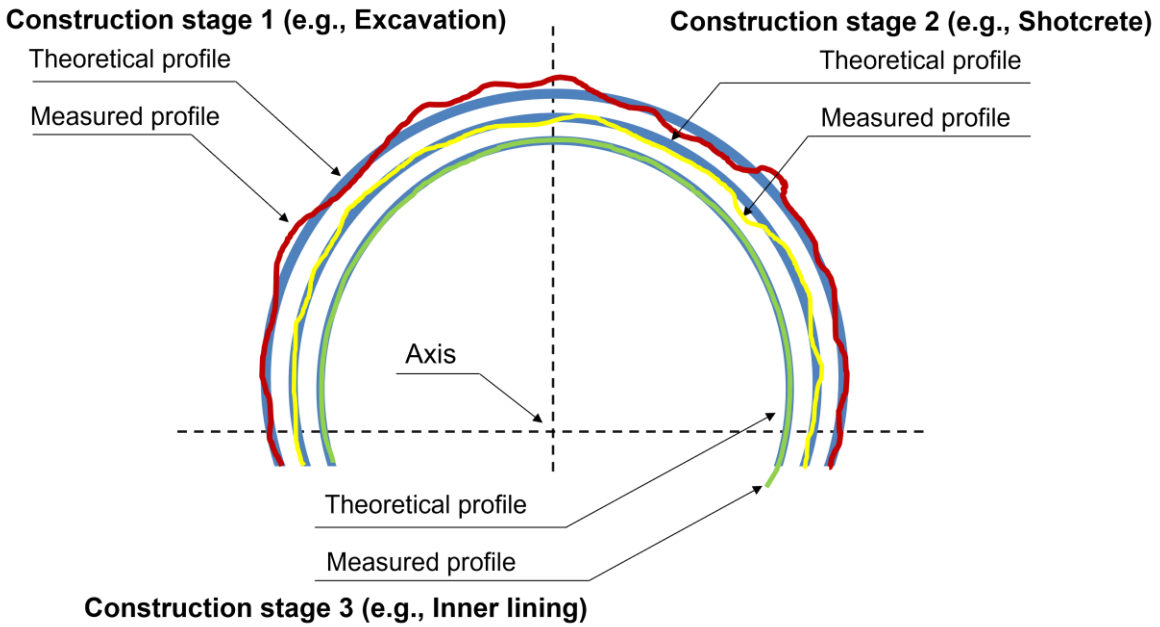
Download the demo project from our home page and unzip it:

https://ambergtechnologies.com/fileadmin/fileadmin/user_upload/amberg-technologies/downloads/AmbergTunnel2/Tutorials/Tutorial_Profile.zip

The folder contains a project used for this tutorial, import data and the project with imported data and all the analysis.

Project Overview

The project contains one site with a fully created design of the Tube and Vertical Shaft. Tube heading includes design of a several construction stages. Each tube has an axes definition and each construction stage has theoretical profiles and sections defined. In these two headings, all possible profile analyses are created.



Download & Install

Please download the software from the following link. You will be just asked for contact information, so we can reach out to you later if you have any further questions.
https://ambergtechnologies.com/private-area/amberg-tunnel/software-manuals

Demo license

You can contact support.tunnel@amberg.ch to get a 1-week demo license.

How to analyse Profile measurements in Amberg Tunnel

1) Step: Import of the profiles

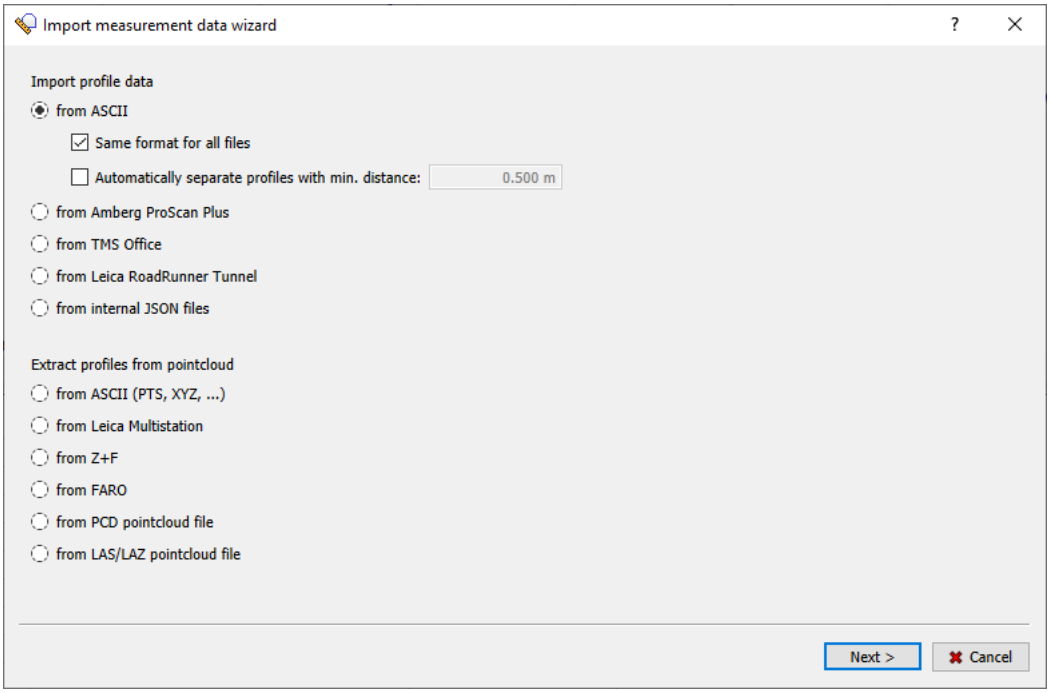
There are several options to import profiles to the Amberg Tunnel project. Importing (and saving) profiles to the construction stage automatically updates all related profile analyses.

A) Import profiles from TXT

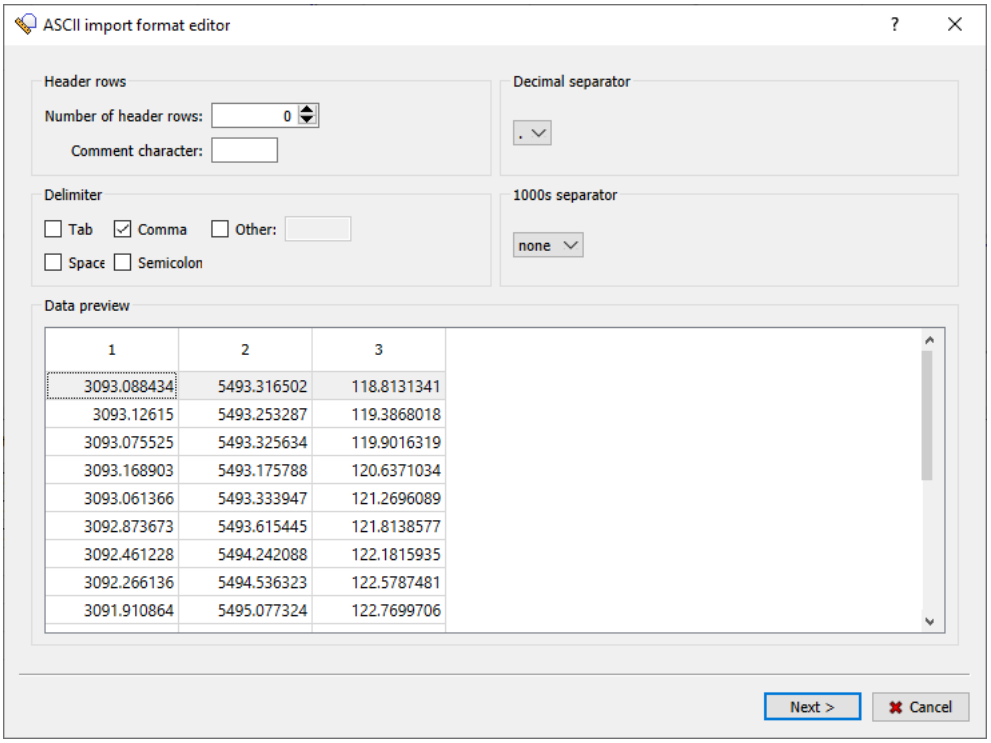
Use this option when you have absolute coordinates of individual profiles in:

- separated text files
- all profile points in one txt file (Check Automatically separate… option)

- In the **Project tree** go to **Construction → Site: Sargans West → Tube heading: Heading AT → Measurements → Final Tunnel→ Measured profiles** (doubleclick to open)
- Select **Import** from the context menu or from the toolbar on the top
- Choose **from ASCII** and select all files in *…\1. Profile Measurements\Final tunnel****.csv**



- In the dialogue screen choose following
  - Number of header rows: **0**
  - Delimiter: **Comma**



- In the following screen choose data fields
  - **Easting**
  - **Northing**
  - **Height**
- On the next screen optionally fill in the information about profiles and Press **Import**
- Press **Save** button
- As soon as you save the editor, you can see examples of results in **P.3 Final Tunnel** analysis. All the profile analyses are updated in real-time.

Import from Amberg Applications (ProScan Plus) *has the same workflow as TXT import. As an import method select* ***from Amberg ProScan Plus*** *and search for the Leica DBX job file where you stored your measurement. Measured profiles are automatically loaded from the job.*

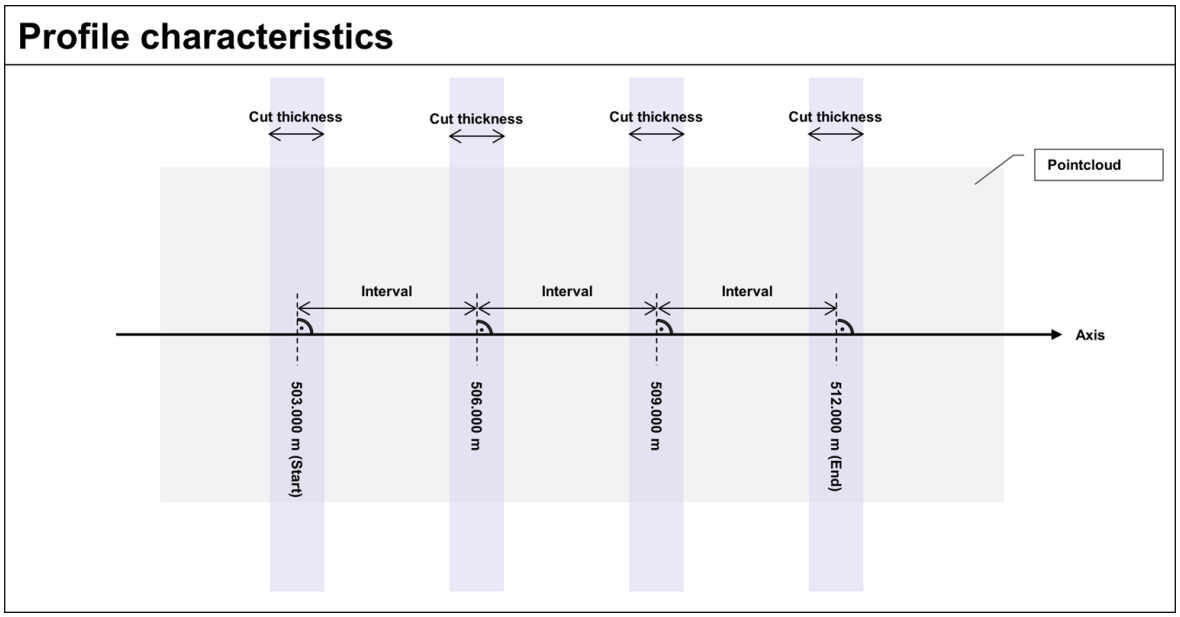
Import from Amberg Navigator *is the easiest of all imports. Data are already sorted into the construction stages. So, you don't have to worry about that and you can import all measured data at once. This is done by right-clicking on the top node of the project tree (Profile project) and choosing* ***Import from Amberg Navigator tablet****.*

The advantage of import from Amberg Applications or Navigator is that you can reposition your measurements later if the control points are updated.

B) Extract profiles from positioned point cloud

This option is mainly used when you have a point cloud but you are not interested in scanning reports and you only need profile reports.

- In the **Project tree** go to **Construction** → **Site: Sargans West** → **Shaft heading: Shaft AT** → **Measurements** → **Shaft Shotcrete** → **Measured profiles** (doubleclick to open)
- Select Import from the context menu or from the toolbar on the top
- Under **Extract profiles from point cloud** choose **From LAS**
- Search for the import file *…\2. Scans\Shaft**Shaft.las***
- Define input parameters as follows:
  - Start HS: **40 m**
  - End HS: **53 m**
  - Interval: **1 m**
  - Profile cut thickness: **0.05 m**
  - Fixed number of points: **100** (Optional)



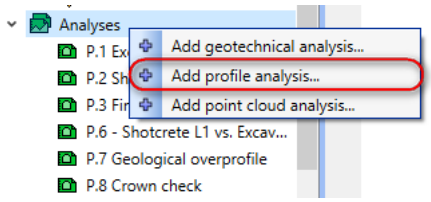
- Import and press **Save** button
- As soon as you save the editor, you can see example of results in **P.1 - As-built** analysis

2) Step: Profile analysis

Once you bring your measurements to Amberg Tunnel project you are ready to create/open the individual analysis

Creation of analysis

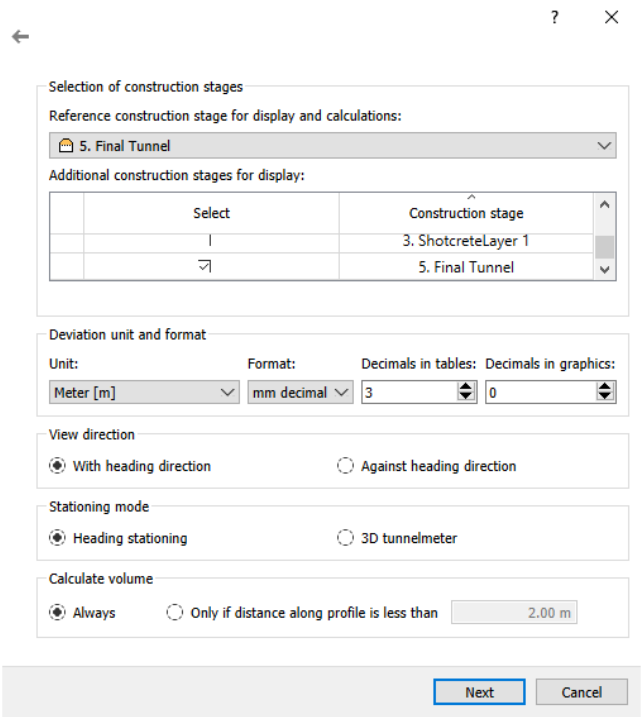
- In the **Project tree** go to **Construction → Site: Sargans West → Tube heading: Heading AT → Analyses**
- Right-click on the **Analyses** node and select **Add profile analysis...**



- Analysis type: Measured vs. design
- Analysis name: Type name of your choice (Analyses are sorted alphabetically)

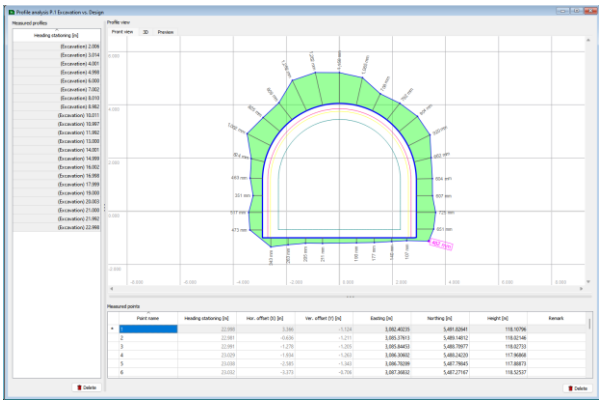
Follows a wizard that will guide you in the process of creating the analysis. All the parameters can be changed later in the analysis settings.

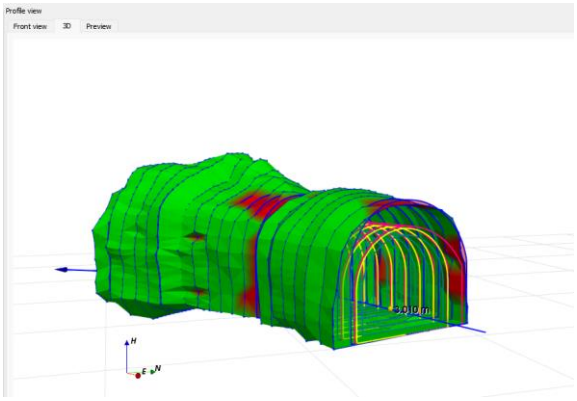
- Select the construction stage **Final Tunnel** where we imported measured profiles. Click **Next**.



- We will not set any filter at this moment. Click **Finish**.

- On the top browse the tabs **Front view, 3D, Preview** to see all the views
  - Use **CTRL** or **Shift** to select multiple profiles and see all selected profiles in the 3D view





- Export **Graphic report**
- Open **Settings** and explore **Filters**, **Geometrical data filters** and **Measurements** options.

- Explore other types of the analysis that were already created in the project Below is list of all the types and where to find them in the project.

Types of profile analysis

A) Measured vs Design

This analysis serves the purpose of comparing measured profiles against the tunnel design of individual construction stages.

It is used as an as-built documentation, calculation of volumes of excavated material, control of under/over break.

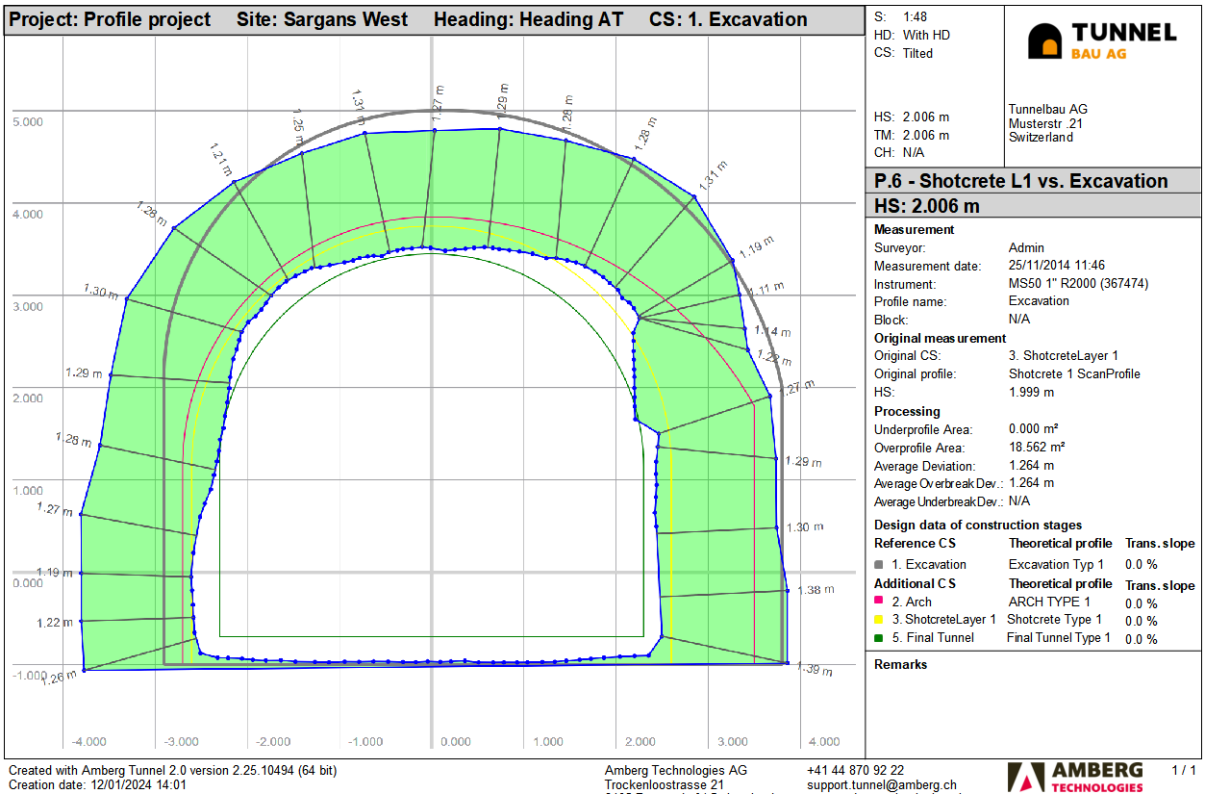
See analysis in
Tube heading → *P.1 Excavation vs. Design* or *P.2 Shotcrete Layer 1 vs Design*
Shaft heading → *P.1 - As-built analysis*

B) Measured vs Measured

The purpose of this analysis is to compare two measured profiles from different construction stages. For example, to derive the thickness of the shotcrete layer you need to compare Excavation vs Shotcrete.

It is used to document the layer thickness and volume of used material.

See analysis in
Tube heading → *P.6 - Shotcrete L1 vs. Excavation*

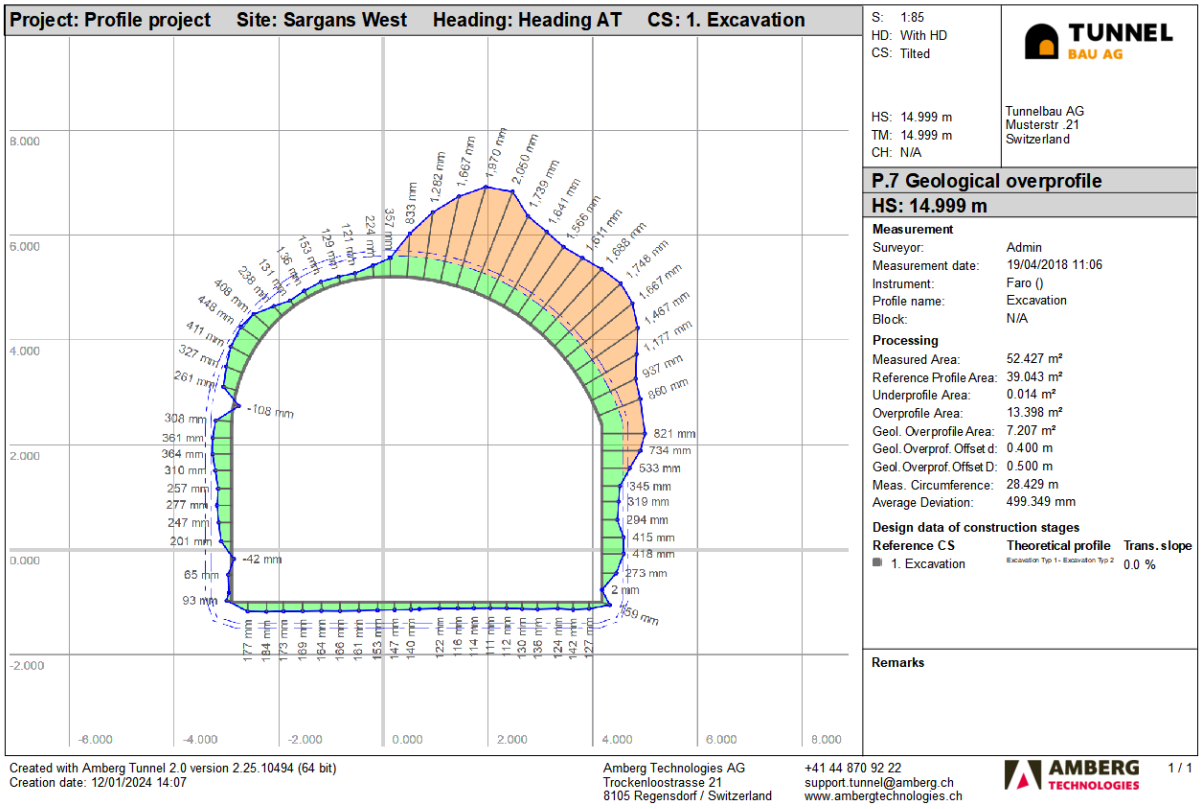


C) Geological over profile

This analysis is based on measured vs design analysis with additional settings to visualise and calculate areas that are beyond the excavation limit.

It is used when tunnelling contract states who is responsible/paying for which type of overbreak. Geological over-profile areas can be computed for drill & blast or TBM headings according to the Swiss norm SIA198.

See analysis in
Tube heading → *P.7 Geological over profile*

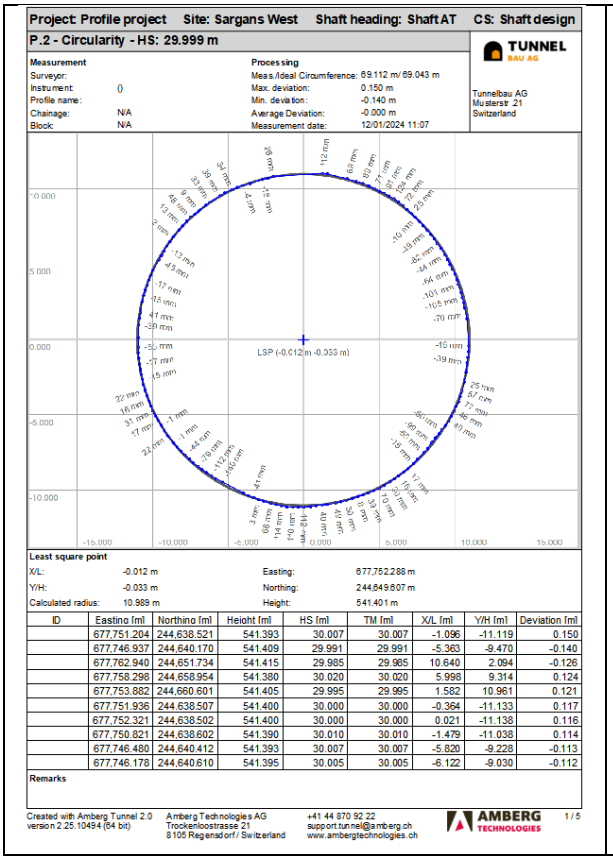


D) Circularity

Special analysis, which is independent of the construction stage and works only on the circular tunnel shapes. This analysis will calculate the best-fitting circle from the measured points and give you the best-fitting centre, radius, and deviation of the measured points. It can be also used in the Drill&Blast tunnels for validating arcs' radius.

See analysis in

Shaft heading → P.2 - Circularity
Tube heading → P.8 Crown check



Project: Profile project Site: Sargans West Shaft heading: Shaft AT CS: Shaft design

P.2 - Circularity - HS: 29.999 m

TUNNEL BAU AG

Tunnelbau AG
Musterstr. 21
Switzerland

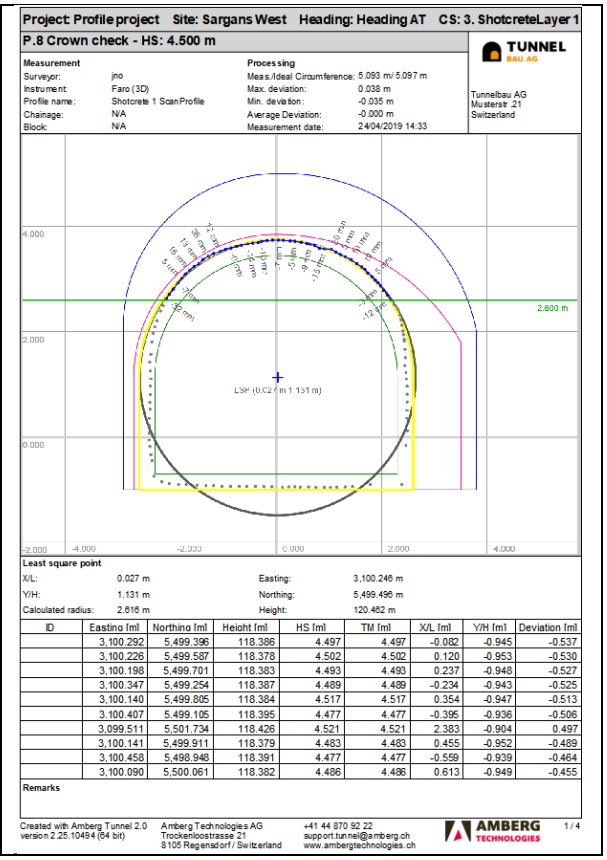
Measurement		Processing	
Surveyor:		Meas./ideal Circumference:	69.112 m/ 69.043 m
Instrument:	0	Max. deviation:	0.150 m
Profile name:		Min. deviation:	-0.140 m
Chainage:	N/A	Average Deviation:	-0.000 m
Block:	N/A	Measurement date:	12/01/2024 11:07

Least square point

X/L:	-0.012 m	Easting:	677,752.288 m
Y/H:	-0.033 m	Northing:	244,649.607 m
Calculated radius:	10.989 m	Height:	541.401 m

ID	Eastina [m]	Northina [m]	Height [m]	HS [m]	TM [m]	X/L [m]	Y/H [m]	Deviation [m]
	677,751.204	244,638.521	541.393	30.007	30.007	-1.096	-11.119	0.150
	677,746.937	244,640.170	541.409	29.991	29.991	-5.363	-9.470	-0.140
	677,762.940	244,651.734	541.415	29.985	29.985	10.640	2.094	-0.126
	677,758.298	244,658.954	541.380	30.020	30.020	5.998	9.314	0.124
	677,753.882	244,660.601	541.405	29.995	29.995	1.582	10.961	0.121
	677,751.936	244,638.507	541.400	30.000	30.000	-0.364	-11.133	0.117
	677,752.321	244,638.502	541.400	30.000	30.000	0.021	-11.138	0.116
	677,750.821	244,638.602	541.390	30.010	30.010	-1.479	-11.038	0.114
	677,746.480	244,640.412	541.393	30.007	30.007	-5.820	-9.228	-0.113
	677,746.178	244,640.610	541.395	30.005	30.005	-6.122	-9.030	-0.112

Remarks



Project: Profile project Site: Sargans West Heading: Heading AT CS: 3. ShotcreteLayer 1

P.8 Crown check - HS: 4.500 m

TUNNEL BAU AG

Tunnelbau AG
Musterstr. 21
Switzerland

Measurement		Processing	
Surveyor:	jno	Meas./ideal Circumference:	5.093 m/ 5.097 m
Instrument:	Faro (3D)	Max. deviation:	0.038 m
Profile name:	Shotcrete 1 ScanProfile	Min. deviation:	-0.035 m
Chainage:	N/A	Average Deviation:	-0.000 m
Block:	N/A	Measurement date:	24/04/2019 14:33

Least square point

X/L:	0.027 m	Easting:	3,100.246 m
Y/H:	1.131 m	Northing:	5,499.496 m
Calculated radius:	2.616 m	Height:	120.462 m

ID	Eastina [m]	Northina [m]	Height [m]	HS [m]	TM [m]	X/L [m]	Y/H [m]	Deviation [m]
	3,100.292	5,499.396	118.386	4.497	4.497	-0.082	-0.945	-0.537
	3,100.226	5,499.587	118.378	4.502	4.502	0.120	-0.953	-0.530
	3,100.198	5,499.701	118.383	4.493	4.493	0.237	-0.948	-0.527
	3,100.347	5,499.254	118.387	4.489	4.489	-0.234	-0.943	-0.525
	3,100.140	5,499.805	118.384	4.517	4.517	0.354	-0.947	-0.513
	3,100.407	5,499.105	118.395	4.477	4.477	-0.395	-0.936	-0.506
	3,099.511	5,501.734	118.426	4.521	4.521	2.383	-0.904	0.497
	3,100.141	5,499.911	118.379	4.483	4.483	0.455	-0.952	-0.489
	3,100.458	5,498.948	118.391	4.477	4.477	-0.559	-0.939	-0.464
	3,100.090	5,500.061	118.382	4.486	4.486	0.613	-0.949	-0.455

Remarks