User Manual

3GSM GmbH
Plüddemanngasse 77
A-8010 Graz, Austria
Tel. +43-316-464744
office@3gsm.at
www.3gsm.at

BlastMetriX

BMX BlastSiteGenerator3D

User Manual
for Version 4.11

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CONTENTS

1 Introduction

The *BMX BlastSiteGenerator3D* is used to define the geometric borders of a *Blast Site* and enables volume calculations. The software is tightly connected to the *BMX BlastPlanner,* which is a software component for blast design. Additionally, the *BMX BlastSiteGenerator3D* allows to merge terrestrial 3D models generated from *Stereo Setups* taken by terrestrial freehand photography (*SMX ReconstructionAssistant*) with 3D models generated from imaging using a UAV system (*SMX MultiPhoto*).

This user manual addresses all topics related to the *BMX BlastSiteGenerator3D* i.e. installation, user interfaces, features and operations. Let us know if we can support you, and give us your valuable feedback. Only this way it remains possible to keep the system both, flexible enough for broad usage and sufficiently specific for your applications.

We wish you success with the *BMX BlastSiteGenerator3D.*

The Team of 3GSM

Graz, October 2024

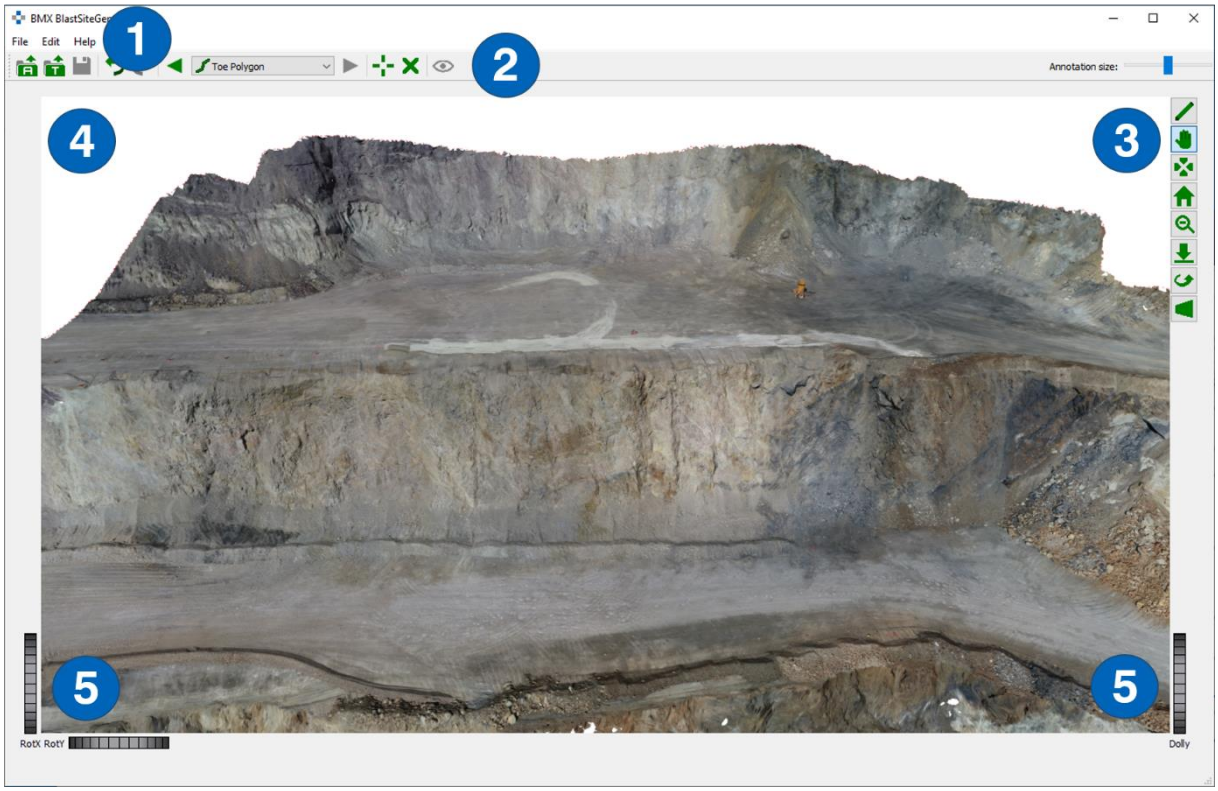
2 General

The *BMX BlastSiteGenerator3D* is part of the *BlastMetriX package* and is not available as a stand-alone program. The installation takes place during the installation of *BlastMetriX* and is described in the corresponding user manuals.

Note:
SMX software components are used under this name in *ShapeMetriX and BlastMetriX,* i.e. there are no dedicated *BMX* versions for e.g. *SMX MultiPhoto*. The same may apply to other software components.

3 User interface

The user interface of the *BMX BlastSiteGenerator3D* (Figure 1) comprises the menu bar, the toolbar, the navigation bar, the viewer and thumb wheels.



1 Menu bar
2 Toolbar
3 Navigation bar
4 3D viewer
5 Thumb wheels

Figure 1: User interface of the BMX BlastSiteGenerator3D

4 Features

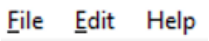
This section describes the available functions of the *BMX BlastSiteGenerator3D.*

4.1 Context menu of the 3D viewer

The context menu of the 3D viewer allows the change in the display of the 3D model. A click on the right mouse button in the viewer opens a pop up window and several options can be chosen:

Draw as is	The 3D topography is completely overlaid by the digital photograph (3D model)
Wireframe overlay	The 3D model and a red coloured overlay of the wireframe is forming the topography
Wireframe	A Triangulated red coloured point cloud is forming the topography
Points	The point cloud of the scene according to the topography is shown
All Points	All available points of the 3D model according to the photograph are shown
Show Axes	Turns the co-ordinate axes on and off
Show Bounding Box	Turns the bounding box surrounding of the 3D model on and off

4.2 Menu bar



The menu bar comprises three main menus. The menu commands are accessible using the mouse cursor. The following paragraphs describe the structure and commands of the three main menus (*File*, *Edit* and *Help*).

Menu File

Open Aerial 3D Model	Opens an aerial 3D model (".jm3" file)
Generate and Save	Scales the 3D model, generates the geometry of the *Blast Site*, enables volume calculations and saves the *Blast Site* file (".smb" fie)
Load Existing Blast Site	Loads an existing *Blast Site* (".smb" file)
Export	
Export Crest and Toe	Exports the *Crest* and the *Toe Polygon* to a ".dxf" file
Import	
Import Delimiter	Imports *Delimiter* positions from a data file (".txt", ".dat", ".prt", ".csv")
Exit	Closes *BMX BlastSiteGenerator3D*

Menu Edit

Undo	Revokes the previously executed commands step by step

Redo	Redoes commands revoked by the "*Undo"* function step by step
Edit	Performs actions within the 3D model, i.e. set markers and polygons
Delete	Removes the currently active marker
Next	Switches to the next marker in the list
Previous	Switches to the previous marker in the list

Menu Help

User Manual	Opens the manual of the software component
Units	Displays the units used by the software
About BlastSiteGenerator3D	Displays version and release information of the software component

4.3 Toolbar

Open Aerial 3D Model

Opens an aerial 3D model (".jm3" file)

Import Face 3D Model

Imports an additional quarry face or area that replaces the aerial 3D model in this sector (".jm3" file).

Generate and Save

Scales the 3D model, generates the geometry of the *Blast Site*, enables volume calculations and saves the *Blast Site* file (".smb" fie)

Undo

Revokes the previously executed commands step by step

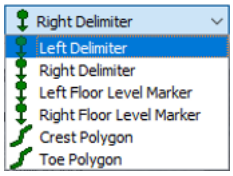
Redo

Redoes the commands revoked by the *"Undo"* function step by step

Previous

Switches to the previous marker in the list

Choose Marker



Selects and activates a marker from the list

Next

Switches to the next marker in the list

Edit

Performs actions within the 3D model, i.e. set markers

Delete

Removes the currently active marker

Preview

Shows a preview of the defined *Top Level Area* and *Floor Level Area*

Annotation Size

Adjust the size of the markers in the 3D model

4.4 Navigation bar

Hint:
The *BMX BlastSiteGenerator3D* toggles between the *Edit* and *Navigate* mode by pressing the "*ESC*" key.

Edit

Performs actions within the 3D model such as marking annotations, etc. (active = blue)

Navigate

Controls the motion and inspection of a 3D model (active = blue)

Seek to a Selected Point

Zooms towards the selected location on the 3D model

Move to Home Position

Sets the viewer to its initial position

Zoom out / Zoom in

Zooms out from the current view. Zooms to the previous view again.

Top Down View

Orientates the 3D model from the camera view (top down).

Auto Rotate (fixed or view)

Rotates the 3D model from a fixed point (top down) or from the current point of view

Toggle Perspective/Parallel Projection

Toggles between perspective and parallel projection

Thumb wheels

The thumb wheels are used for rotation and zooming

4.5 Navigation mode

The devices used in the *Navigate* mode are the mouse and/or the keyboard.

Mouse navigation

- Rotation: The left mouse button rotates the 3D model. Just keep the left button pressed and move the mouse around to see the 3D model rotating.
- Context menu: The right mouse button opens a context menu where the representation of the 3D model can be influenced.
- Panning: The middle mouse button is used to pan the 3D model. The same can be done by pressing "*Ctrl*" or "*Shift*" and using the left mouse button.
- Zooming: Pressing the left and middle mouse button at the same time is used to zoom. The same can be done by pressing "*Ctrl*" and "*Shift*" and using the left mouse button. When turning the wheel of a wheel mouse the 3D model is also zoomed.

Hint:
It is preferred to have a mouse with 3 buttons, or a wheel mouse. Usually the wheel acts as the third mouse button.

Keyboard navigation

- Straight motion is performed by pressing the corresponding arrow key *"Left"*, *"Right"*, *"Up"* or *"Down"*.
- Zooming is performed by pressing *"Shift"* simultaneously with the arrow key *"Up"* for zooming in and the arrow key *"Down"* for zooming out.
- Rotation of the 3D model in a desired direction is performed by pressing "*Ctrl*" simultaneously with the corresponding arrow key *"Left"*, *"Right"*, *"Up"* or *"Down"*.

5 Elements of a blast site

Following terms are used to define the geometry of the *Blast Site* (see Figure 2):

Left Delimiter	The position of the *Left Delimiter* on the top of the bench limits the geometry of the *Blast Site* on the left. It defines the position of the *Left Border Plane.*
Right Delimiter	The position of the *Right Delimiter* on the top of the bench limits the geometry of the *Blast Site* on the right. It defines the position of the *Right Border Plane.*
Left Floor Level Marker	The position of the *Left Floor Level Marker*, i.e. toe point of the quarry on the left side, limits the geometry of the *Blast Site* at its bottom. It defines together with the *Right Floor Level Marker* the position of the *Floor Level Plane*.
Right Floor Level Marker	The position of the *Right Floor Level Marker*, i.e. toe point of the quarry on the right side, limits the geometry of the *Blast Site* at its bottom. It defines together with the *Left Floor Level Marker* the position of the *Floor Level Plane*.
Crest Polygon	The *Crest Polygon* defines the upper boundary of the quarry face with a polygon.
Toe Polygon	The *Toe Polygon* defines the lower boundary of the quarry face with a polygon.
Top Level Area	The Top Level Area is defined by the *Crest Polygon* and is automatically generated by the software (see *Top Level Plane* in the *BMX BlastPlanner)*.
Floor Level Area	The Floor Level Area is defined by the *Toe Polygon* and is automatically generated by the software (see *Floor Level Plane* in the *BMX BlastPlanner)*.

Note:
The position of the *Left* and *Right Delimiter* can be imported from a point data file (".txt", ".dat", ".prt", ".csv"). See Chapter 6.2 for further information.

Note:
A detailed descriptions of elements defining the *Blast Site* is found in the user manual *BMX BlastPlanner*.

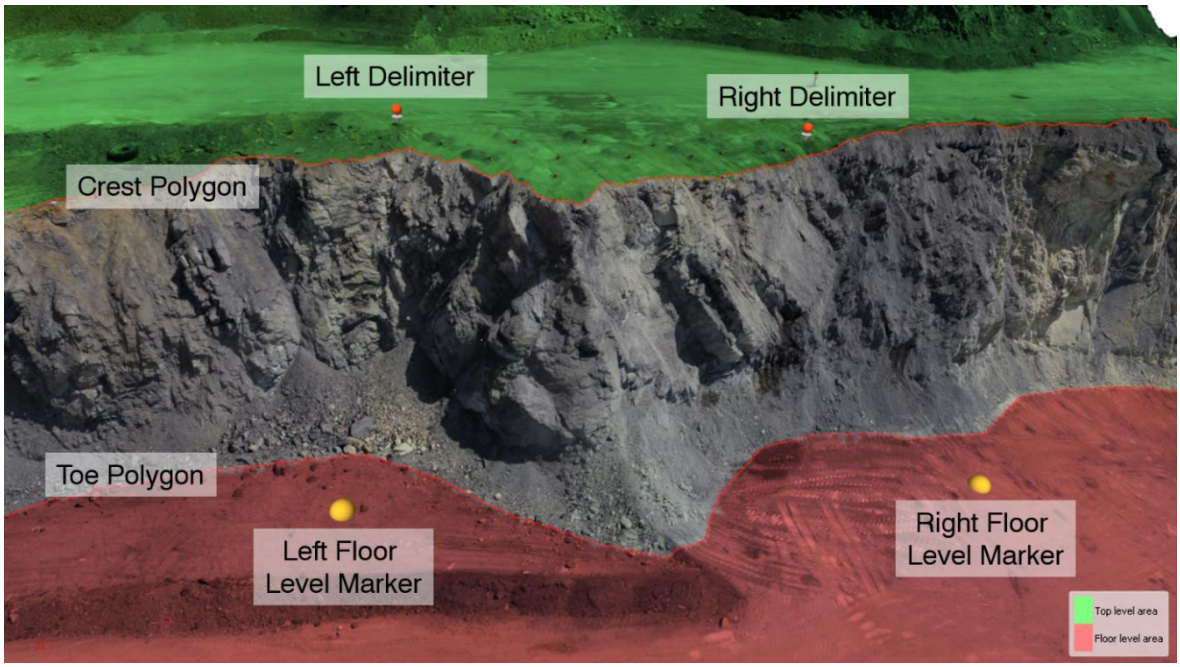


Figure 2: Example of a blast site geometry

6 Operation

6.1 Standard operation procedure

1. Load a 3D model (".jm3" file) generated by clicking *"File | Open Aerial 3D Model"* or by the use of the according icon .
2. Select "*Left Delimiter"* from the pull-down menu "*Choose Marker*" in the toolbar and define the left border of *the Blast Site* by clicking the position of the *Left Delimiter* in the 3D viewer (Figure 3). For an accurate position zoom into the 3D model until the center of the markers can be proper identified.

Figure 3: Set of the Left Delimiter

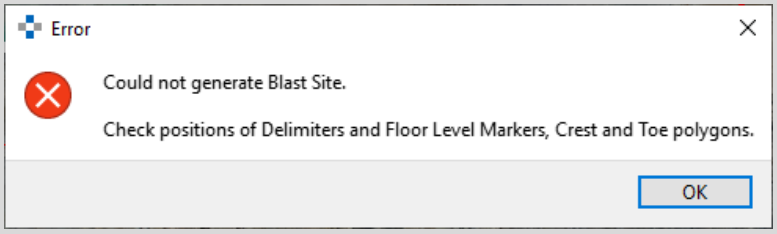
3. Select "*Right Delimiter"* from the pull-down menu "*Choose Marker*" in the toolbar and define the right border of the *Blast Site* by clicking the position of the *Right Delimiter* in the 3D viewer. For an accurate position zoom into the 3D model until the centre of the markers can be proper identified.

Note:
BMX BlastSiteGenerator3D switches automatically to the next element defining the geometry of the *Blast Site* (i.e. position of markers and definition of polygons) by clicking *"Edit | Next"* in the menu bar or the corresponding ▶ icon in the toolbar,

4. Repeat step 2 and 3 to position the *Left Floor Level Marker* and the *Right Floor Level Marker* on both sides of the quarry on the desired floor levels.

Hint:
Floor Level Markers have significant influence on volume calculations. Be aware of muck piles or raising or declining terrain.

Note:
The *Left Delimiter* and the *Right Delimiter* have to be bounded by the *Crest Polygon*, i.e. they must be located in the *Top Level Area*. The *Floor Level Markers* have to be bounded by the *Toe Polygon* i.e. they must be located in the *Floor Level Area*. If the points are not set proper an error note pops up.



5. Select "*Crest Polygon" from* the pull-down menu "*Choose Marker*" in the toolbar. Set the *Crest Polygon* by clicking the mouse along the *Top Level Surface (*Figure 4).
6. Confirm the polygon by clicking the middle mouse button or by pressing the *"Return"* button on the keyboard. The *Crest Polygon* appears as red continuous line in the viewer (Figure 5).

Hint:
Pressing the "*Shift*" button allows to move the added points of the polygon individually. A click on the right mouse button deletes the last added point of the polygon.

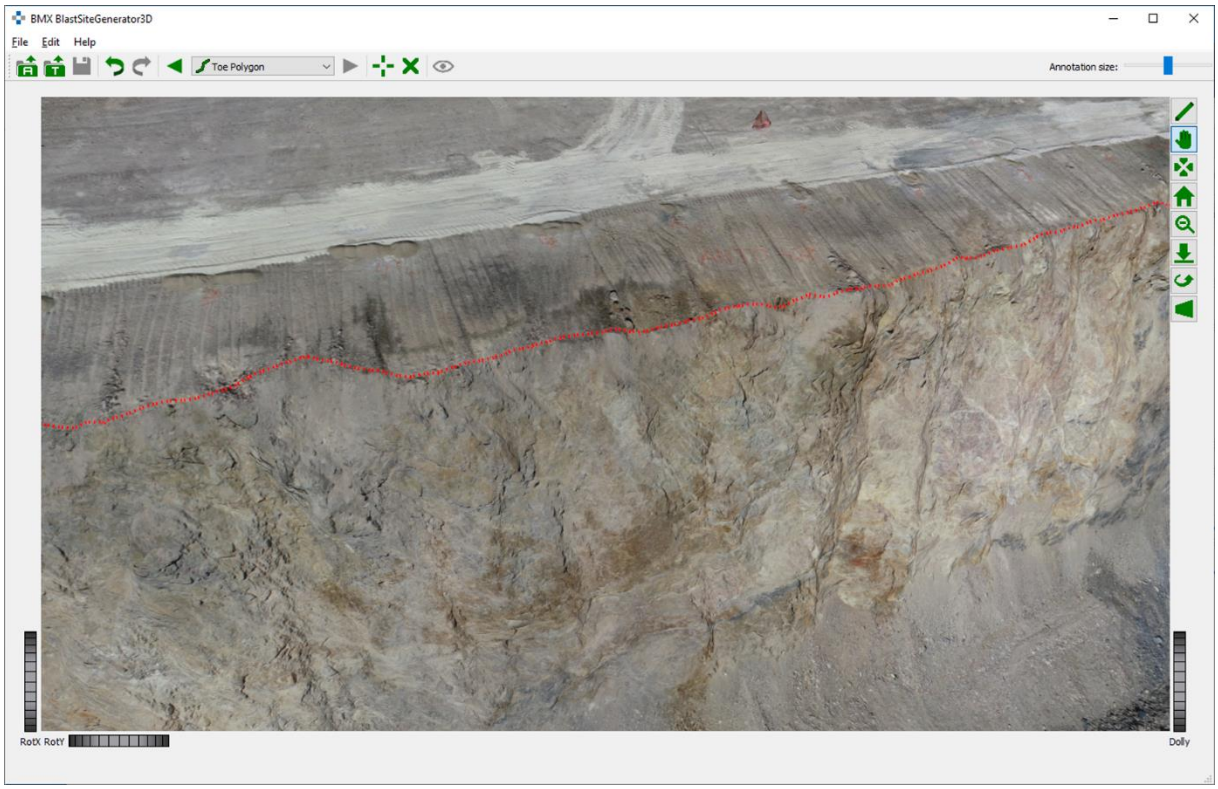


Figure 4: Setting the Crest Polygon

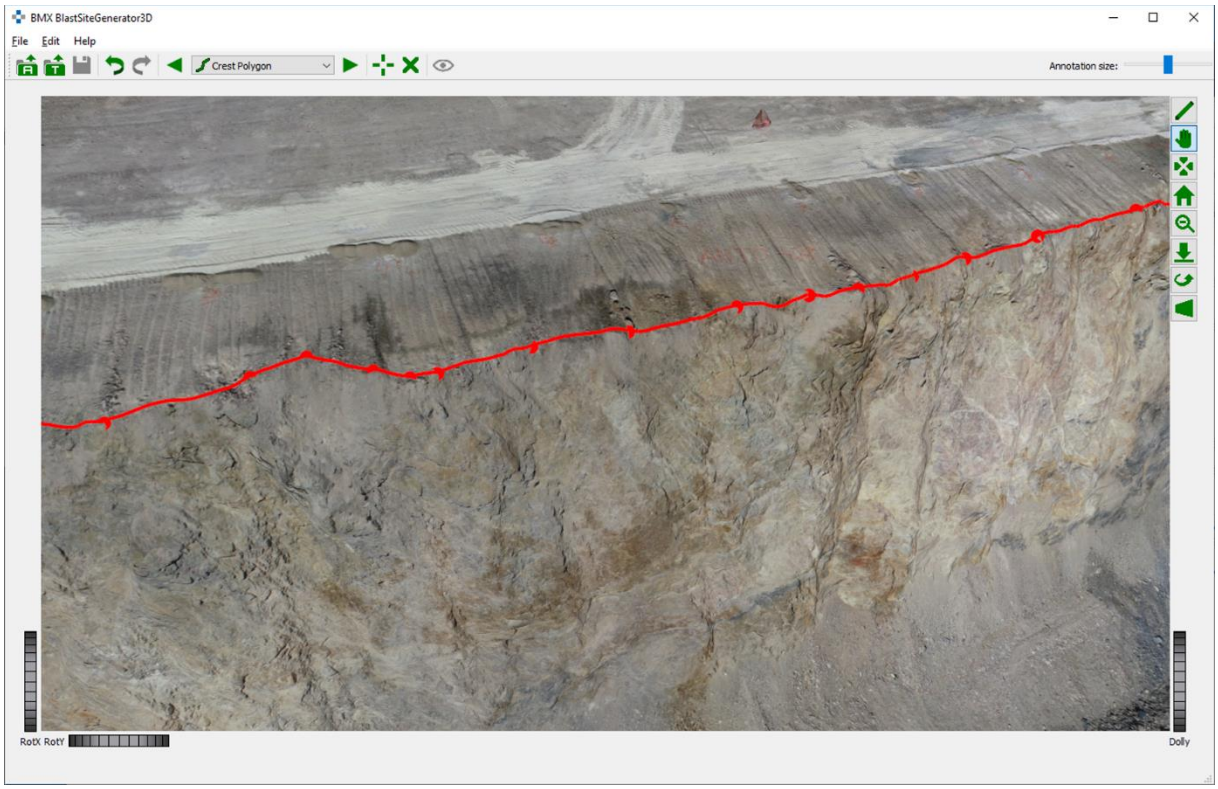


Figure 5: Crest Polygon after confirmation

7. Repeat step 5 and 6 to set the *Toe Polygon* along the floor level of the *Blast Site*.

Note:
The *Crest* and the *Toe Polygon* are exported to a ".dxf" file by clicking by clicking *"File | Eport | Export Crest and Toe"*.

8. Click on the *"Preview"* icon in the toolbar and outlook of the generated *Blast Site* is displayed in the 3D viewer. The green colored area reveals the *Top Level Area*, while the red colored area the *Floor Level Area* (see Figure 6).
9. Generate and save the 3D model (".jm3") and the geometry of the *Blast Site* (".smb") by clicking *"File | Generate and Save"* in the menu bar or by clicking the according icon . Rename and choose the directory to save in the appearing window. The generation process is displayed in the progress dialog shown in Figure 7.
10. Close the program with a click on *"File | Exit"*.

Hint:
The geometry of the *Blast Site* (".smb" file) is automatically loaded with the 3D model (".jm3" file) in the *BMX BlastPlanner*, if they have equal file names.

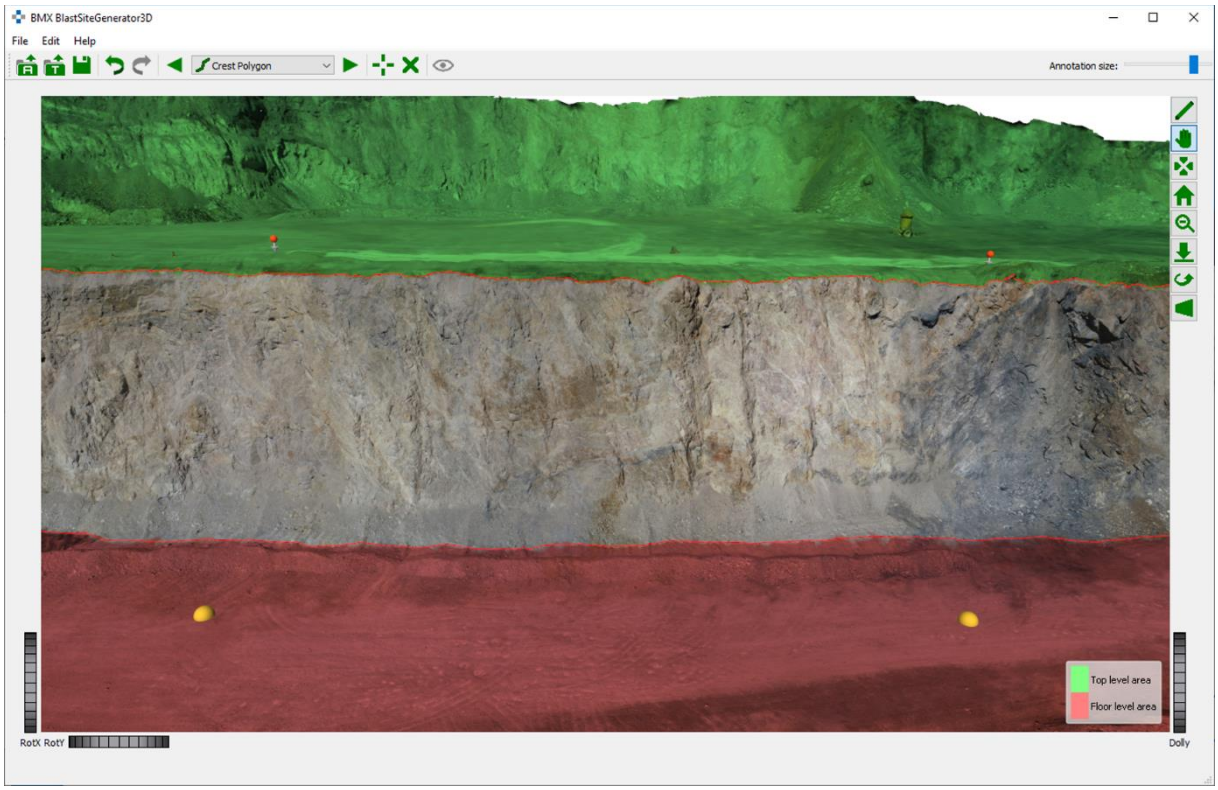


Figure 6: Preview of a generated Blast Site

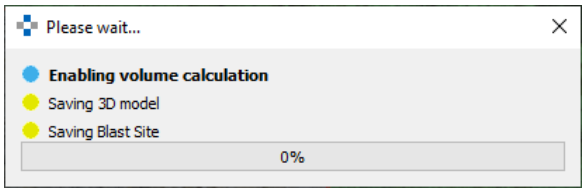
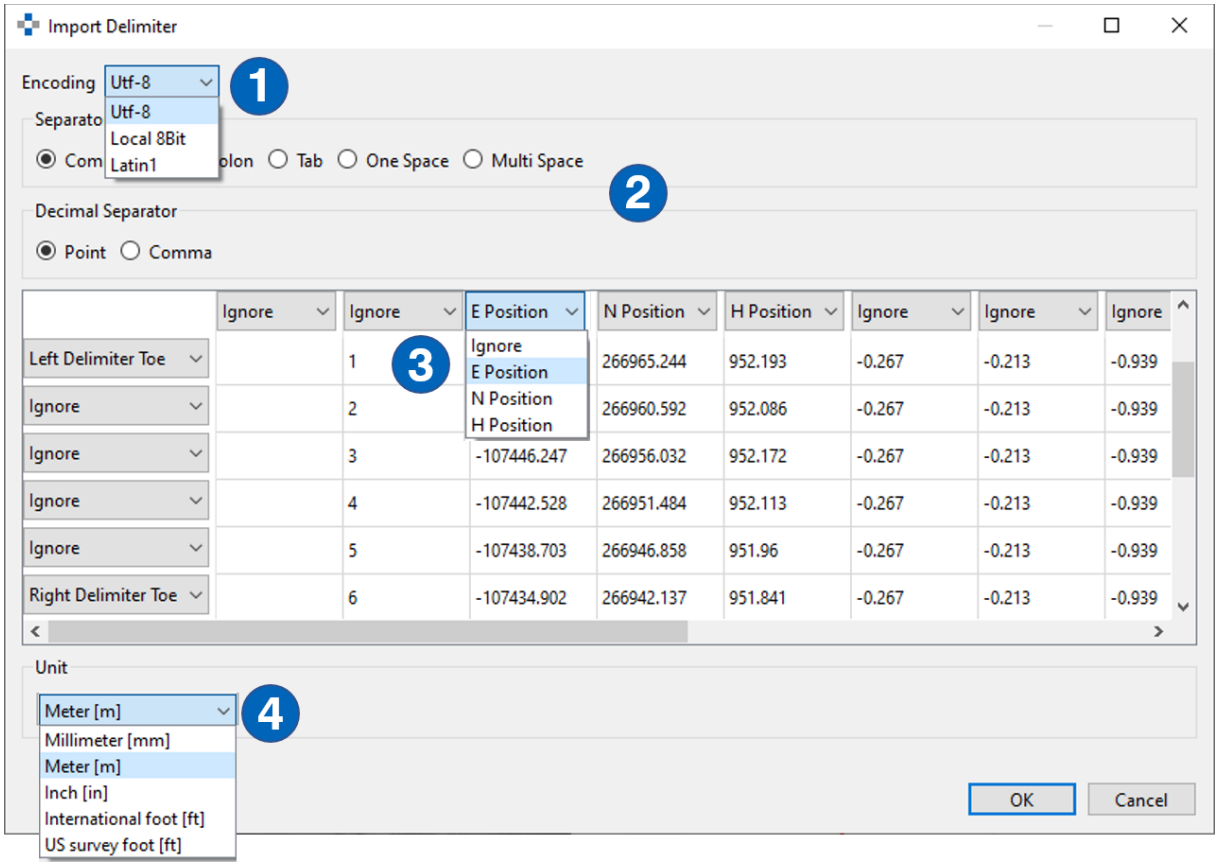


Figure 7: Window with progress dialog.

6.2 Import of Delimiter

The position of the *Left* and *Right Delimiter* can be imported from a point data file (".txt", ".dat", ".prt", ".csv") by following procedure:

1. Select *"File | Import | Import Delimiter"* in the menu bar.
2. A dialog window *"Import Delimiter"* (Figure 8) appears requiring following inputs:
    a. Character encoding
    b. Used separator
    c. Data classification of E/N/H
    d. Units (millimeter [mm], meter [m], inch [in], international foot [ft], US survey foot [ft])
3. Click the *"OK"* button to import the position of the *Left* and *Right Delimiter*



1 Character encoding
2 Separators
3 Data
4 Unit

Figure 8: Import Delimiter

6.3 Import face area

UAV imagery may not give adequate information of the properties of the quarry face; e.g. if geological assessment of the quarry face is required. Terrestrial imagery taken by freehand photography (see *BlastMetriX* user manuals) may contribute to overcome this problem. The *BMX BlastSiteGenerator3D* enables merging of aerial and terrestrial 3D models by following procedure:

1. Click on *"Import Face 3D Model"* icon in the menu bar. The imported terrestrial 3D model replaces the overlapping area.
2. Define the geometry of the *Blast Site* following the standard operation procedure described in Chapter 6.1.
3. Generate and save the 3D model (aerial and terrestrial) and the geometry of the *Blast Site* (".smb") as described in Chapter 6.1.

Note:
Import of a quarry face or an area requires aligned 3D models. Alignment has to be performed with the *SMX Referencer* or *BMX TiePointReferencer* (see corresponding manuals).

Note:
All information from the primary (aerial) 3D model is lost in the overlapping area when importing a new data set with the function "*Import Face 3D Model*". The *BMX BlastSiteGenerator3D* rewrites the original 3D model (".jm3") file when saving. Renaming of the 3D model is highly recommended.

6.4 Warning

Enabling volume calculation failed

Enabling the volume calculations in *BMX BlastPlanner* requires a consistent 3D model. If the 3D model and its meta-data are not consistent, the volume calculation cannot be enabled. In this case *BMX BlastSiteGenerator3D* gives a warning.

Volume calculation cannot be enabled if the following issues take place:

- Model merging has been performed without trimming the 3D models with the trim polygon (see *SMX ModelMerger*)
- 3D models have been generated or modified by the user with software components which do not support volume calculation (previous versions).
- The license does not enable volume calculations (*BlastMetriX Basic* system)

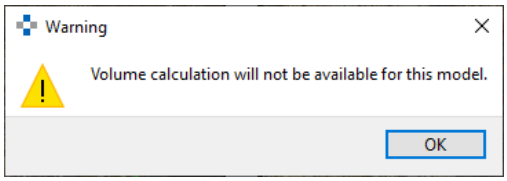


Figure 9: Warning if volume calculation could not be enabled