O-PITBLAST

USER MANUAL

BLAST DESIGN & OPTIMIZATION PLATFORM

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1.Introduction

O-Pitblast® 2017, is a PC Windows-based application software designed for the planning, control and optimization of rock blasting operations. Developed by O-Pitblast©, is an application that pretends to fulfill all the need of blast engineers in order to optimize, control, reduce costs and increase safety in their blasts.
This platform allows the user to import terrain features, like topography and rock characteristics, and design the best blast for each operation. This is possible due to the artificial intelligence module that identifies potential safety risks and KPI's capable to generate savings. Besides all the operation modules, it has a management section that permits the recording of blast data, generation of blast plans and reports, KPI control graphics, track & trace technology, user control and multiple-projects management.
This software is user friendly and this manual will guide the user throughout all the basic features needed to learn and control it.

2.System Requirements (Recommended)

Operating System	Windows 7 or later
Productivity Tools	Adobe PDF
Processor Type	Core i5 Processor or higher
Memory	8 GB RAM or higher
Graphics Card	512 MB Video Memory or higher
Free Hard Drive Space	5 GB
Minimum Resolution	1280 x 720

3.Installing O-Pitblast® Platform

To install the O-Pitblast® Platform, download the file from: http://downloads.o-pitblast.com/ and after the download of the file, double click on the O-Pitblast® Platform executable (.msi) icon (Fig. 1) and follow the onscreen instruction of the Setup program.

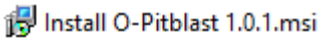

Fig. 1 - O-Pitblast Installation icon

After the welcome window appears (Fig. 2), click Next and select the Typical installation method. Previously you must agree with the EULA (End-user license agreement) and select INSTALL to execute the installation of the software (Fig. 5).

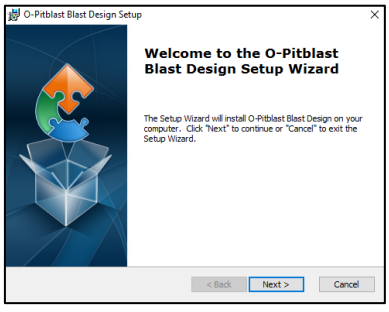

Fig. 2 - O-Pitblast Welcome Window

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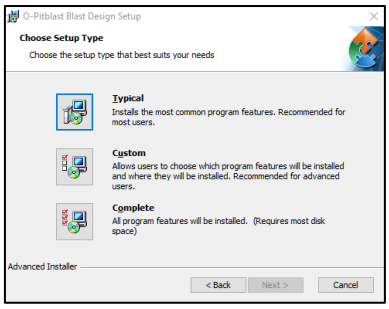

Fig. 3 - O-Pitblast Installation Type

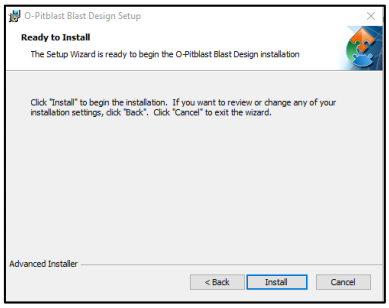

Fig. 4 - O-Pitblast Ready to Install

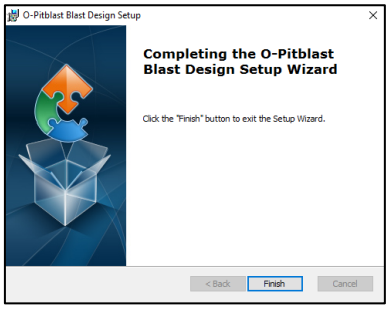

Fig. 5 - O-Pitblast Installation Finished

A desktop icon (Fig. 6) is created and you must click on it to execute O-Pitblast® Platform.

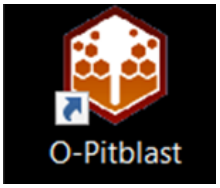

Fig. 6 - O-Pitblast Desktop icon

4.Updates

O-Pitblast® update installation is automatic. If an update is available, and the user is connected to internet a pop-up window will appear advising to proceed with the installation of the update.

5.Registering O-Pitblast® Platform

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When clicking in the O-Pitblast desktop icon a loading screen (Fig. 7) and an authentication window (Fig. 8) will be available for the user registration. Your login credentials must be given by O-Pitblast Technical Support (support@o-pitblast.com). Introduce your user credentials and confirm.

Fig. 7 - O-Pitblast Loading Screen

Fig. 8 - O-Pitblast User Login Window

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6.O-Pitblast® Overview

O-Pitblast® interface is showed in Fig. 9 and it is composed by 5 sectors:

A. Main Control Bar
B. Toolbox
C. Work Environment
D. View Pane
E. Status

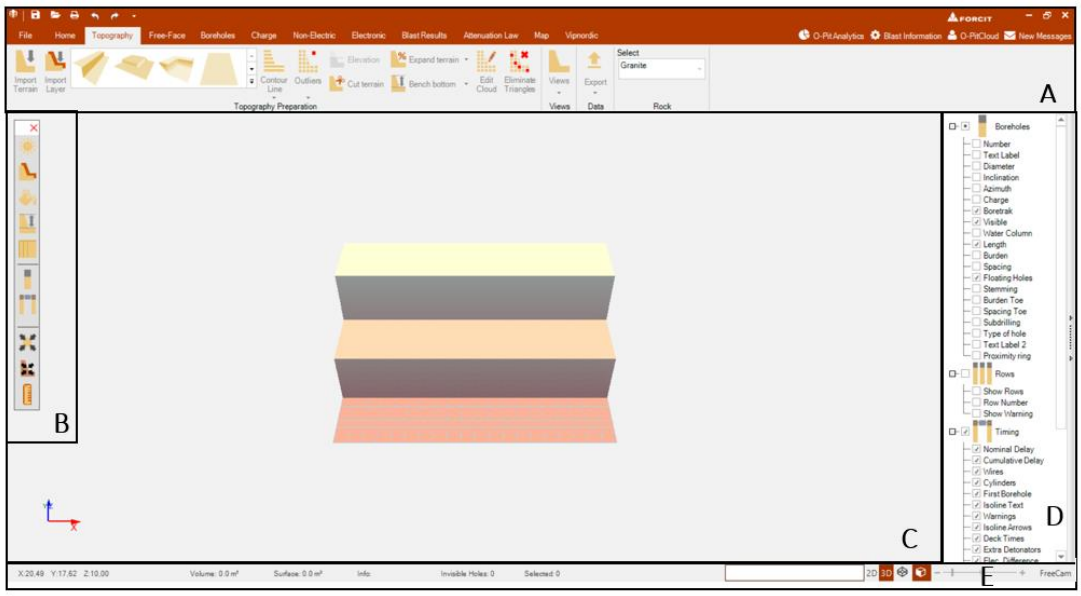

Fig. 9 - O-Pitblast Overview

6.1.Main Control Bar

The main control bar controls all the functionalities of the Software on it is possible to save a project, open existents projects, share files, and edit an entire plan.

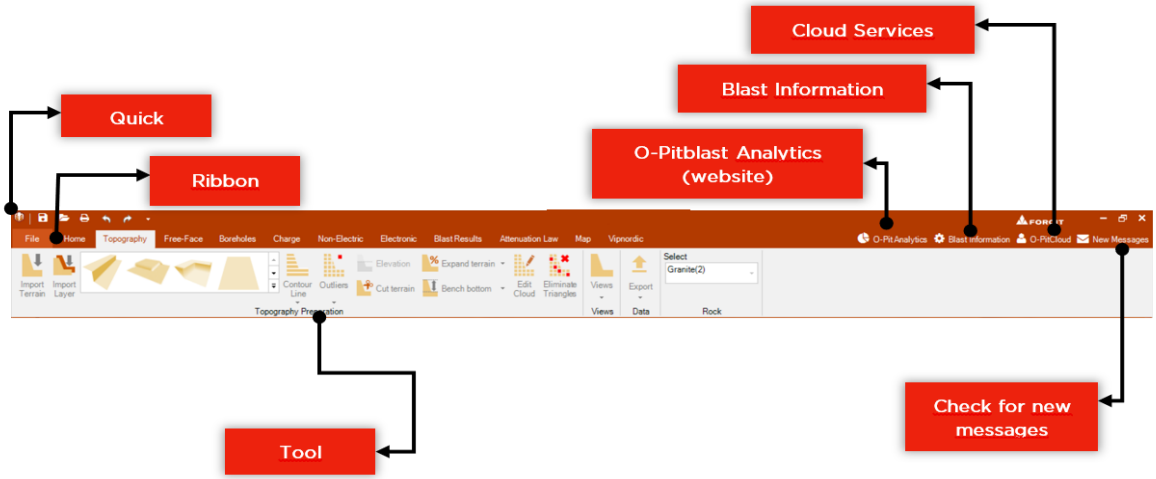

Fig. 10 - Main Control Bar

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6.2. Quick Access Bar

Here the user as several options:

- Save the actual file;
- Open a new file;
- Print report;
- Undo;
- Re-do;
- Open toolbox, check for updates and news, tutorials, download the manual and see the list of shortcuts (Fig. 12).

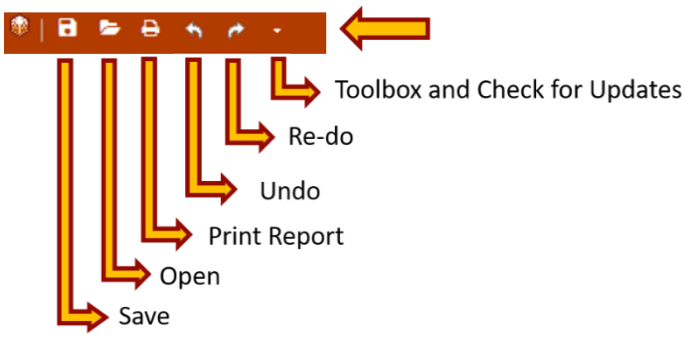

Fig. 11 - Quick access bar

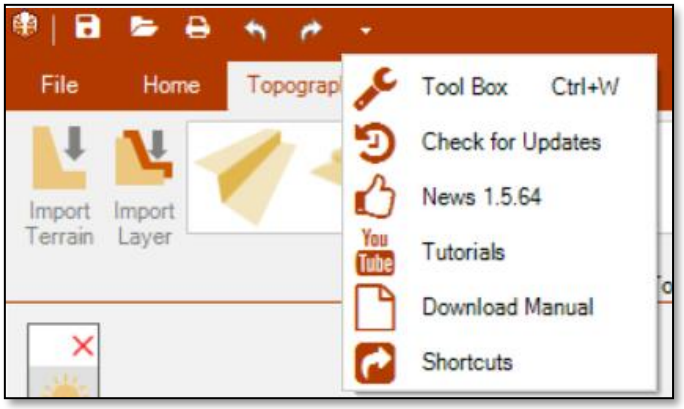

Fig. 12 - Option inside of quick access bar

6.3. Files Tab

On the files tab (Fig. 13) the user can manage the files and project options.

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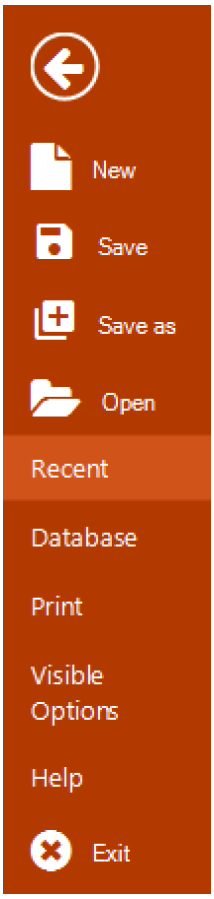

Fig. 13 - Files Tab

6.3.1. Create a New Project

By clicking on the **New** project, the user opens a new instance of O-Pitblast Software.

6.3.2. Save and Save as the Current Project

O-Pitblast allows the user to save each project by generating a file with *.opit extension (Fig. 14).

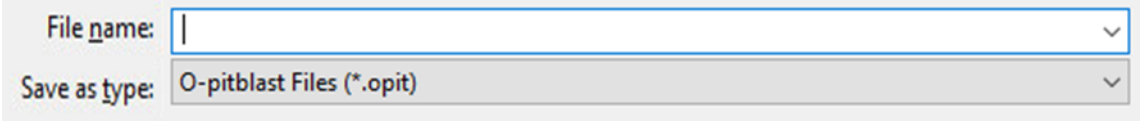

*Fig. 14 - Save *.opit File*

The **Save** option will save the project by updating an existent one, in the other hand, the **Save As** option will generate a new file.

6.3.3. Open an Existent File

To open an existent file, the user can click twice on the saved file icon (Fig. 13) on the Windows File Explorer.

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Fig. 15 - O-Pitblast icon

Another option is through the **Files Tab**, by selecting the **Open** service.

6.3.4. Open a Recent File

O-Pitblast stores up to 20 files on the recent tab (Fig. 16). The user can select the file and it will open automatically.

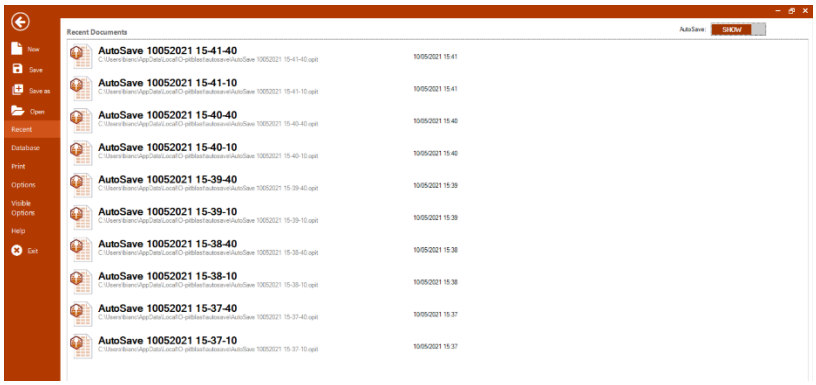

Fig. 16 - Recent Files

6.3.5. Database

The database allows the storage of explosives types and explosives accessories.

6.3.5.1. Creating Detonators

To create a new detonator, the user must click in the add button , add the **Name/Description** of the element, the **Type** (Dual Detonator, Surface Connector, In-Hole Detonator, Electronic Detonator or Detonating Cord), the **Surface Delay (ms)**, the **In-Hole Delay (ms)**, the **Color,** the **Length (m)**, the **Price**, the **Gramature (g/m)**, the **Discount (%)** and the **Scatter (%)**. To delete an element, it is necessary click on the delete button and, if the user needs to change some characteristics of any detonator, there is the update button . The user can also import their product information by clicking on the import button .

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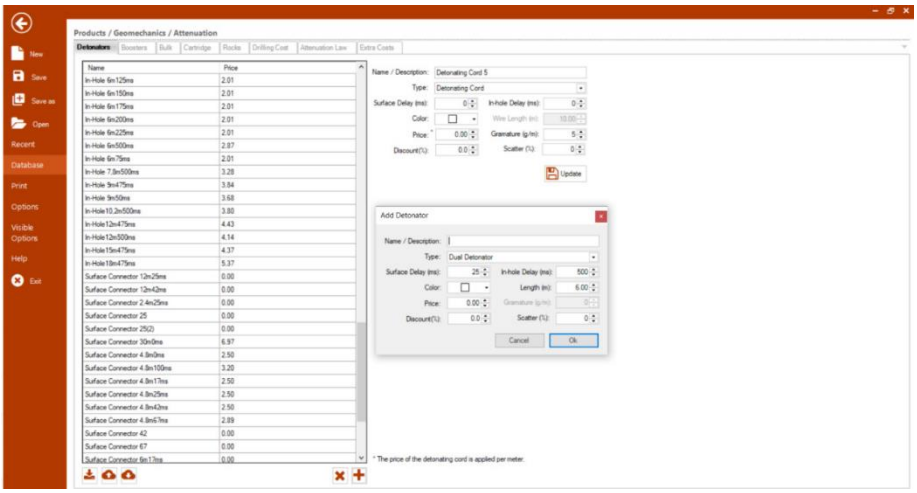

Fig. 17 - Detonators Database (Adding detonator)

6.3.5.2. Creating Boosters

To create a new booster, the user must click in the add button ✚, add the **Name/Description** of the element, the **Length (mm)**, the **Diameter (mm),** the **Weight (g)**, **Price** and Discount (%). To delete an element, it is necessary click on the delete button ✖ and, if the user needs to change some characteristics of any booster, there is the update button 🖫. The user can also import their product information by clicking on the import button 📥.

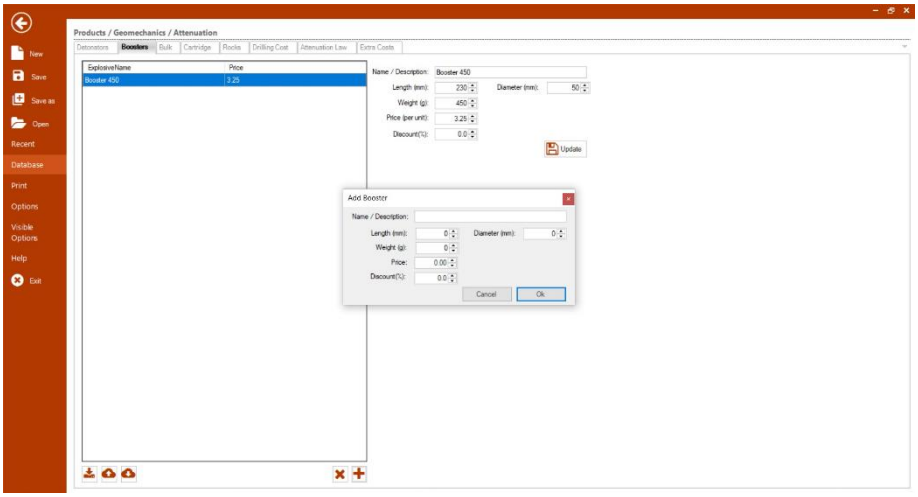

Fig. 18 - Booster Database (Adding booster)

6.3.5.3. Creating Bulk Explosives

To create a new Bulk explosive, the user must click in the add button ✚, add the **Name/Description** of the element, the **Density (g/cm^3)**, **RWS**, the **Price, VoD (m/s),** the **Discount (%)** and **Effective Energy (kJ/Kg)**. To delete an element, it is necessary click on the delete button ✖ and, if the user needs to change some

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characteristics of any bulk explosive, there is the update button . The user can also import their product information by clicking on the import button .

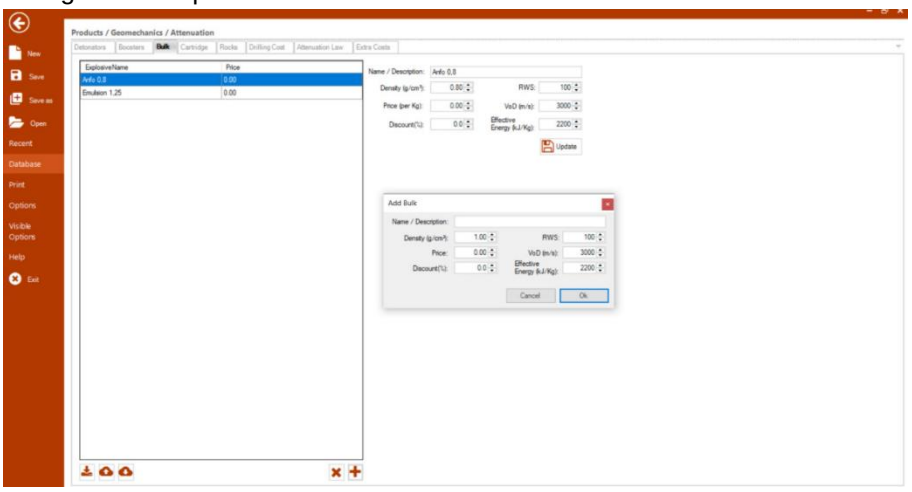

Fig. 19 - Bulk Database (Adding bulk explosives)

6.3.5.4. Creating Cartridge Explosives

To create a new Cartridge explosive, the user must click in the add button , add the **Name/Description** of the element, the **Length (mm)**, the **Diameter (mm)**, **Weight (g)**, **RWS**, the **Price,** the **Discount (%)**, the **Density (g/cm^3)**, **Effective Energy (kJ/Kg),** and the **VoD (m/s).** The user can also choose if he wants per Kg or per Unit by clicking on those options. To delete an element, it is necessary click on the delete button and, if the user needs to change some characteristics of any bulk explosive, there is the update button . The user can also import their product information by clicking on the import button .

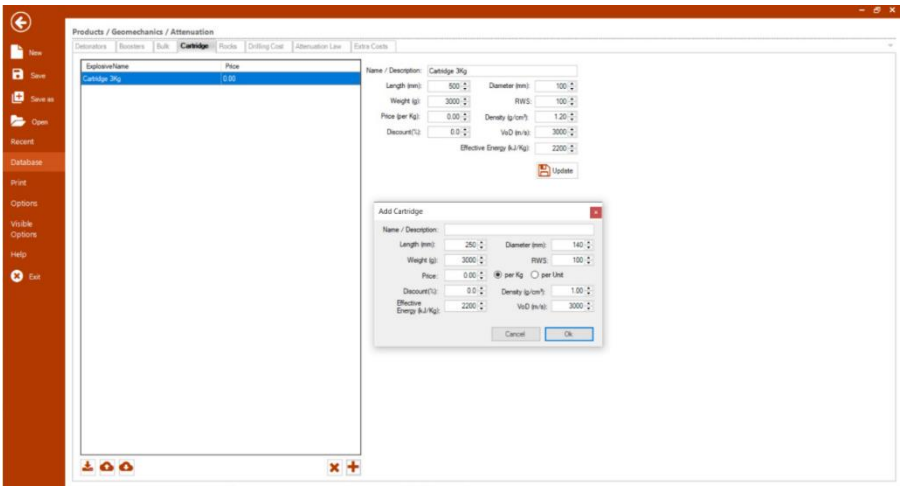

Fig. 20- Cartridge Database (Adding cartridge explosives)

6.3.5.5. Creating Rocks

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To create a new Rock, the user must click in the add button , add the Name/Description of the element, the Rock density (g/cm³), the Unc. Compressive Strengh (Mpa), the Young's Modulus (Gpa), the Rock Factor, the Dynamic Compressive Strength (MPa), the Dynamic Confined Comp. Strength (MPa), the Dynamic Tensile Strength (MPa) and the Poisson´s Ratio. To delete an element, it is necessary click on the delete button and, if the user needs to change some characteristics of any bulk explosive, there is the update button .

The user can also import their rock properties information by clicking on the import button .

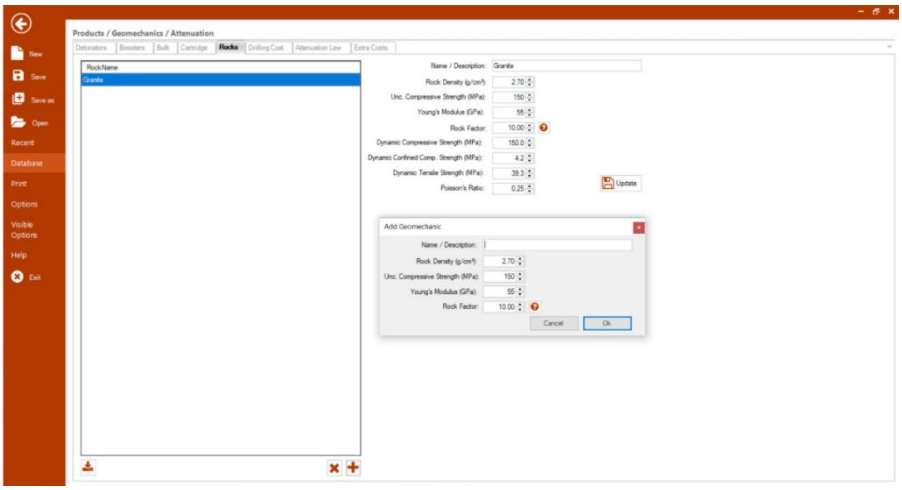

Fig. 21 - Rock Database (Adding rock types)

The user can change the Rock Factor by click in and then it will appear the window below:

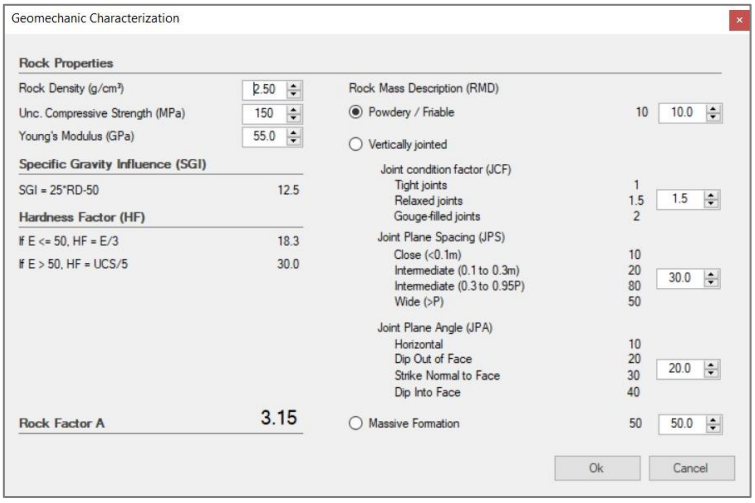

Fig. 22 – Geomechanical characterization Window (Adding geomechanical parameters)

6.3.5.6. Creating Drilling Costs

To create a new Drilling Cost, the user must click in the add button , add the **Description** of the element, the **Diameter (mm)** and the **Price per meter**. To delete an element, it is necessary click on the delete button and, if the user needs to change some characteristics of any bulk explosive, there is the update button .

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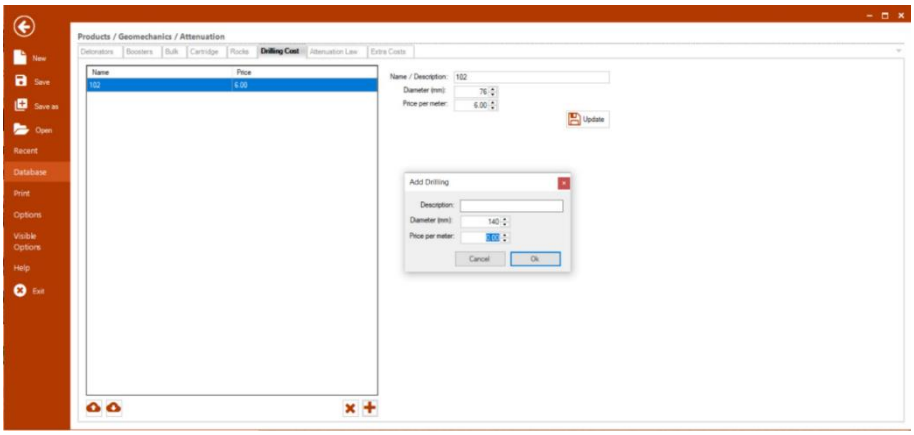

Fig. 23 – Drilling Cost Database (Adding drilling costs)

6.3.5.7. Creating Attenuation Law

To create a new Attenuation Law, the user must click in the add button , add the **Name/Description** of the element and the K, α and β factors. To delete an element, it is necessary click on the delete button and, if the user needs to change some characteristics of any bulk explosive, there is the update button .

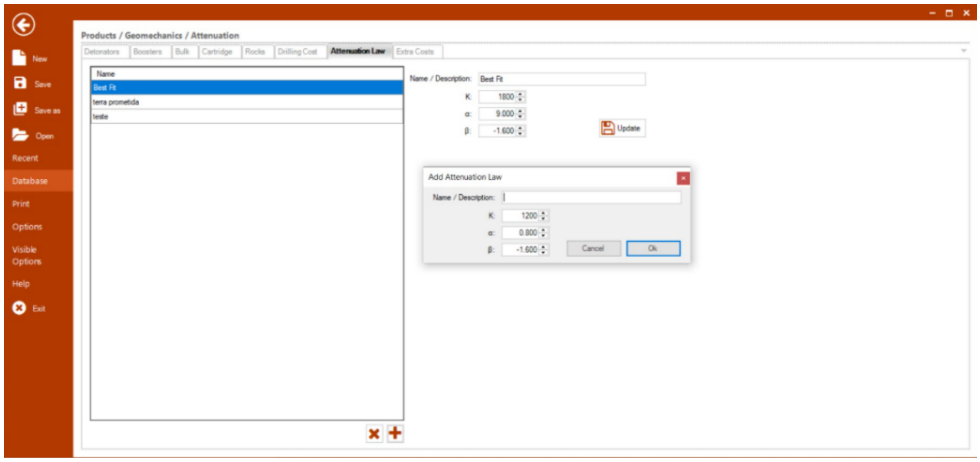

Fig. 24 – Attenuation Law Database (Adding attenuation law)

6.3.5.8. Creating Extra Costs

To create a new Extra Costs, the user must click in the add button , add the **Name/Description** of the element and the **Unit Price**. To delete an element, it is necessary click on the delete button and, if the user needs to change some characteristics of any extra costs, there is the update button .

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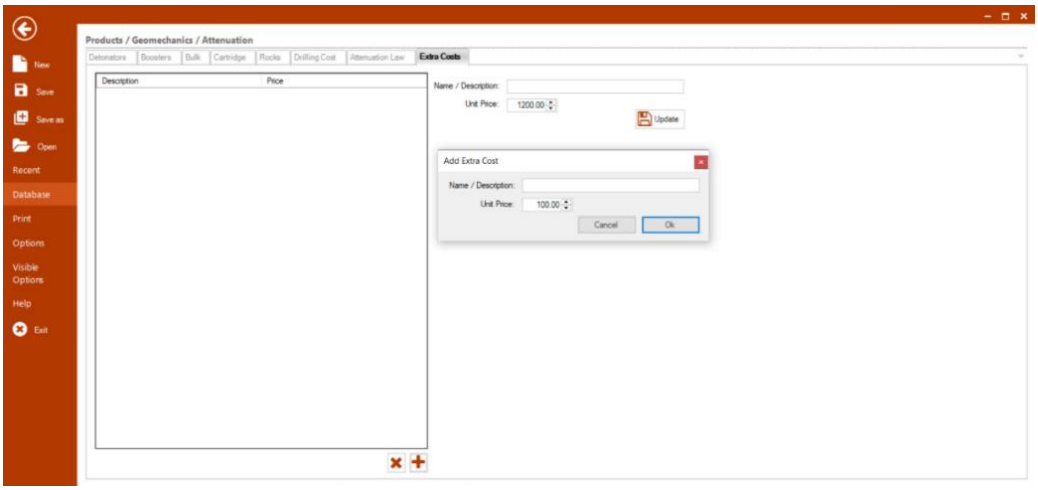

Fig. 25 – Extra Costs Database (Adding extra costs)

6.3.5.9. Sharing Database Information

6.3.5.9.1. Send to Cloud

On the database, inside of each product, click on the “Send to cloud” button (Fig. 26). This option will send all the product information to the O-PitCloud (for example, to appear in the O-PitApp when creating a new products).

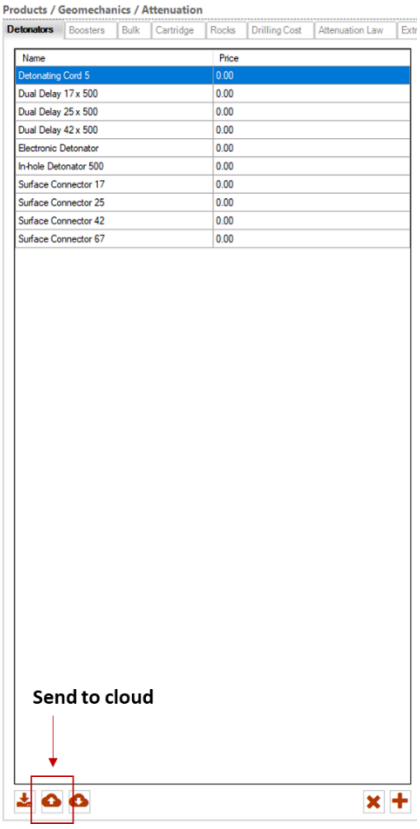

Fig. 26 - "Send to Cloud" option

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6.3.5.9.2. Download from Cloud

On the option “Download from the Cloud” (Fig. 27), the user can insert a code (18.2.9 to find how to generate this code) to download the information from other O-Pitblast users’ database.

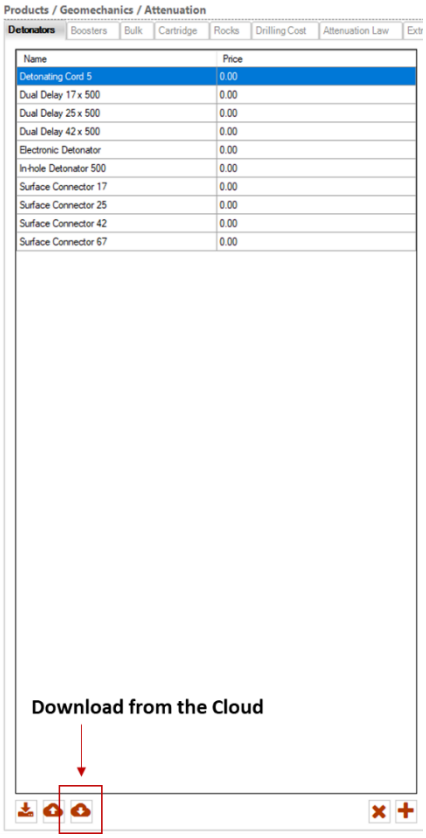

Fig. 27 - "Download from Cloud" button

After inserting the code, the user will see a list with all the information and will be able to choose which one he wants to import (Fig. 28).

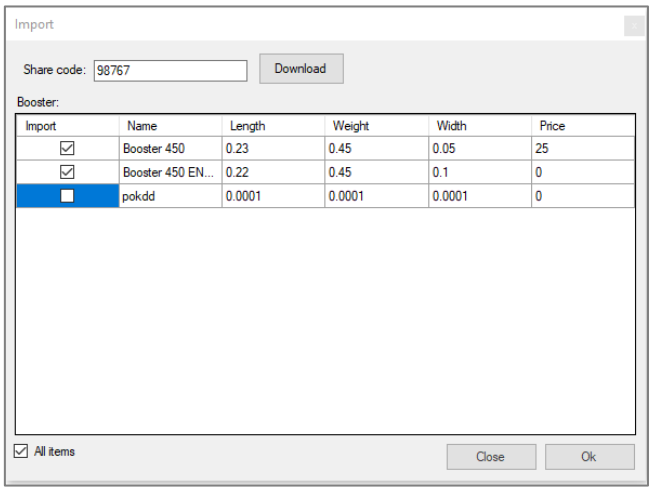

Fig. 28 – Window with items for importation (example)

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6.3.6. Print the Blast Plan

In the Blast Plan **Print** Tab, the user can preview the blast plan pages. Is possible to edit the final model by checking and un-checking each available option.

6.3.6.1. Preview fill PDF

When the user is in “Print”, it has on the bottom left size the option “Preview and Print”. This allows the user to see the report before he prints it.

Fig. 29 - Preview PDF button

6.3.6.2. Save to Excel

On the “Print” section, there is also a button on the left with the option “Save to Excel”. This allows the user to save the blast report as excel file.

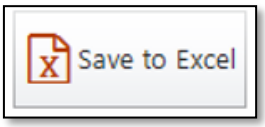

Fig. 30 - Preview PDF button

6.3.6.3. Configure PDF

In this button the user can configure the report through the general or drilling tabpage. Inside the general tab it is possible to change the **color**, **size**, **connector label size** and **hole diameter zoom.** And inside drilling tab can change the **line color**, **opacity** and **width**.

Fig. 31 - Configure report button

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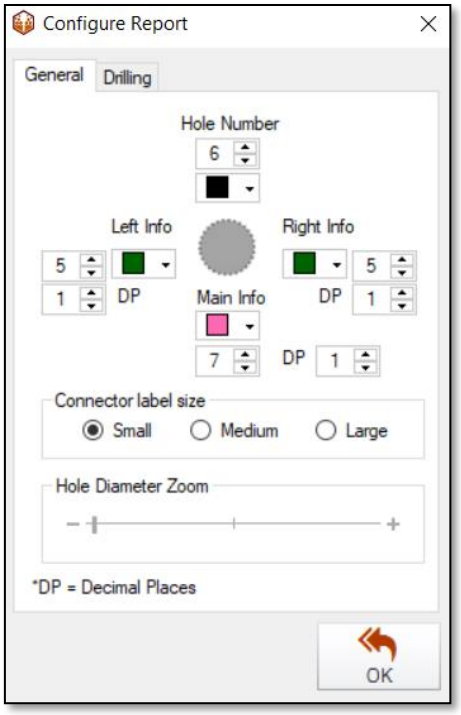

Fig. 32 - Configure Report: General tab

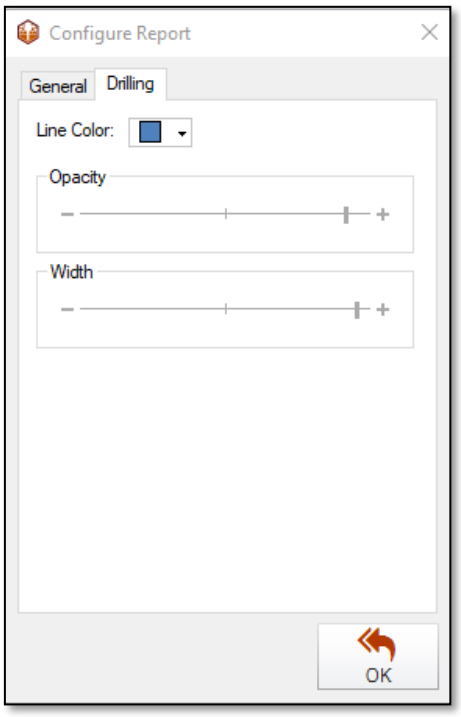

Fig. 33 - Configure Report: Drilling tab

6.3.6.4. Page Options

On the **Size Options** section is possible to select the page size for the general information pages, and for the Plans pages. (Fig. 34).

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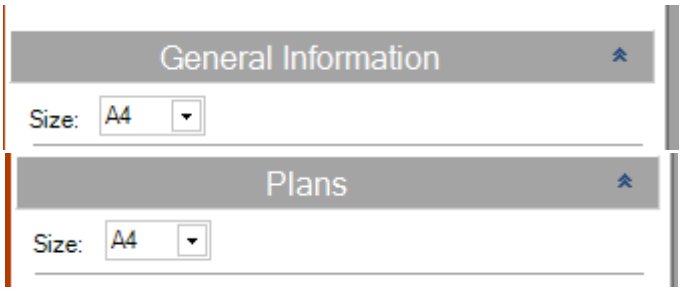

Fig. 34 - Printing Blast Plan - Page Options

Also, in the page options (Fig. 35), the user has the possibility to insert a logo for the online report , select logo for report or delete the logo used .

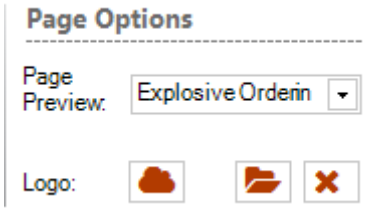

Fig. 35 - Page options

6.3.6.5. General Information

The General Information section (Fig. 36) allows the selection of Explosive Ordering, Accessories Ordering, Blast Resume, Comments, Charge Rule Design, Rows, Driller's Report, Borehole Information (Fig. 37), Profile First Row, Cost, Rows, Detonator Profile, Fit Booster to BB and Extra Detonators List, Map Details (Fig. 38), Driller's log (with D.I option – only showing information on the report of holes with deviation data), Path Logger (list with Path ID, path order, number of hole associated and delays per detonators), Fragmentation, Histogram and Theoretical Bench Height (this option uses the Edit Theoretical information (Fig. 36). This last option refers to the theoretical information (Fig. 39) that can be added to appear on the theoretical volume calculations (Fig. 39).

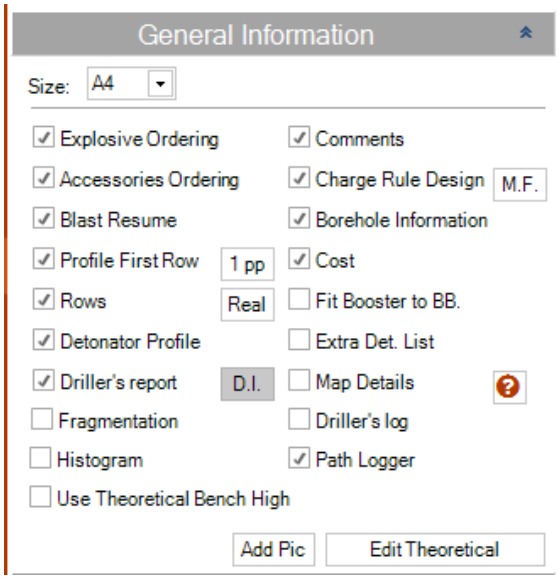

Fig. 36 – Printing Blast Plan - General Information

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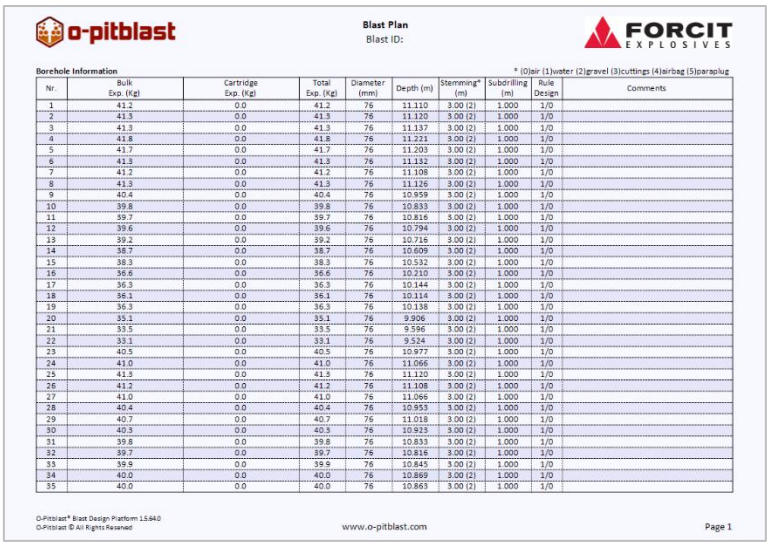

o-pitblast

Blast Plan
Blast ID:

FORCIT EXPLOSIVES

Borehole Information

* (0)air (1)water (2)gravel (3)cuttings (4)airbag (5)parsplug

Nr.	Bulk Exp. (Kg)	Cartridge Exp. (Kg)	Total Exp. (Kg)	Diameter (mm)	Depth (m)	Stemming* (m)	Subdrilling (m)	Rule Design	Comments
1	41.2	0.0	41.2	76	11.110	3.00 (2)	1.000	1/0	
2	41.3	0.0	41.3	76	11.120	3.00 (2)	1.000	1/0	
3	41.3	0.0	41.3	76	11.137	3.00 (2)	1.000	1/0	
4	41.8	0.0	41.8	76	11.221	3.00 (2)	1.000	1/0	
5	41.7	0.0	41.7	76	11.203	3.00 (2)	1.000	1/0	
6	41.3	0.0	41.3	76	11.132	3.00 (2)	1.000	1/0	
7	41.2	0.0	41.2	76	11.108	3.00 (2)	1.000	1/0	
8	41.3	0.0	41.3	76	11.126	3.00 (2)	1.000	1/0	
9	40.4	0.0	40.4	76	10.959	3.00 (2)	1.000	1/0	
10	39.8	0.0	39.8	76	10.833	3.00 (2)	1.000	1/0	
11	39.7	0.0	39.7	76	10.816	3.00 (2)	1.000	1/0	
12	39.6	0.0	39.6	76	10.794	3.00 (2)	1.000	1/0	
13	39.2	0.0	39.2	76	10.716	3.00 (2)	1.000	1/0	
14	38.7	0.0	38.7	76	10.609	3.00 (2)	1.000	1/0	
15	38.3	0.0	38.3	76	10.532	3.00 (2)	1.000	1/0	
16	36.6	0.0	36.6	76	10.210	3.00 (2)	1.000	1/0	
17	36.3	0.0	36.3	76	10.144	3.00 (2)	1.000	1/0	
18	36.1	0.0	36.1	76	10.114	3.00 (2)	1.000	1/0	
19	36.3	0.0	36.3	76	10.138	3.00 (2)	1.000	1/0	
20	35.1	0.0	35.1	76	9.906	3.00 (2)	1.000	1/0	
21	33.5	0.0	33.5	76	9.596	3.00 (2)	1.000	1/0	
22	33.1	0.0	33.1	76	9.524	3.00 (2)	1.000	1/0	
23	40.5	0.0	40.5	76	10.977	3.00 (2)	1.000	1/0	
24	41.0	0.0	41.0	76	11.066	3.00 (2)	1.000	1/0	
25	41.3	0.0	41.3	76	11.120	3.00 (2)	1.000	1/0	
26	41.2	0.0	41.2	76	11.108	3.00 (2)	1.000	1/0	
27	41.0	0.0	41.0	76	11.066	3.00 (2)	1.000	1/0	
28	40.4	0.0	40.4	76	10.953	3.00 (2)	1.000	1/0	
29	40.7	0.0	40.7	76	11.018	3.00 (2)	1.000	1/0	
30	40.3	0.0	40.3	76	10.923	3.00 (2)	1.000	1/0	
31	39.8	0.0	39.8	76	10.833	3.00 (2)	1.000	1/0	
32	39.7	0.0	39.7	76	10.816	3.00 (2)	1.000	1/0	
33	39.9	0.0	39.9	76	10.845	3.00 (2)	1.000	1/0	
34	40.0	0.0	40.0	76	10.869	3.00 (2)	1.000	1/0	
35	40.0	0.0	40.0	76	10.863	3.00 (2)	1.000	1/0	

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Fig. 37 - Boreholes Info

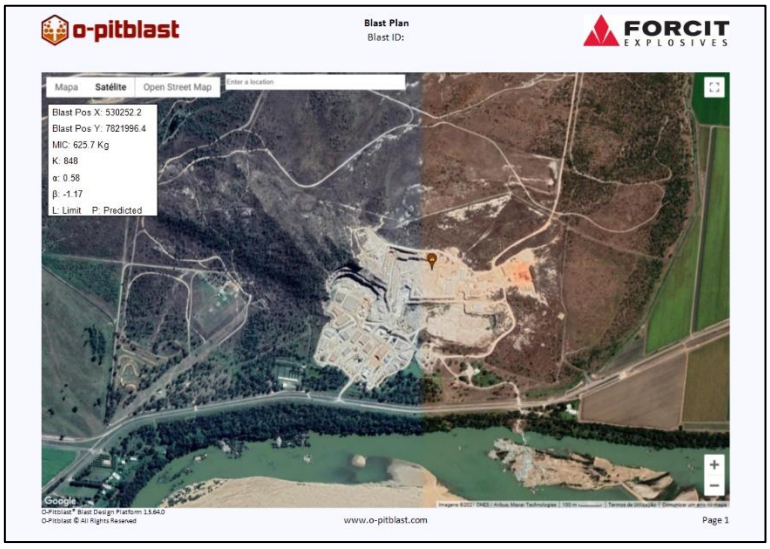


Fig. 38 - Map info

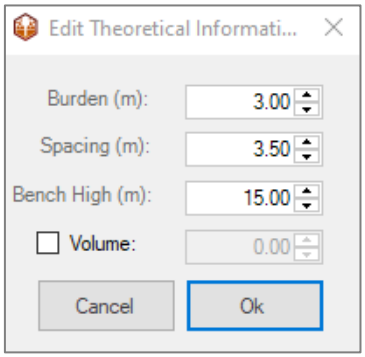
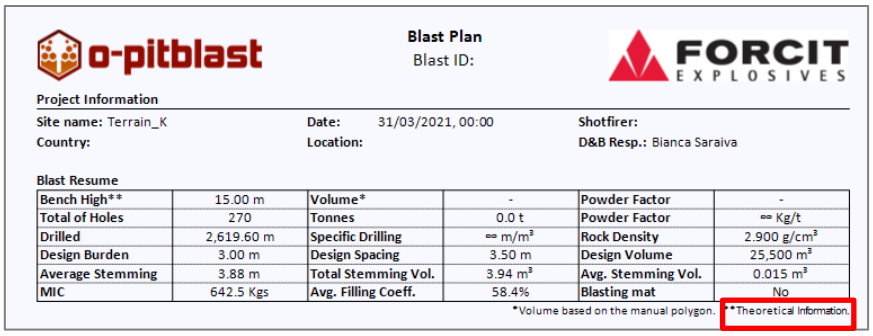


Fig. 39 - Edit Theoretical Information



o-pitblast

Blast Plan
Blast ID:

FORCIT EXPLOSIVES

Project Information

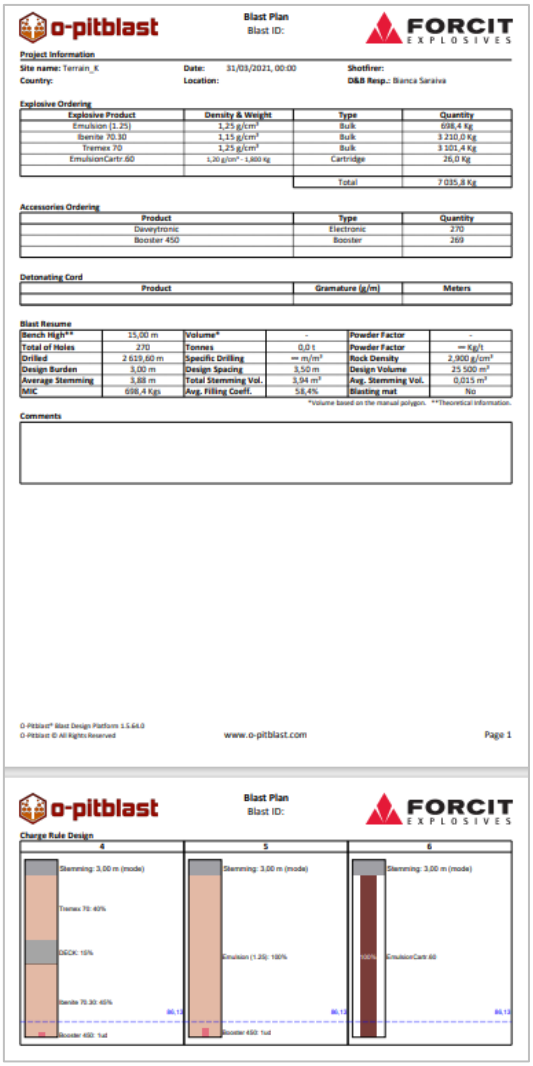
Site name: Terrain_K | **Date:** 31/03/2021, 00:00 | **Shotfirer:**
Country: | **Location:** | **D&B Resp.:** Bianca Saraiva

Blast Resume

Bench High**	15.00 m	Volume*	-	Powder Factor	-
Total of Holes	270	Tonnes	0.0 t	Powder Factor	∞ Kg/t
Drilled	2,619.60 m	Specific Drilling	∞ m/m³	Rock Density	2.900 g/cm³
Design Burden	3.00 m	Design Spacing	3.50 m	Design Volume	25,500 m³
Average Stemming	3.88 m	Total Stemming Vol.	3.94 m³	Avg. Stemming Vol.	0.015 m³
MIC	642.5 Kgs	Avg. Filling Coeff.	58.4%	Blasting mat	No

*Volume based on the manual polygon. **Theoretical Information.

Fig. 40 - Theoretical Information that can be added on the blast report



o-pitblast — Blast Plan — Blast ID: — FORCIT EXPLOSIVES

Project Information

Site name: Terrain_K | Date: 31/03/2021, 00:00 | Shotfirer:
Country: | Location: | D&B Resp.: Bianca Saraiva

Explosive Ordering

Explosive Product	Density & Weight	Type	Quantity
Emulsion (1.25)	1,25 g/cm³	Bulk	698,4 Kg
Ibenite 70.30	1,15 g/cm³	Bulk	3 210,0 Kg
Tremex 70	1,25 g/cm³	Bulk	3 101,4 Kg
EmulsionCartr.60	1,20 g/cm³ - 1,600 kg	Cartridge	26,0 Kg
		Total	7 035,8 Kg

Accessories Ordering

Product	Type	Quantity
Daveytronic	Electronic	270
Booster 450	Booster	269

Detonating Cord

Product	Gramature (g/m)	Meters

Blast Resume

Bench High**	15,00 m	Volume*	-	Powder Factor	-
Total of Holes	270	Tonnes	0,0 t	Powder Factor	∞ Kg/t
Drilled	2 619,60 m	Specific Drilling	∞ m/m³	Rock Density	2,900 g/cm³
Design Burden	3,00 m	Design Spacing	3,50 m	Design Volume	25 500 m³
Average Stemming	3,88 m	Total Stemming Vol.	3,94 m³	Avg. Stemming Vol.	0,015 m³
MIC	698,4 Kgs	Avg. Filling Coeff.	58,4%	Blasting mat	No

*Volume based on the manual polygon. **Theoretical Information.

Comments

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Charge Rule Design

Fig. 41 - Blast Plan- General Information

It is important to refer that the user needs to take a picture of the map (see Map Module) to get that information in the report.
The user can also add new pictures to the report, by clicking on “Add Pic” (Fig. 42) on the General Information.

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Fig. 42 - Add picture option

Then just need to choose how many external pictures wants to add (maximum 4 photos until 9 pages) and add them on the plus sign (Fig. 43).

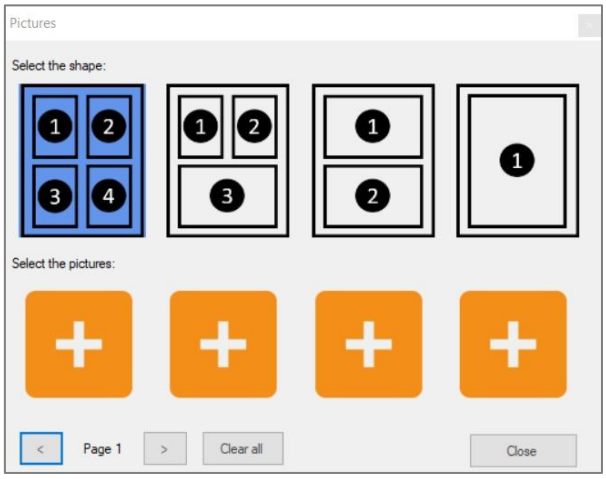

Fig. 43 - Add pictures to the report

6.3.6.6. Plans Information

O-Pitblast generates eight types of plans, **Drill Plan** (Fig. 45), **Tie-Up Plan** (Fig. 46 e Fig. 47), **Offset** Plan (Fig. 48), **Charge** Plan (Fig. 49), **EDZ** Plan, **Electronic Differences** Plan, **Drag Connection** Plan (Fig. 50) and **Hole´s Angle Analysis** Plan (Fig. 51) that can be managed in the section of Fig. 44.

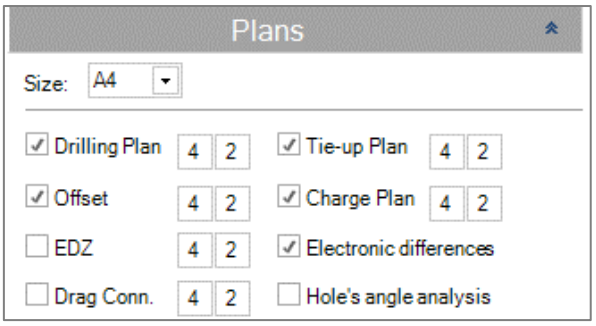

Fig. 44 - Printing Plan – Plans

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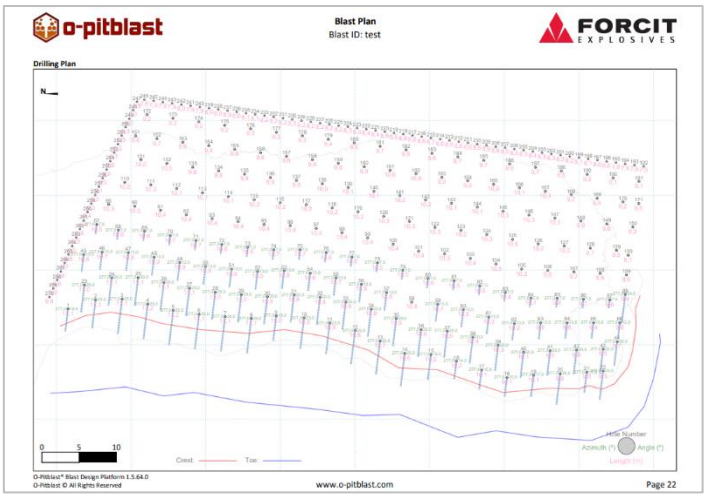

Fig. 45 - Drill Plan

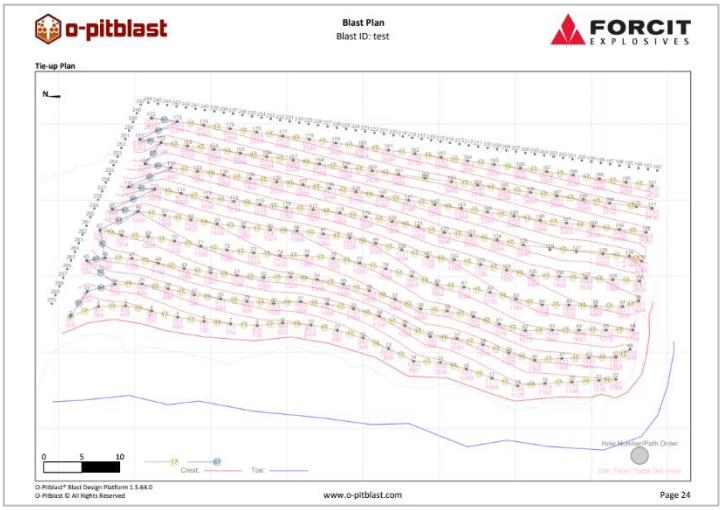

Fig. 46 – Tie-Up Plan

Fig. 47 – Tie-Up Plan: Isoline Arrows

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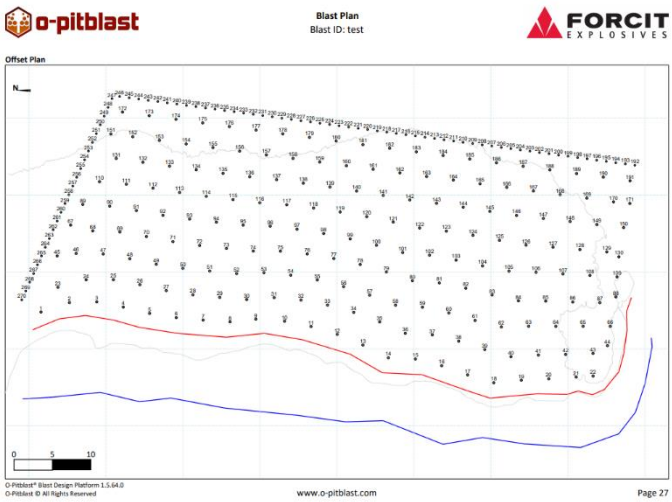

Fig. 48 - Offset Plan

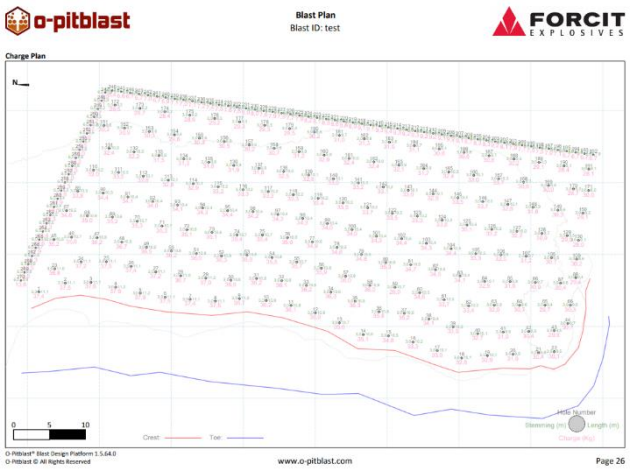

Fig. 49 - Charge Plan

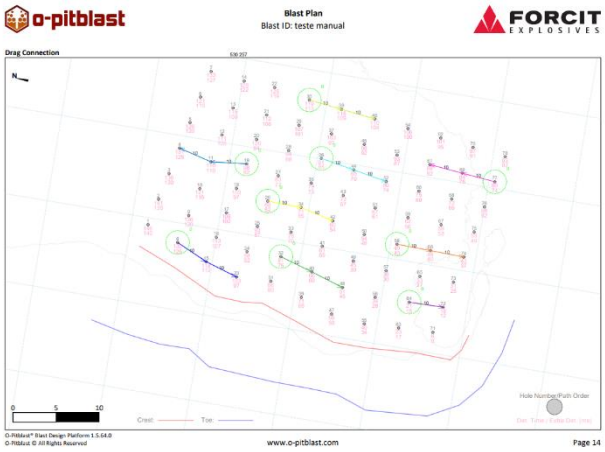

Fig. 50 – Drag Connection Plan

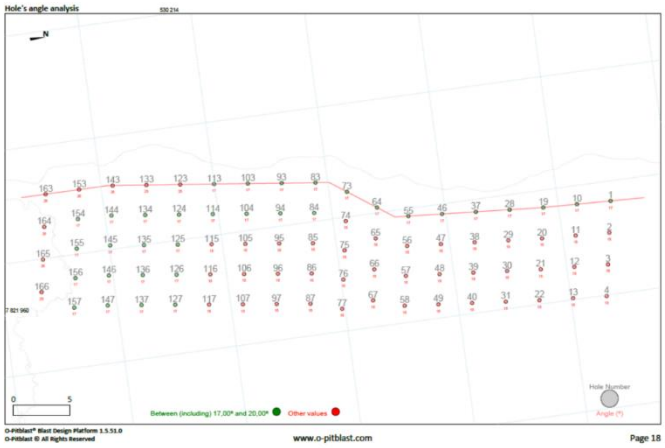

Fig. 51 – Hole´s Angle Analysis Plan

6.3.6.7. Plans Options

The Plans Options section permits the selection of some element to be present on plans: Azimuth and Angle, Contour Lines, Crest and Toe, Grid (selection of default values), Time Isolines, Isoline Arrows, Connector Label, Scale, Best Fit, Show Detonators Time, Use Label (instead of number of hole), Show Hole ID, Extra Detonators Time, Stemming/Length on Charge, Comments, Legend, Driller's Report Length (shows the longitude on driller's report), Electronic Path, Double Tie-Up Report, Print Zones (option to appear zones in the report, for example polygons) and the user can, within the field of the selected zone, choose whether to print the entire zone or a specific zone (polygon). The Print Points (option to appear points in the report, for example points from lines). The Best Fit option generates the best adjustment of the holes, crest and toe in the printed paper and it. If the user deselects this option, the user can adjust the plan by angle.

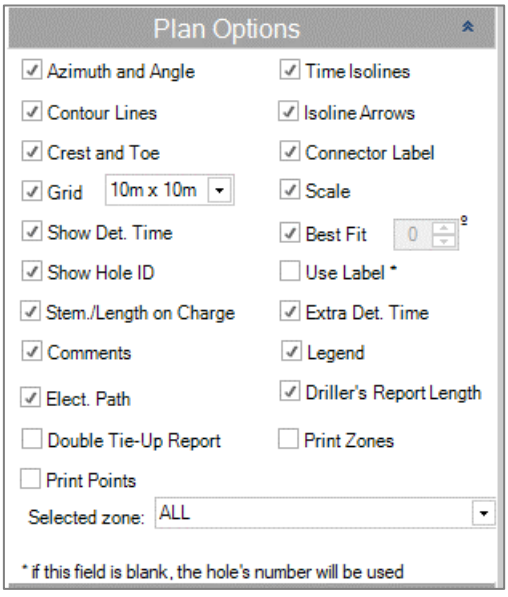

Fig. 52 - Printing Plan - Plans Options

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6.3.6.8. Save Configuration

The user can save the configuration that he wants in all report from there. Just need to create a configuration and save it to future refer. It also can delete a configuration.

Fig. 53 - Save Configuration. Buttons from left to right: load configuration, delete configuration and save a new configuration.

6.3.7. Options

Here the user has access to general options to change **currency** (Fig. 54), **unit system -** Fig. 55 **-** (the change it only will be applied when you restart O-Pitblast)**, Language** (Fig. 56) , select whether **to show coordinates in feet** (Fig. 57)**, terrain detail -** Fig. 58 **-** (up to a maximum of 500000 points), **auto save -** Fig. 59 **-** (that allows to automatically save the user work in .opit files - in a defined interval)**, Force Relief Tool** - Fig. 60 – activated tool when the software required, **Volume calculation** (Chapter 6.3.7.1), **line aspect** (solid line or traditional line - Fig. 61 and Fig. 62), **high performance** (the change it only will be applied when you restart O-Pitblast)**, electronic path** (Fig. 63 e Fig. 64)**, clearance zone** (Chapter 6.3.7.2), and possibility to see the **initial step by step** (that appears the first time that the user opens O-Pitblast). And in this section, it also possible to select blast simulation –cumulative delay: show nominal (Fig. 65). The user can use **Hole´s angle definition** – Fig. 66 - to assign steep holes in the Hole´s Angle Analysis Plan, according to the minimum and maximum angle entered. In addition, there is the **PPV isoline limit** which makes it possible to attribute the minimum desired value to appear on the map.

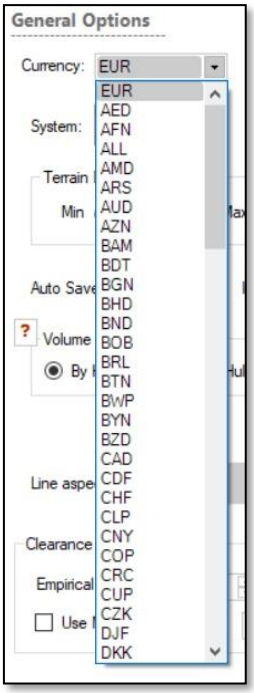

Fig. 54 - Change currency

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Fig. 55 - Change to metric/imperial system

Fig. 56 - Change terrain detail

Fig. 57 - Change terrain detail

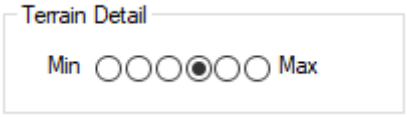

Fig. 58 - Change terrain detail

Fig. 59 - Auto Save option

Fig. 60 – Force Relief Tool option

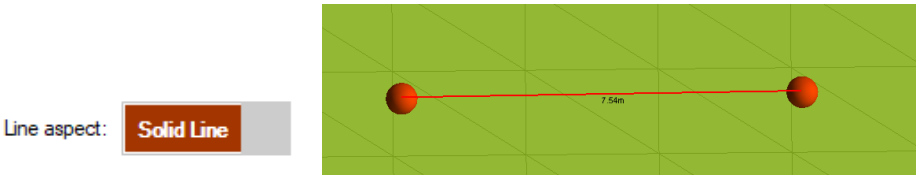

Fig. 61 – Solid line

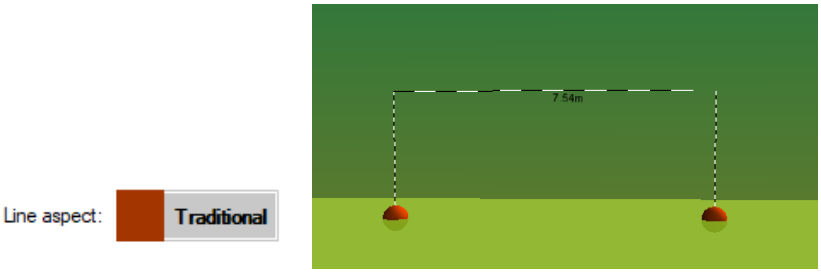

Fig. 62 - Traditional line

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Fig. 63 - Change to see Electronic Path as multiple paths

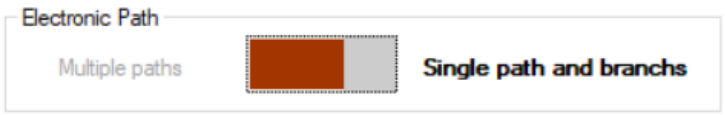

Fig. 64 - Change to see Electronic Path as single path and branch

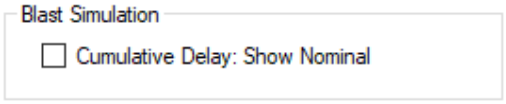

Fig. 65 – Select Blast Simulation

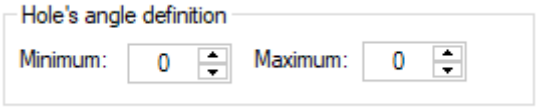

Fig. 66 – Hole´s angle definition

6.3.7.1. Volume Calculation

On the tab “Options”, the user has the possibility to choose different ways to calculate the blast volume.

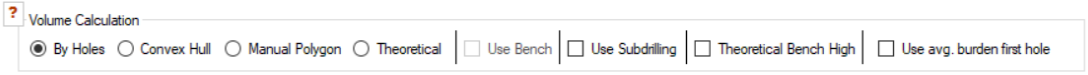

Fig. 67 – Options to volume Calculation

Below are described the different options to calculate the blast volume. Inside of each options the user as the option to include the **subdrilling**, to **use the bench** bottom (for Convex Hull calculation, instead of average length of the holes) to **use a theoretical bench height** value (inserted manually) or **use average burden on first row** (Fig. 68).

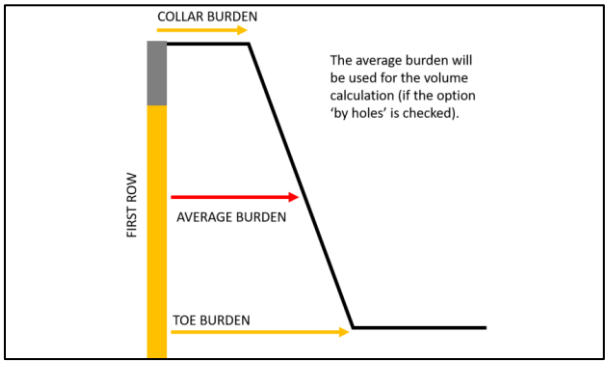

Fig. 68 - Collar burden vs average burden

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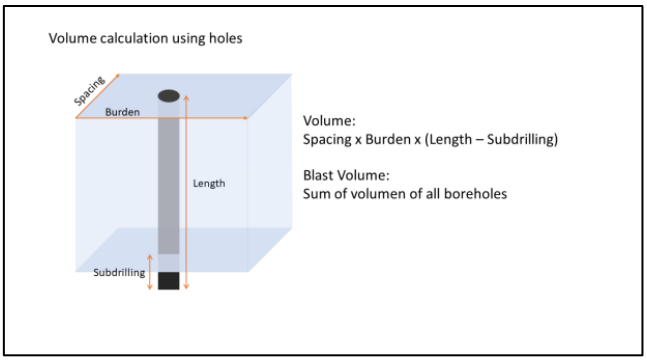

Fig. 69 - Volume calculation "By holes"

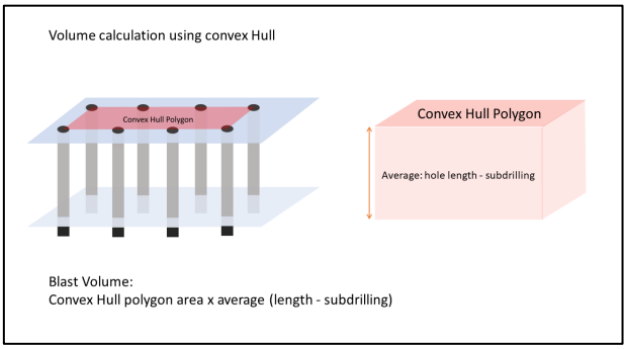

Fig. 70 - Volume calculation using "Convex Hull"

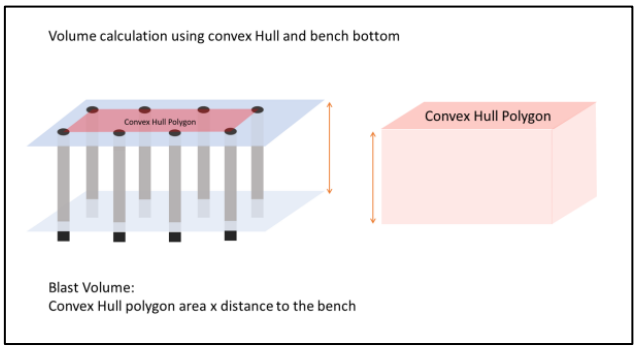

Fig. 71 - Volume calculation using convex Hull until bench bottom (instead of holes average length)

On the option “Manual Polygon” (Fig. 72), the user needs to design a polygon on the area he wants to be part of the volume calculation, right click over the zone and select the option “set as blast volume”.

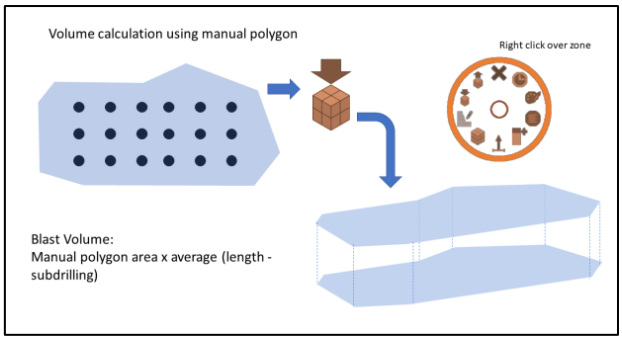

Fig. 72 - Volume calculation using manual polygon

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6.3.7.2. Clearance Zone

This option allows the user to define some factors for the clearance zone. The user must define an **empirical constant K**, as higher this constant as harder is the rock, and a safety factor for personal and equipment (Fig. 73). And the user must assign values to **Safety Factor** (personnel and equipment).
Like shown in the picture bellow (Fig. 74), the software will calculate the fly rock risk based in 3 different types: face burst, cratering and rifling. Then, it will have in account the worst case and will multiple the result for the safety factors. The user can also select whether to separate the fly rock risk calculation for the first line only by all or one of the 3 mechanisms mentioned above, including use crest as a limiter. In addition, for the other rows, it can also be calculated using the 3 types.

Fig. 73 - Calculation of Clearance zone

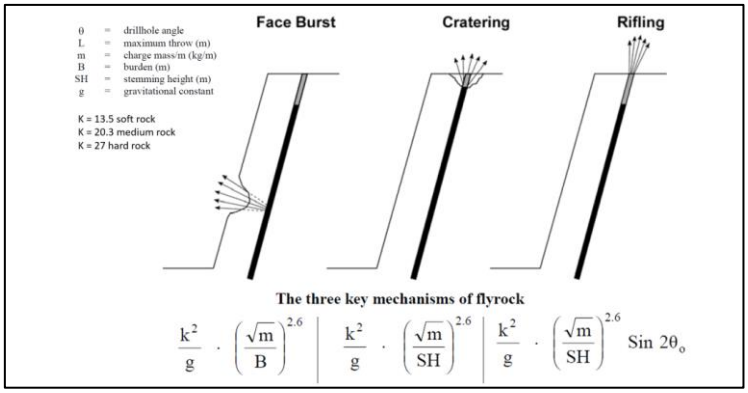

Fig. 74 - Face burst, cratering and rifling calculation

Another way to calculate it, it is to give manual values for the clearance zone (Fig. 75).

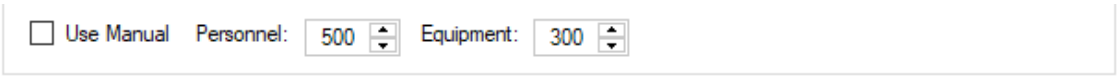

Fig. 75 - Manual input for clearance zone

6.3.8. Visible Options

The visible options allow the user to mark de option that he wants to see in the ribbon. The user can mark and unmark the **Topography** label, **Free-Face** label, **Boreholes** label**, Charge** Label, **Electronic** label, **Non-Electronic** label, **Blast Results** label, **Attenuation Law** label, **Home** label, and **Map** label.

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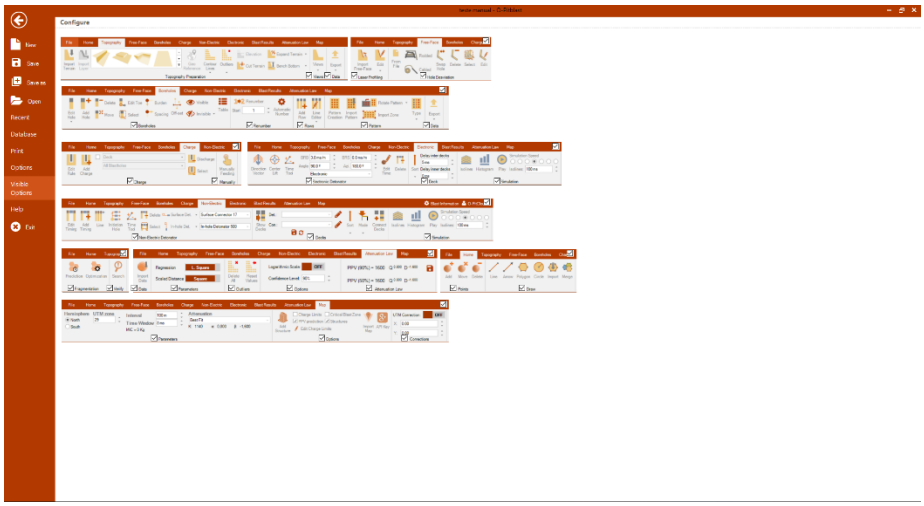

Fig. 76 – Visible options tab

6.3.9. Help

Through the **Help** tab, the O-Pitblast user will have access to **O-Pitblast Website**, to a platform to **Contact** O-Pitblast team, several **Movie Tutorials** and other interest connections.

Fig. 77 - Help Tab

6.3.9.1. Ask for Help

This option (Fig. 78) allows the user to open a new ticket where the O-Pitblast file is send to the server with the error reported. Also, the user can add a **tittle** (referring the question/problem), **comments** explaining the problem/question and **pictures** (on the plus sign).

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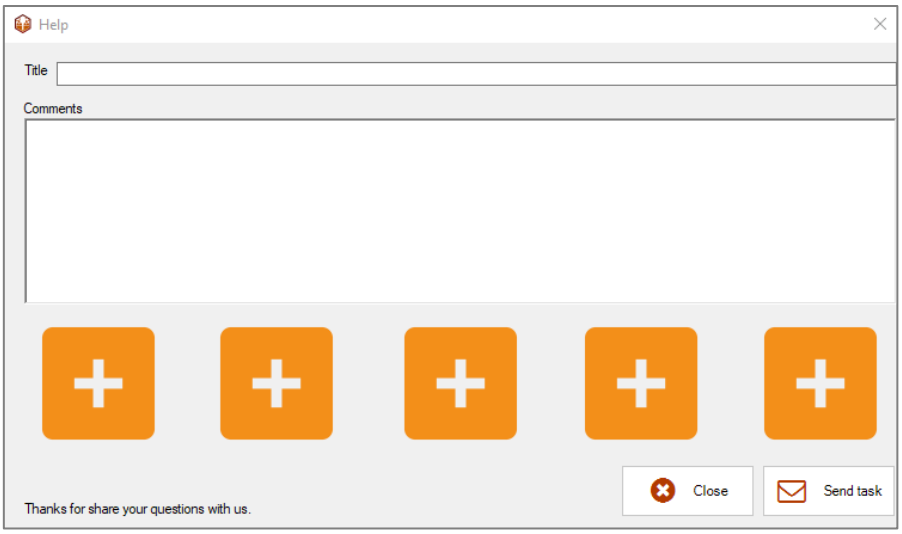

Fig. 78 - Ask for help tab

6.3.10.Exit

By clicking in the **Exit** tab, O-Pitblast will shut down.

6.4.Tool Box

Tool box centralize all the useful means to control the visual effects of the working environment. It is divided in 7 sub-categories with an extra **Centralize** button to center the terrain in the user screen, an Extra **Size View** and an extra **Ruler** button that will help the user to make measurements on the terrain and check the angles. To all these sub-categories, the actions will only be applied after clicking in the confirmation button **Ok**.

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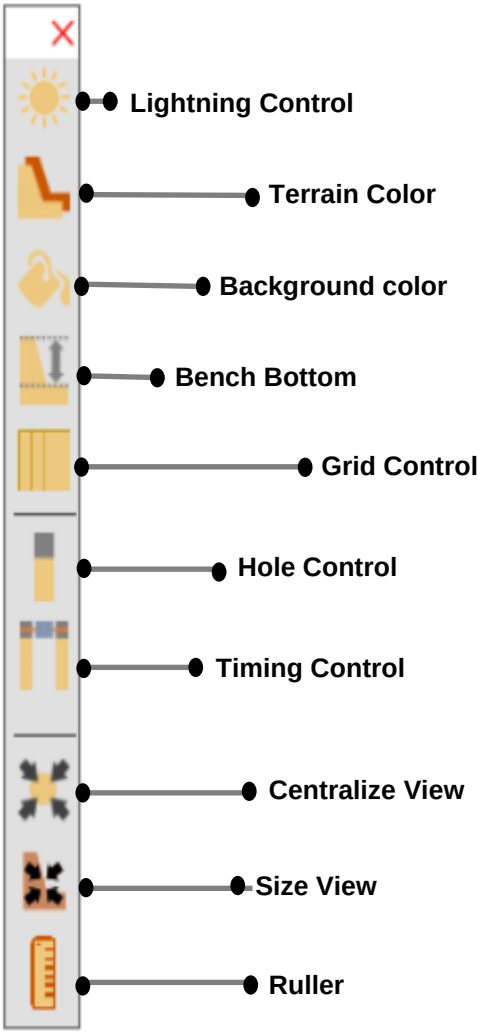

Fig. 79 - Tool Box Window

6.4.1. Lighting Control -

In the **Lighting Control Window** (Fig. 80), the user can control the light **Intensity** as also as the incident lighting vector direction (**X** and **Y**).

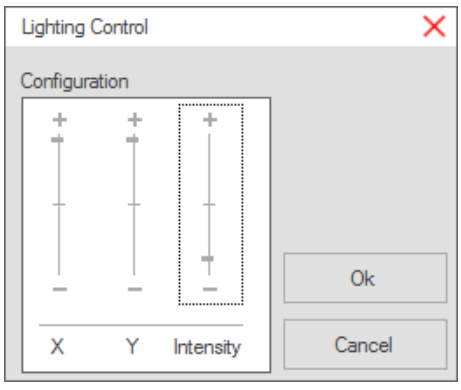

Fig. 80 - Lighting Control Window

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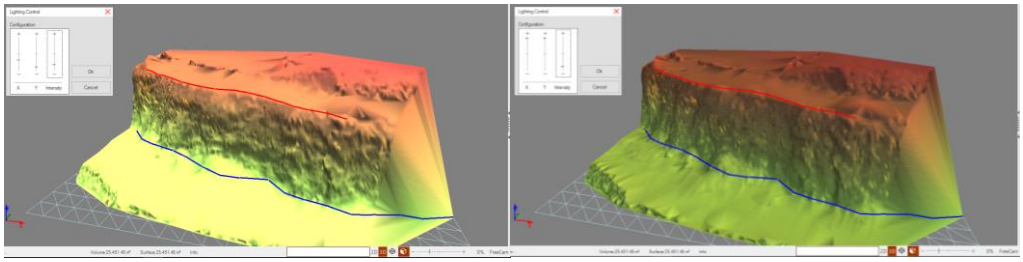

Fig. 81 - Lighting Control

6.4.2. Terrain Color -

To change the terrain visualization characteristics, in the **Terrain Color Window** (Fig. 82)**,** the user can modify:

- Main terrain Color or Layer color
- Triangulation type (**Solid** or **Wire**)
- Scan points
- Transparency
- Delete layers

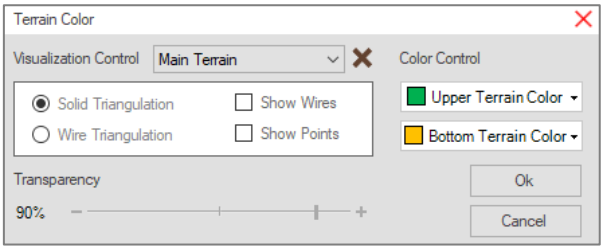

Fig. 82 - Terrain Color Window

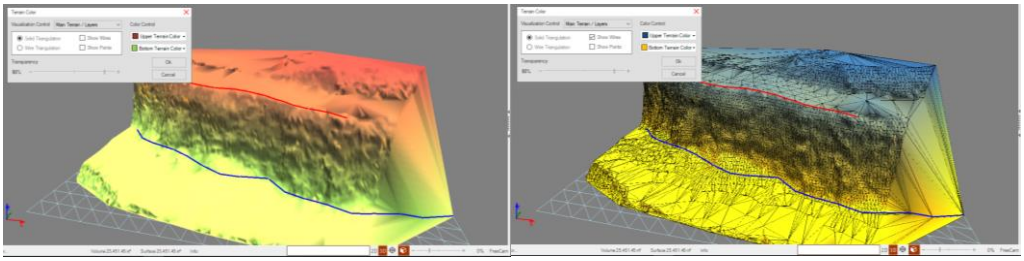

Fig. 83 - Terrain Color Edition

6.4.3. Background Color -

The **Background Color Windows** (Fig. 84) allows the user the change the Background color

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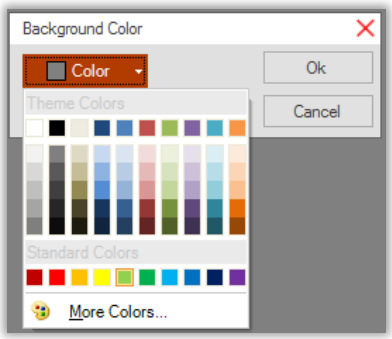

Fig. 84 - Background Color Window

6.4.4. Bench Bottom Control -

In the **Bench Bottom Control Window** (Fig. 85), the user can adjust the bench bottom level, inclination, azimuth, color and triangulation type (solid or wire). Also, the user as the option to “Set layer” where he can create new layers of work (Fig. 87 - Two layers of work (red and black)).

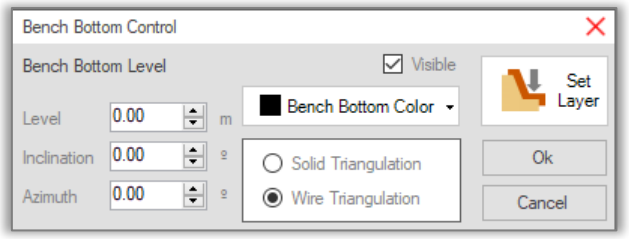

Fig. 85 - Bench Bottom Control Window

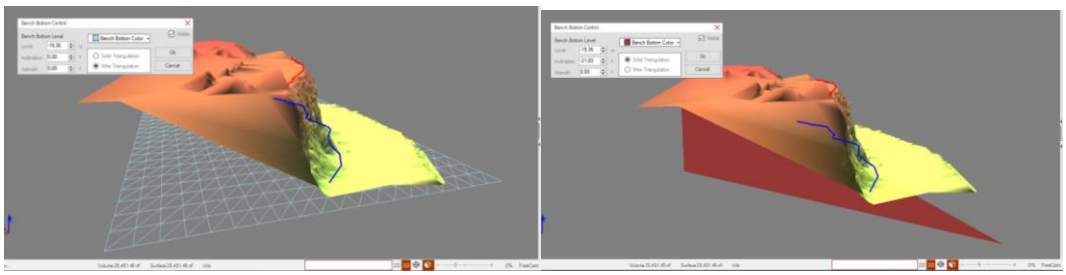

Fig. 86 - Bench Bottom Edition

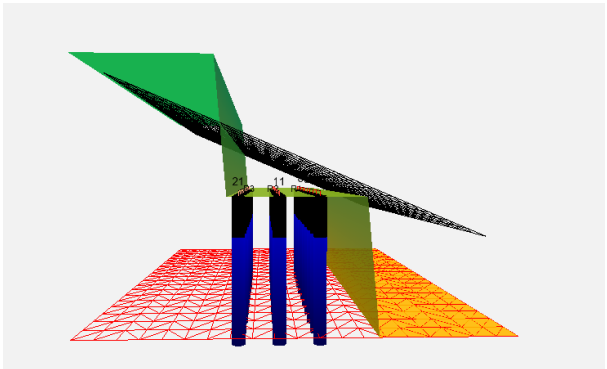

Fig. 87 - Two layers of work (red and black)

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6.4.5. Grid Control

The **Grid Control** allows the user the change the **grid** (meters), **color** or if is **visible** or not.

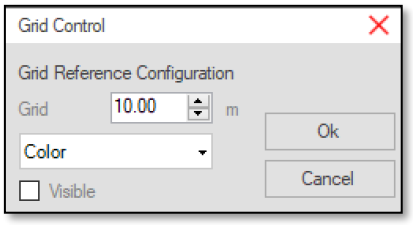

Fig. 88 - Grid control

6.4.6. Hole Control -

The **Hole Control Window** (Fig. 89) controls the hole visualization characteristics such as type color, diameter scale.

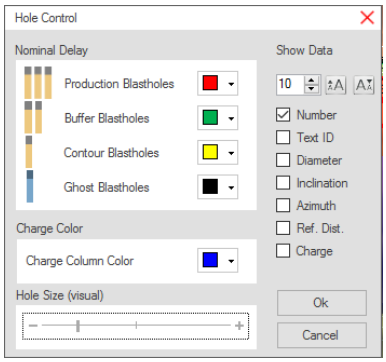

Fig. 89 - Hole Control Window

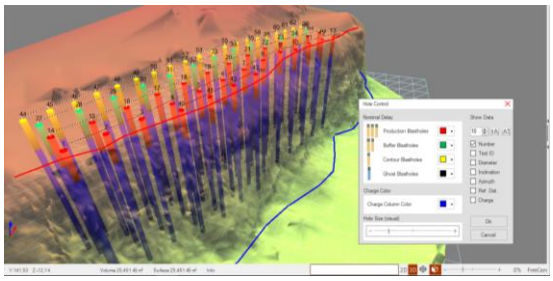

Fig. 90 - Holes visualization control

6.4.7. Timing Control -

In the Timing Control Window (Fig. 91), the user can establish the visualization of the nominal times of connectors or/and cumulative blast delays of each hole. Besides that, is possible to control de size of connector cylinders and text sizes.

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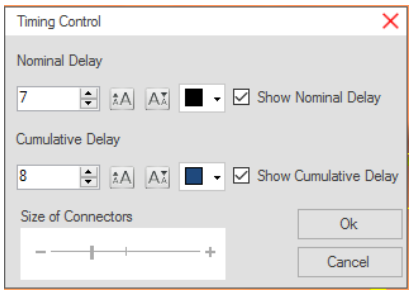

Fig. 91 - Timing Control Window

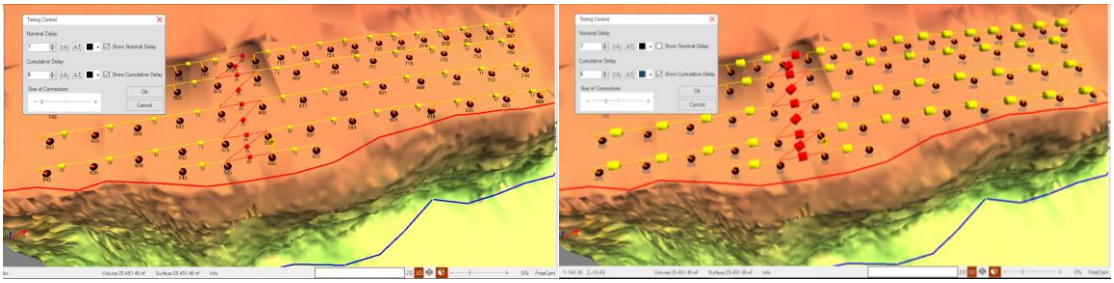

Fig. 92 - Editing Connectors

6.4.8. Ruler -

In the **Ruler** options the user can measure any part of the terrain, such as length of borehole or the burden between two holes. Just click on the ruler option and click in a point on the terrain. Then drag the mouse until the other point (the two points of measure).

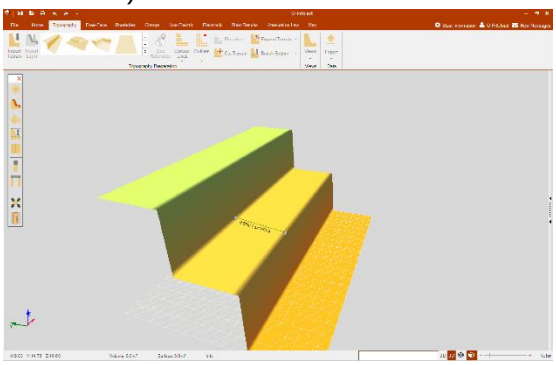

Fig. 93 – Ruler tool (measurement view)

One left-click on the measurement and it will appear the angles.

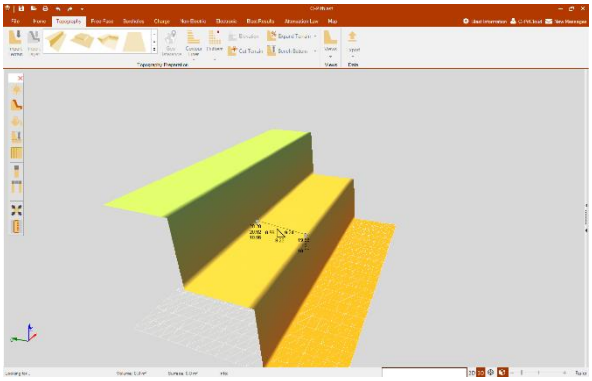

Fig. 94 - Ruler tool (angles view)

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And finally, two left-clicks and it will pop up a window to create a new label to that measurement. And the user can change the XY size and the azimuth.

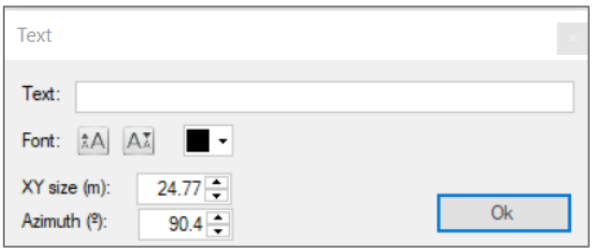

Fig. 95 - Label window

To see the distance between a collar and a bottom (of two different holes), the user needs to click in CRTL + on the sphere above the hole. The same thing to see the distance between two bottoms (Fig. 96 - Distance between two bottoms (CRTL + click on orange spheres)).

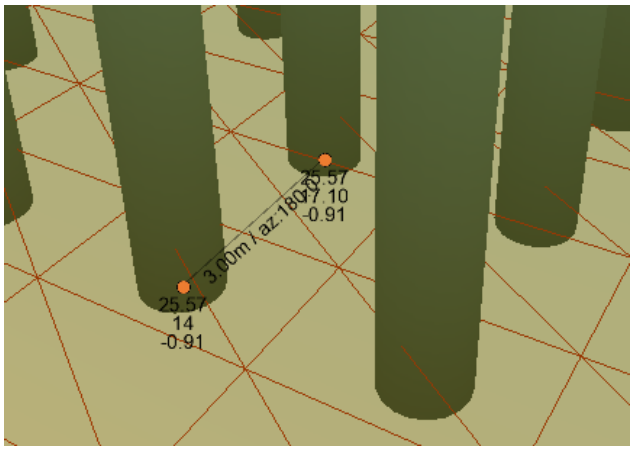

Fig. 96 - Distance between two bottoms (CRTL + click on orange spheres)

To delete the ruler, the user must click on CRTL plus the right button over the ruler.

6.5. Work Environment

The work environment is the area where the project terrain will be shown which the user can edit, change and add planning elements. It has three views (2D, 3D: parallel (orthogonal) view and perspective).

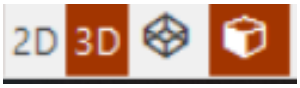

Fig. 97 – From the left to the right: 2D view, 3D view, orthogonal view and perspective view.

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6.6. View Pane

The view pane allows the user to select several view options.

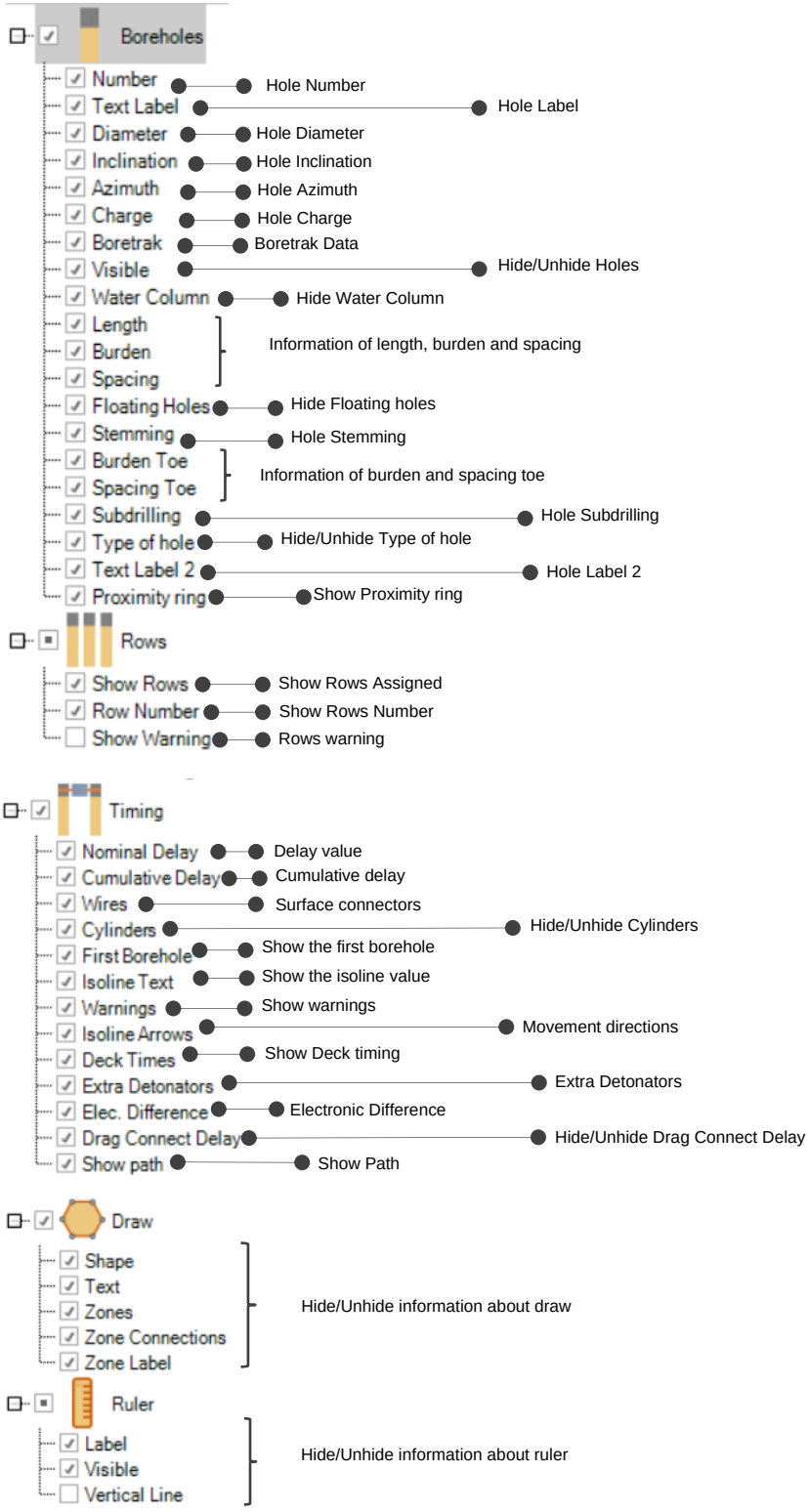

Fig. 98 - View Pane

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6.7. Operation Control Tab

In the **Operation Control Tab** (Fig. 99) the user can observe information like:

- Mouse coordinates
- Terrain volume
- Terrain area
- Hided holes
- Status info
- Status bar
- View perspectives
- Control zoom
- Stage info

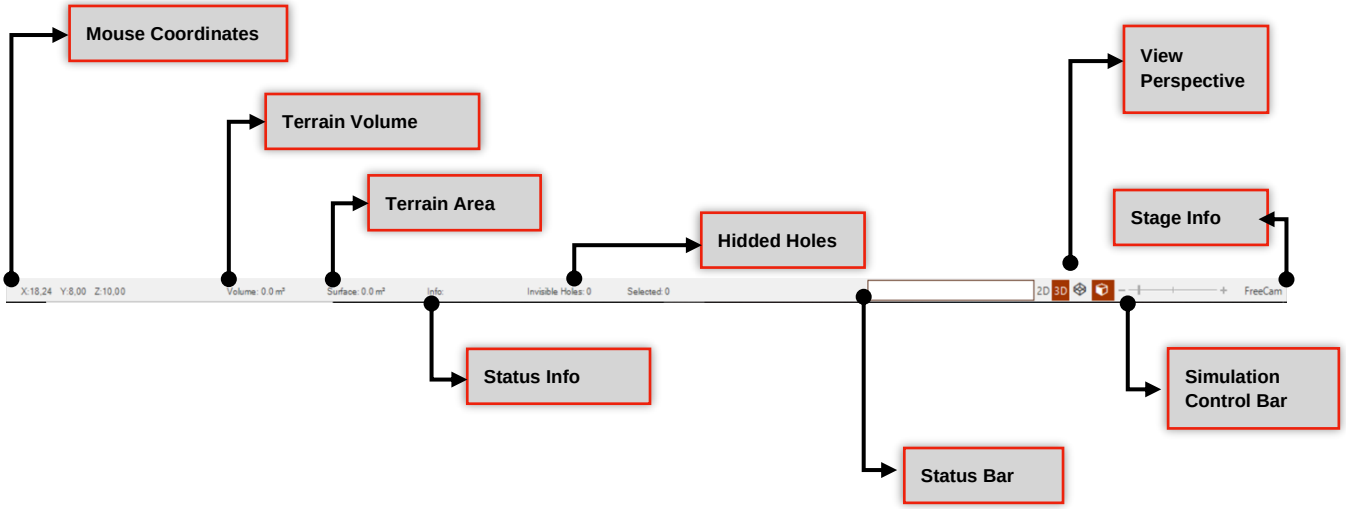

Fig. 99 - Operation Control Tab

6.8. Borehole Radial Menu -

The **Borehole Radial Menu** pretends to be an easy and useful tool to use key functions. This radial menu appears when pressing the mouse with the right-click button in one hole. Fig. 100 displays the main functions available in this menu.

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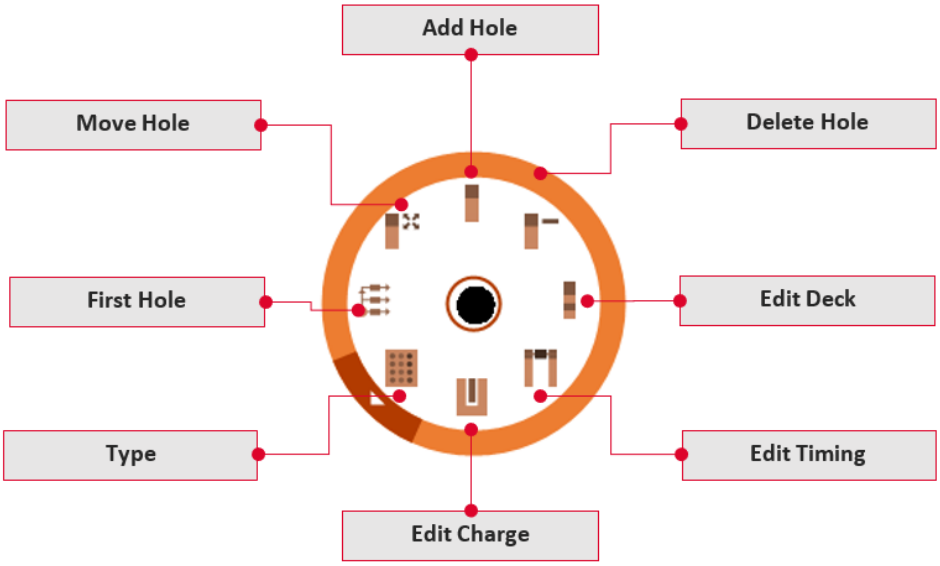

Fig. 100 - Borehole Radial Menu

7.Home

Home module includes tools that allows to add points, polygons, circles, arrows, etc.

Fig. 101 – Home module

Icon		*Description*
	Add point	Add a new point and use it to create lines, arrows, etc.
	Move point	Update the position of a point
	Delete point	Delete all points
	Import point	Import points for your terrain
	Line	Add a new line
	Arrow	Add a new arrow
	Polygon	Create a new polygon
	Circle	Add a new circle

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	Import	Import several polygons from an external file
	Merge	Merge zones and create new ones

7.1. Add, Move, Delete and Import Points

The user can add a new point by clicking on the Add symbol and by pressing the left button of the mouse on the terrain.

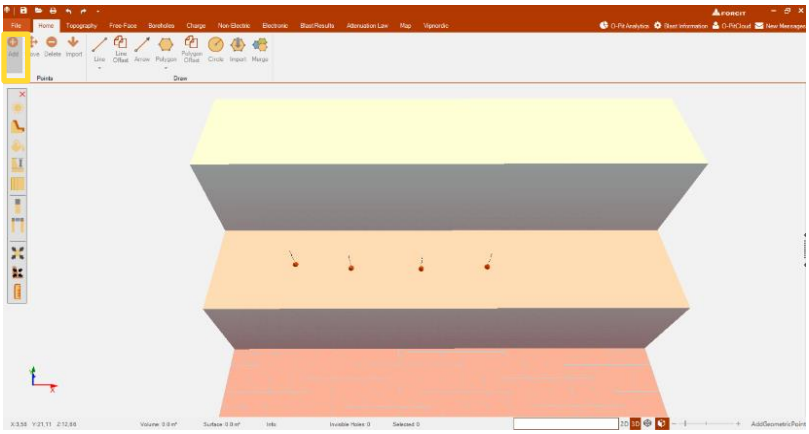
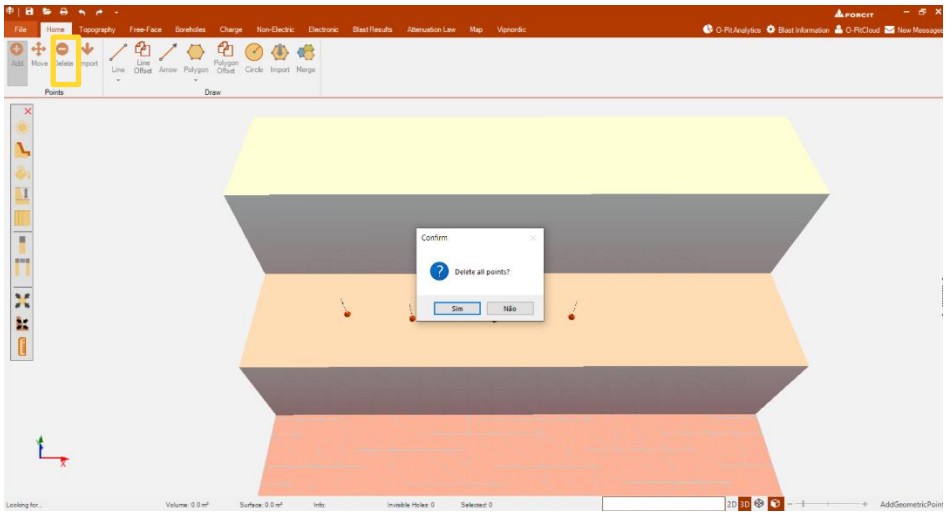


Fig. 102 – Add new points

The user can move a point by clicking on the **Move** button by left-clicking on a point and drag it to another place.
The user can delete all points by clicking on the **Delete** button.



Finally, the user can import points by clicking on the **Import** button.

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7.1.1. Add, Move and Delete One Point

The user can do the same things just to one point with the singular menu. This menu appears when pressing the mouse with the right-click button in one point. The picture bellow displays the main functions available in this menu.

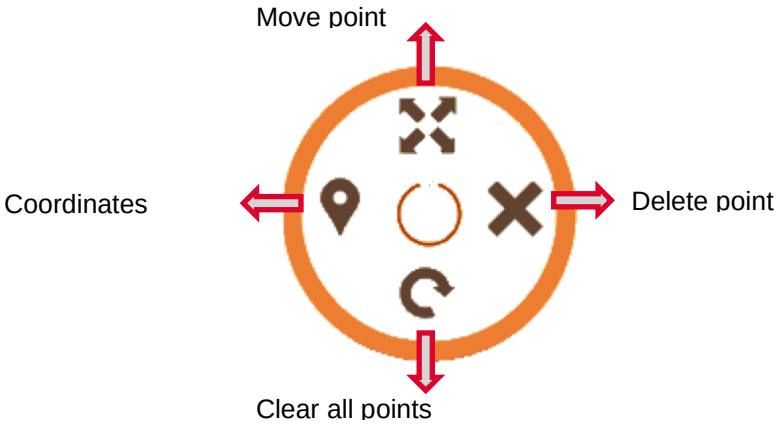

Fig. 103 – Menu of a singular point

The **Coordinates** option opens a window that allows the user to input the coordinates that he wants.

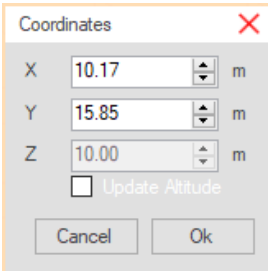

Fig. 104 -Coordinates window

7.2. Create Draw

7.2.1. Create Lines, Arrows Polygon and Circle

The user can create a new line and a new row by clicking on the **Line** button and click in any place of the terrain and drag the mouse (without drop) to another point.

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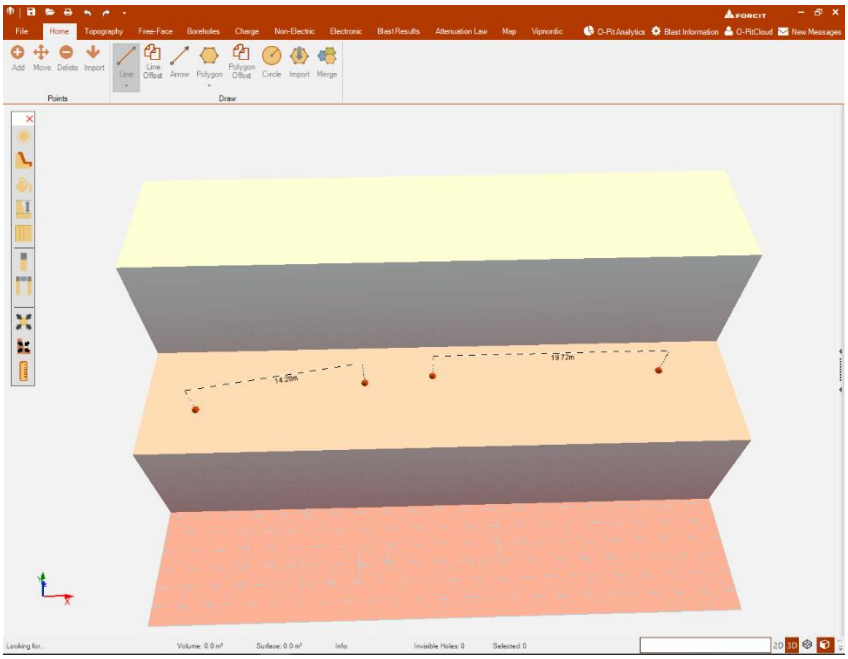

Fig. 105 – Create a new line

Also, inside of the line option (Fig. 106), the user has the option to **import a file** with the coordinates of a line, export as an external file .dxf (Fig. 106), and to create **a vertical line** that will show him the distance (vertical distance) from that point until the bench bottom - left click on the terrain to mark the point - (Fig. 108)

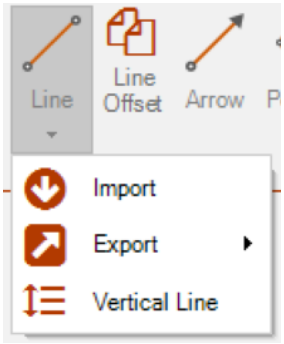

Fig. 106 - Option to import line and see a vertical line

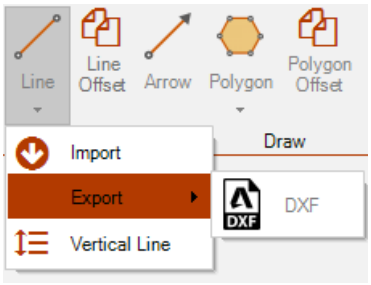

Fig. 107 - Option to export line as .dxf

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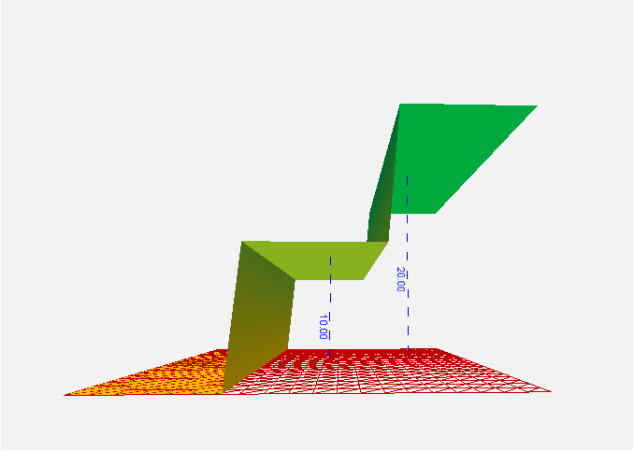

Fig. 108 - Vertical line option (left click on the terrain to mark the point)

To create polygon the user must left click on the mouse in the terrain and draw the polygon that he wants.

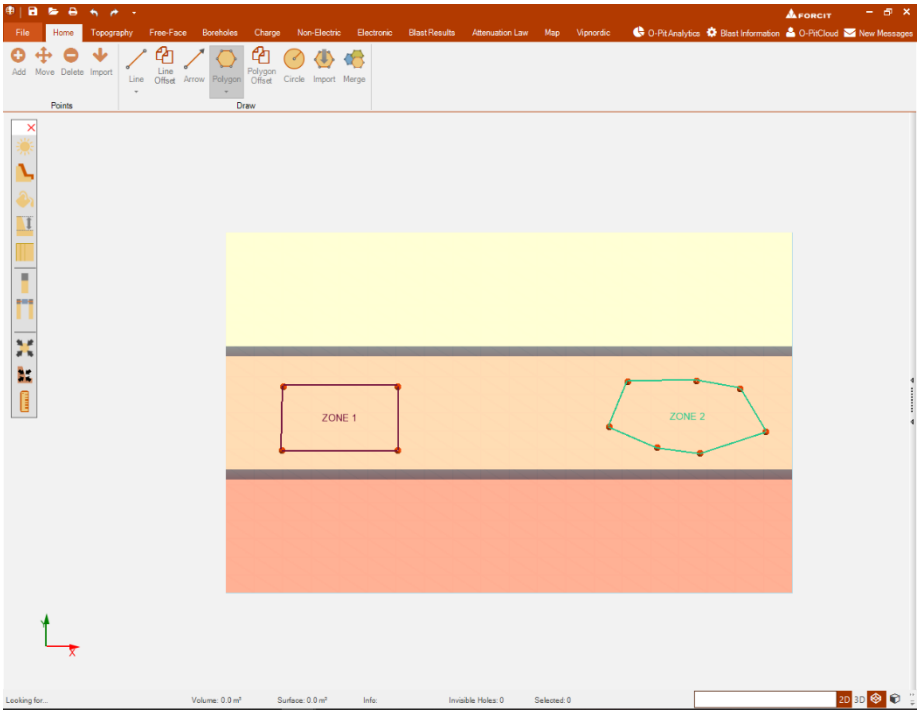

Fig. 109 – Create a new polygon

Also, inside of the polygon icon the user has the option **use crest** (Fig. 110). If there is a crest defined the user can use this option. This button will use the crest point the help the user to easily create a new polygon.

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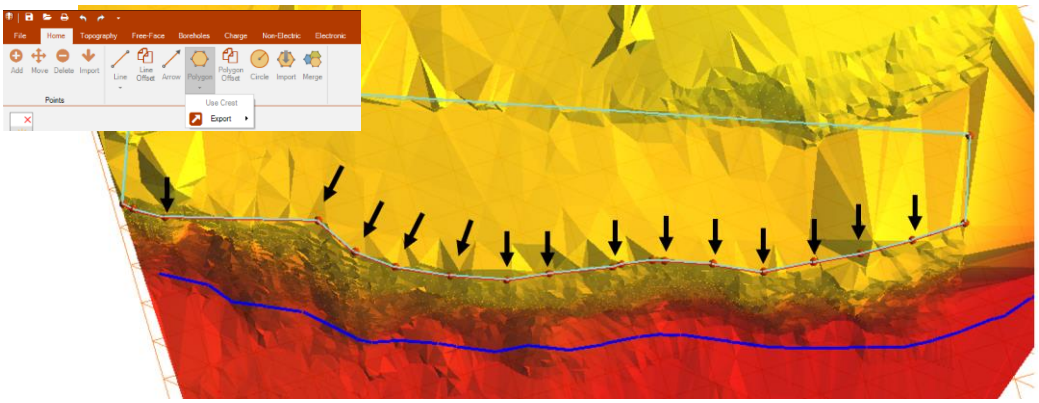

Fig. 110 - Use crest option

And finally, it is possible export the polygon as .dxf file too.
To create circle the user must left click on the mouse in the terrain and draw the circle where he wants.

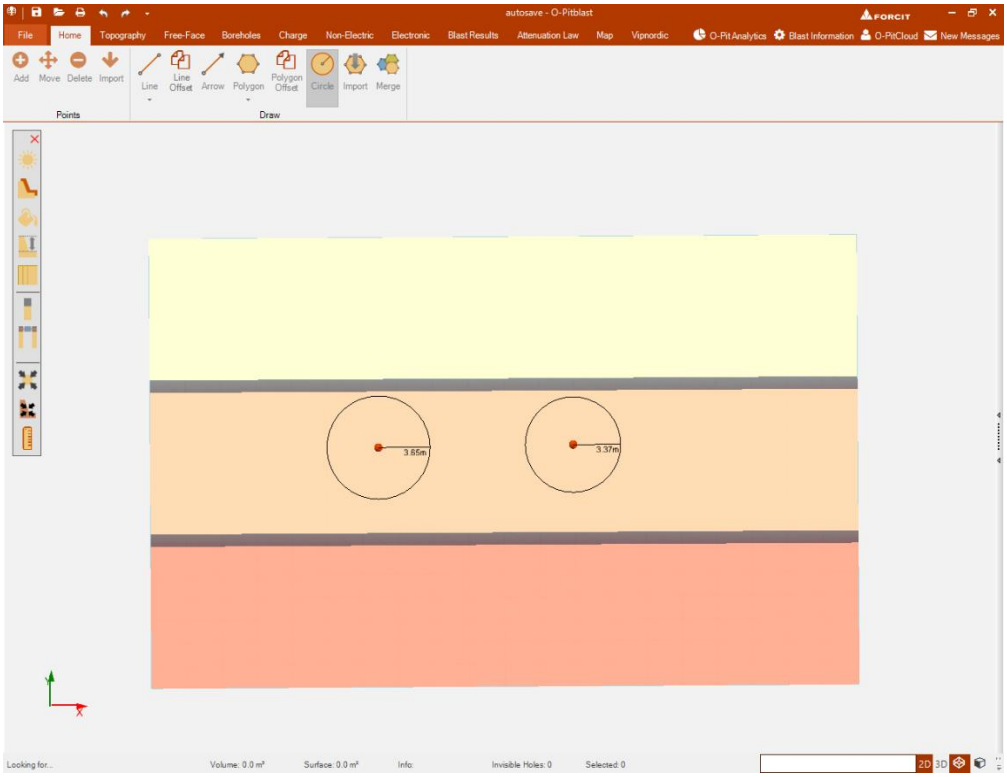

Fig. 111 – Create circle

7.2.2. Line Offset

The user can use the line offset tool to duplicate a previous line created. After clicking on this tool, a pop-up window will appear to insert the desired offset value, and then it is necessary to click on the line.

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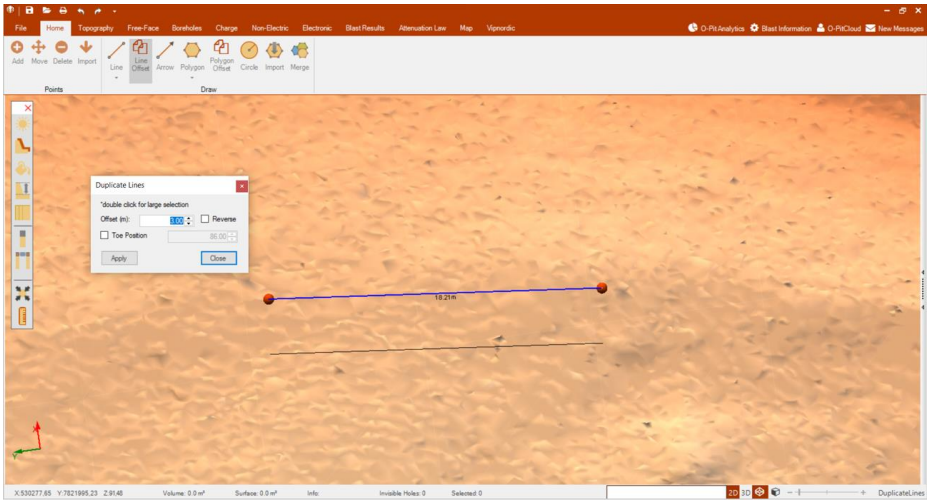

Fig. 112 – Line offset option (duplicate lines window)

7.2.3. Polygon Offset

The user can also create a polygon offset using the tool “polygon offset”.

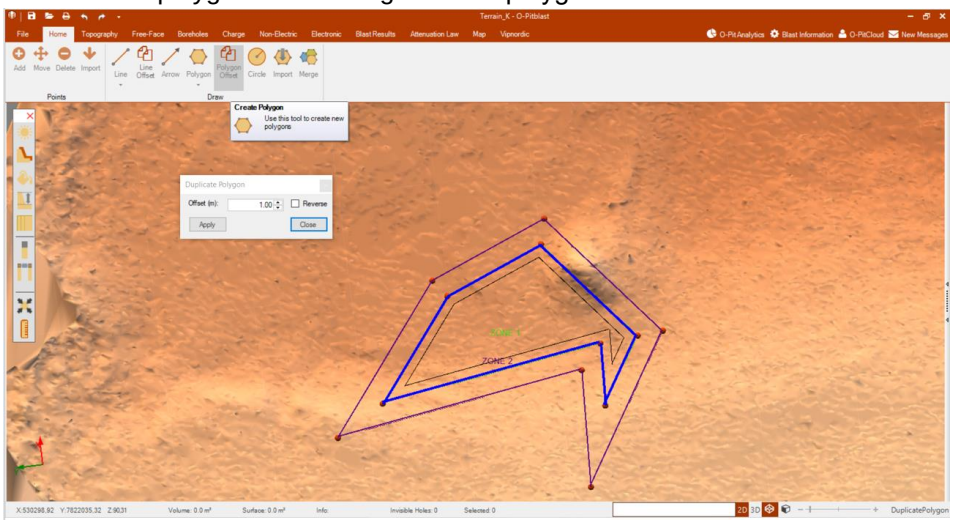

Fig. 113 – Polygon offset option (duplicate polygon window)

7.2.4. Import Polygon

To import a polygon the user can click on the button **Import** and upload .dxf .xml .csv files. Also, the user as the option to change the coordinate system of the data (see **Topic 47**).

7.2.5. Merge

The user can merge different polygons to create a new one. First, he clicks on the button **Merge** and it will pop up a window (Fig. 114) to choose the zone that the user wants to merge. Then he can delete the selected zones by checking the box that said **Delete selected zones**.

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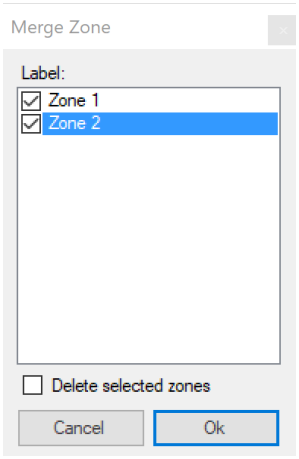

Fig. 114 – Merge zones window

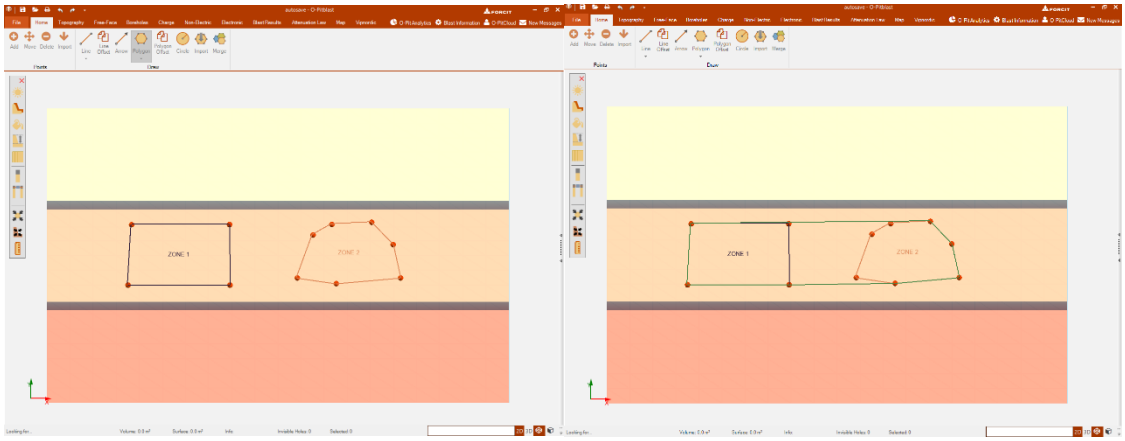

Fig. 115 –Left (A): Two separated polygons; Right (B): Merged zone

7.3.Zone Menu

This module also as another menu, that appear when a polygon is created when the user right-clicks inside of the polygon zone. In the picture bellow we'll see the main options.
Clicking on the **Delete** and **Delete Points** button the user will erase the polygon/points of the polygon. By clicking on the **Add Hole** button will create a pattern (10.8.1) inside of the polygon area. Clicking on **Edit Label** will create a label – the user must insert a name/description for that label. The **Change Polygon Color** button will allow the user to change the polygon color. The button **Export Zones Points** will generate a .csv file with coordinate system of the points of the polygon. The **Show Volume** button will tell the user the volume of the terrain inside of the polygon. Finally, the button **Edit timing** (Fig. 118) will let the user to add a translation delay (ms) in the timing of the boreholes (when using electronic detonators). Also, the user as **the Volume Calculation** option, where he can set the zone to be included or excluded on the volume calculations (Chapter 6.3.7.1 and Fig. 117).

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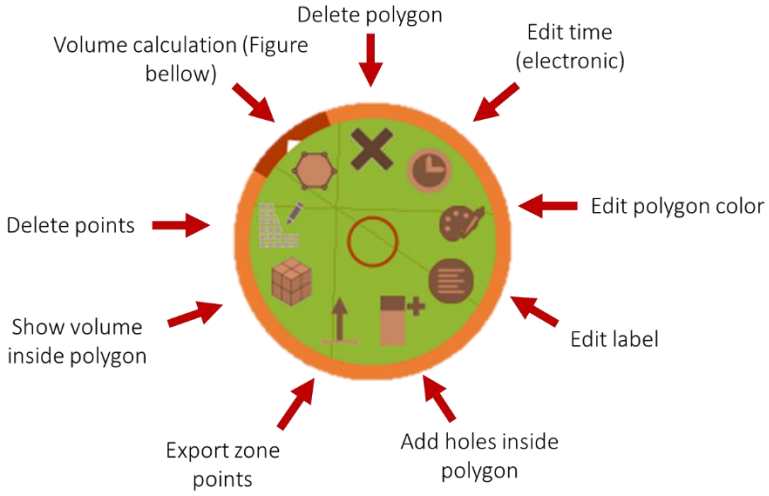

Fig. 116 – Zone Menu

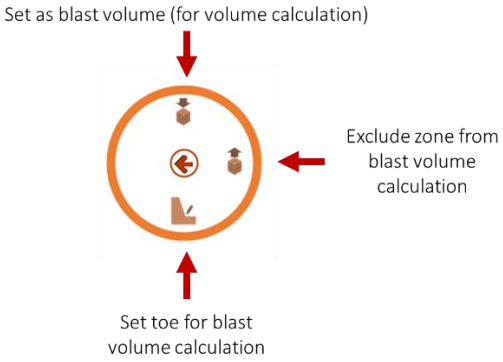

Fig. 117 - Blast volume calculation options

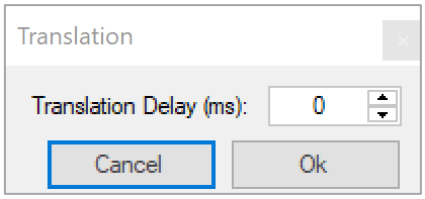

Fig. 118 – Add Timing Window

8.Topography

Topography module includes all the important tools for terrain importation and edition.

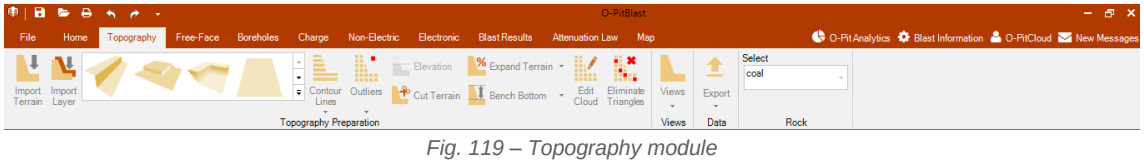

Fig. 119 – Topography module

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8.1. Topography preparation

Icon		Description
	Import Terrain	Import terrain from file (.xyz, .xls .str .csv)
	Import Layer	Import Layer from file. A Layer can be a terrain element, orebody stratum or any geometrical shape.
	Geo-Reference	Geo-Reference a terrain tool. This tool allows the geo-reference a terrain or free face scan, having field reference points.
	Outliers	Outliers detection tool. Some terrains or Laser scans have outliers' points such as out of range pick-ups or dust refraction point. This algorithm eliminates those noises to the minimum level.
	Terrain	Terrain outlier elimination tool.
	Crest/Toe	Crest/Tool outlier elimination tool.
	Terrain Styles	This tool allows the user to create or use a pre-stipulated topography.
	Elevation	Elevation edition tool. This tool allows the manual edition of the terrain, selectin an area and changing its elevation
	Cut Terrain	Cut terrain tool. This tool permits the cutting of a determinate terrain in order to define a precise work area.
	Expand Terrain	Expand terrain tool. With this tool the user can expand a determinate work terrain.
	Bench Bottom	Bench Bottom control. Bench bottom definition tool
	Views	This tool allows the user to see some crucial points of the terrain like the free-face and isolines.
	Export	The user can export their data about the terrain and contour (.csv files).
	Bench Bottom	The user can change the bench bottom elevation, inclination and azimuth.
	Contour Lines	The user can see the terrain isolines and define the interval (meters) and if want them visible or invisible.
	Edit Cloud	The user can eliminate cloud points from the terrain.
	Eliminate Triangles	The user can eliminate triangulation triangles from the terrain.
	Select	The user can select the type of rock associated to that terrain.

8.1.1. Importing terrain -

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By clicking in the import terrain icon, a selection window will appear in order to select the terrain file (Fig. 120).

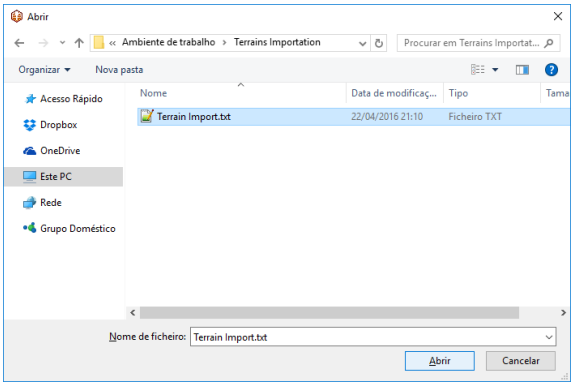

Fig. 120 - Import terrain window

The user must attribute the X, Y and Z values to North coordinates, East coordinates and elevation coordinates, respectively (Fig. 121) and click **Import coordinates** (Fig. 124).

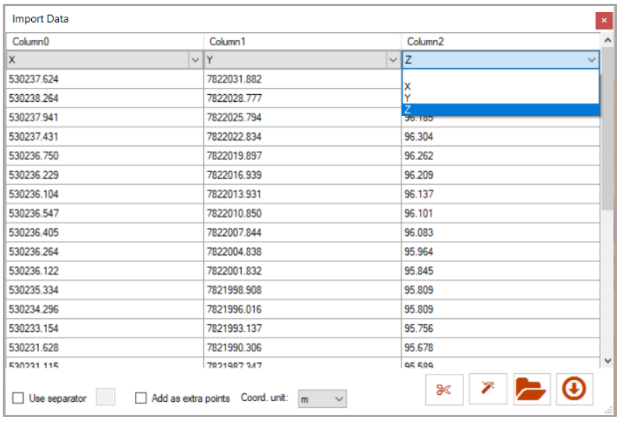

Fig. 121 - Correlating XYZ values with North, East and Elevation

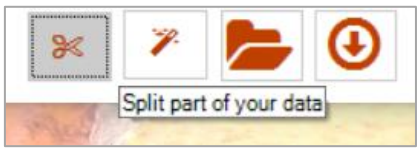

Fig. 122 – Split part option

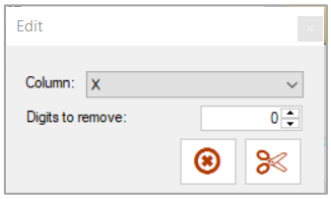

Fig. 123 – Split part – Edit window: Curt part of your data

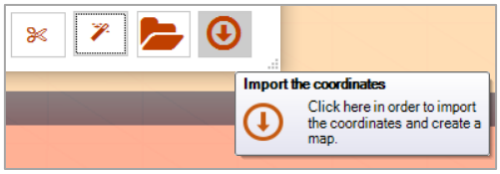

Fig. 124 - Importing terrain

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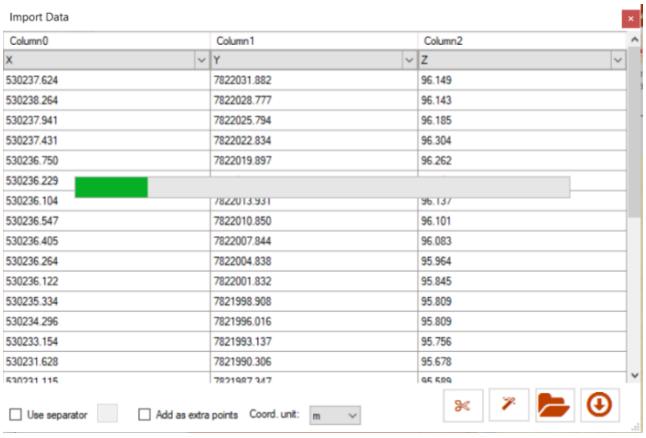

Fig. 125 - Loading Terrain

8.1.2. Coordinate System

With this option the user as the possibility to change the X, Y, and Z from one coordinate system to other.

First, the user must choose the X, Y and Z of raw data (Fig. 121). Then clicks on the coordinate system ( ) icon on the import terrain system window.
After that it will pop up a window (Fig. 126) where the user must choose from/to which coordinate system that he wants.

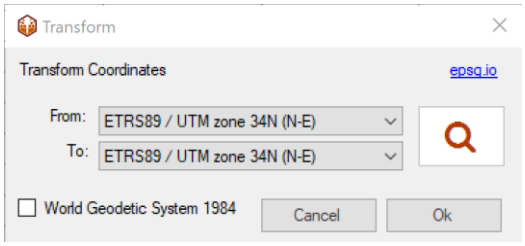

Fig. 126 - Choose from/to coordinate system window

Then the handler chooses magnifier glass (Fig. 127) to search for new coordinate systems.

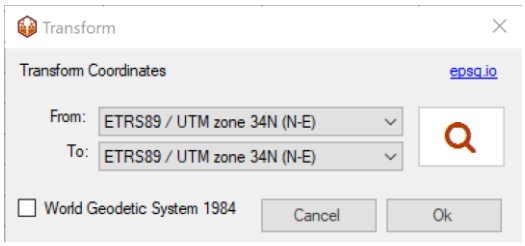

Fig. 127 - Search new coordinate system

This will open a new window (Fig. 128) here the user can search for the new coordinate system through:

- ETRS;
- Name;
- UTM ZONE.

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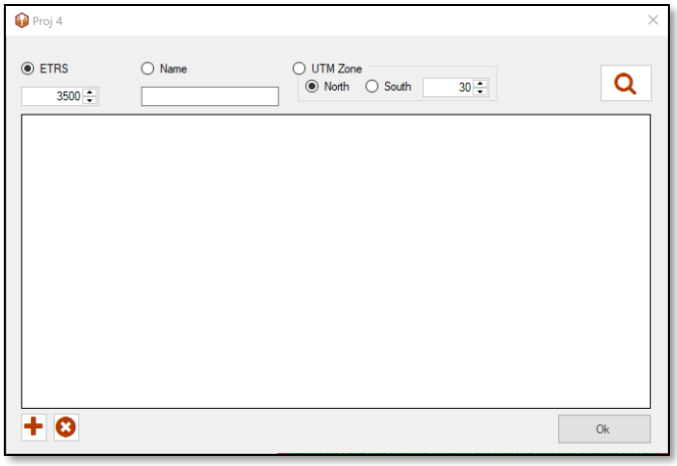

Fig. 128 – New coordinate system window

After inputting a parameter in the search method chosen (ETRS, Name or UTM Zone) the user clicks again in the magnifier glass on top right to get the results (Fig. 129).

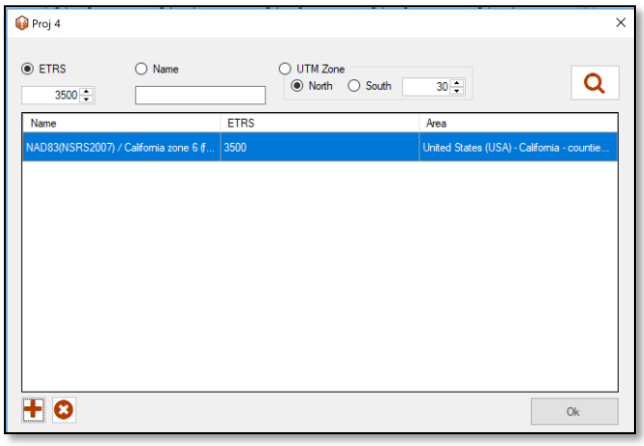

Fig. 129 - Search results

To **add** the pretend system to the main window the user must click on the plus sign ( ) and it will appear a message confirming the action "**Data added successfully".**

Otherwise, if the user pretends to **delete** the coordinates that he previously saved it must click on the cross ( ). This option will open all database previously added and the user can choose which ones he wants to eliminate.
Finally, the user just chooses **from** and **to** (Fig. 130) which coordinate system he wants to change and clicks in **OK** button.

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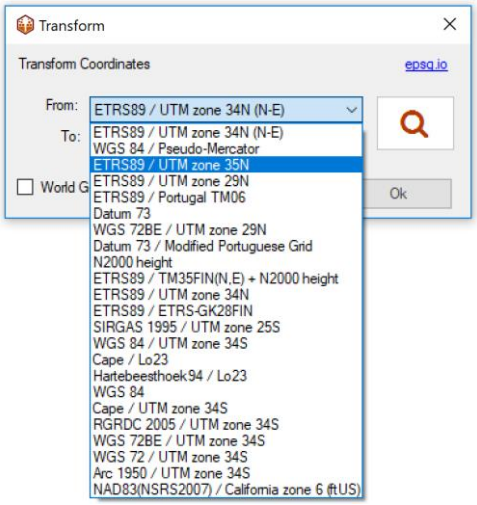

Fig. 130 - Coordinate system present in the database

8.1.3. Import Layer

In this option the user can import a terrain as a layer (it works as a normal importation). After that it can treat the new layer has a new bench bottom adjusting the pattern until the layer (Fig. 131) or, for example, change layer color (Fig. 132).

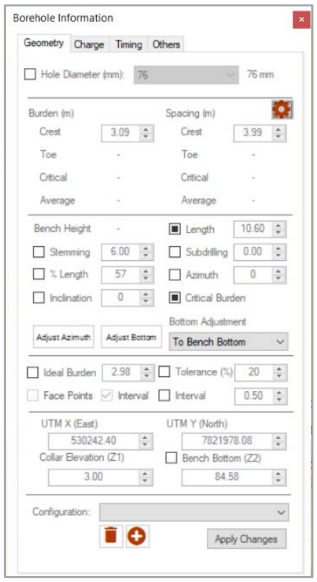

Fig. 131 - Adjust hole until layer

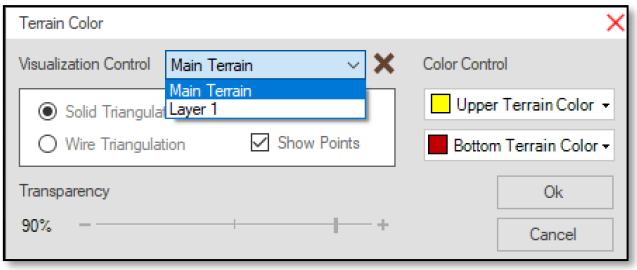

Fig. 132 - Change layer color

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8.1.4. Terrain Style -

At this step the user can create or use one of the terrains that are available on the software. When the user clicks on **Create Style** it will appear a new window (Fig. 133) with some parameters like **Longitude, Toe (m), Altitude (m), Angle (°) and Azimuth (°)** to fill in to create a new style.

Fig. 133 – Topography's available and Create Style Button

8.1.5. Contour Lines -

The user can hide/unhide the contour lines of the terrain and choose the isolines interval in meters.

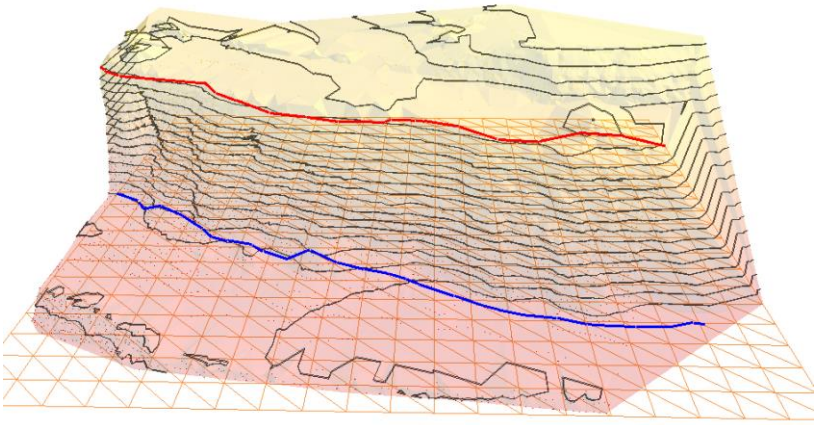

Fig. 134 - Isolines visible on the terrain

8.1.6. Cutting Terrain -

To cut a terrain region the **Cut Terrain** icon allows the user to select a work area and erase the surround zones. The user must click in the terrain to define the cutting borders and press the **Enter** or **Double-Click** to execute the command (Fig. 135).

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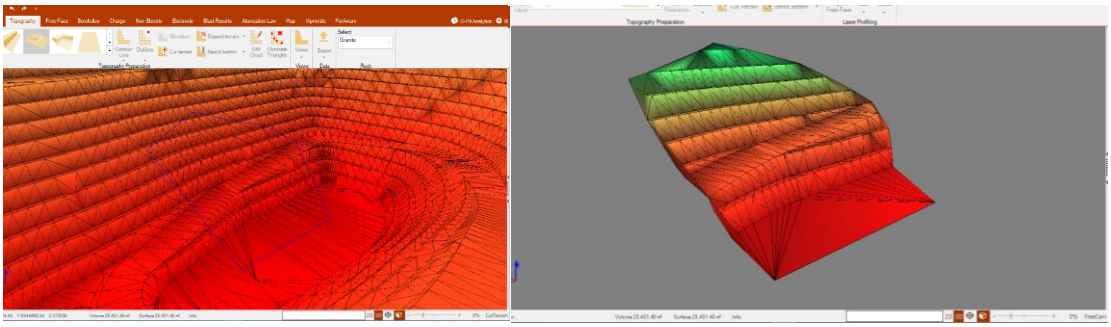

Fig. 135 – Area selection and terrain cutting

8.1.7. Expand Terrain -

The terrain expansion tool generates a new set of points that allows the actual terrain expansion. In Fig. 136 is possible to observe results of this tool and it can be applied. The user must select the percentage of terrain expansion and click in **Apply**.

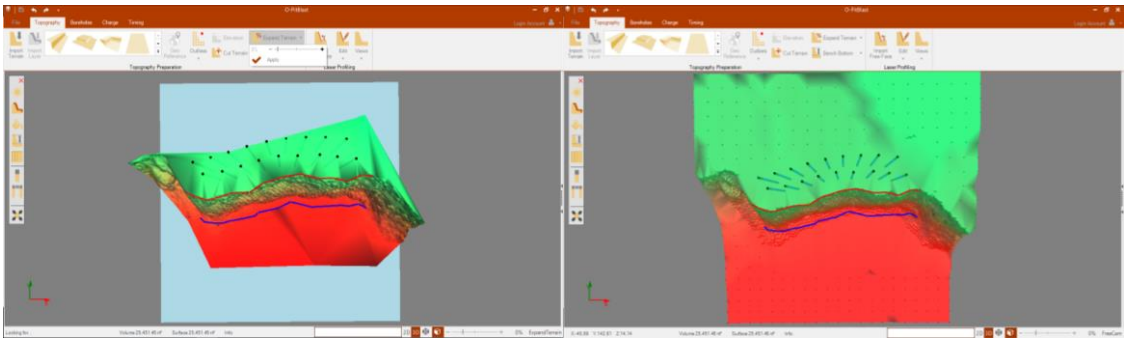

Fig. 136 - Expansion terrain tool results

8.1.8. Bench Bottom -

The Bench Bottom tool permits the adjusting the bench bottom level, inclination and azimuth (Fig. 137).

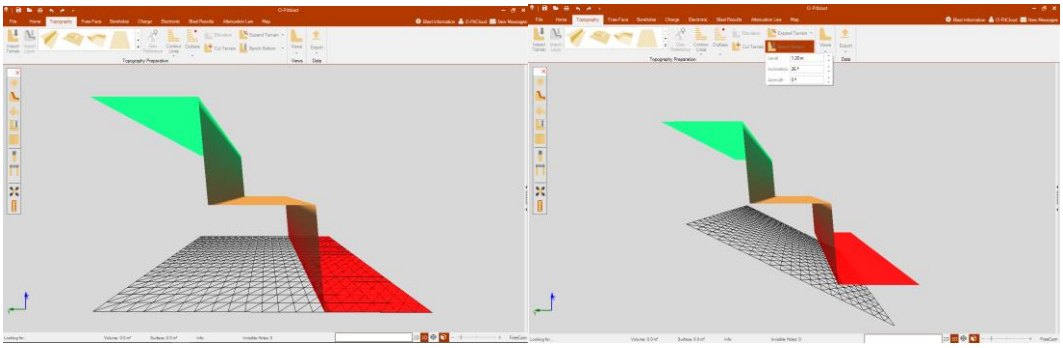

Fig. 137 - Bench Bottom Editions

8.1.9. Edit Cloud

In this option the user can edit cloud points.

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First, he needs to check if the points are visible or not. If not, needs to put them visible (Topic 6.4.2).

After clicking on **Edit Cloud** button it will pop a window (Fig. 138) explaining how to delete points.

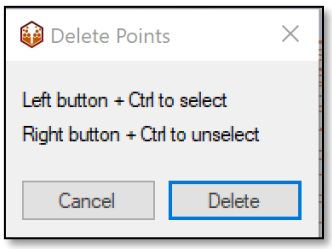

Fig. 138 - Delete cloud points window

The user must click over a point with the left mouse button, press ctrl and drag the mouse on the terrain until all points that he wants to delete are select (Fig. 139). After that just click in **delete** the select points.

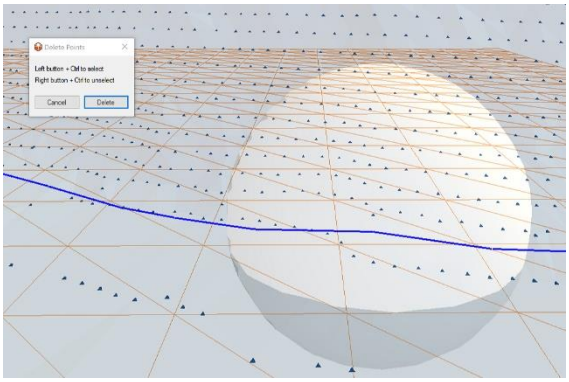

Fig. 139 - Area with selected points

It's important to refer that select points will turn red (Fig. 140), before that they are in the terrain color.

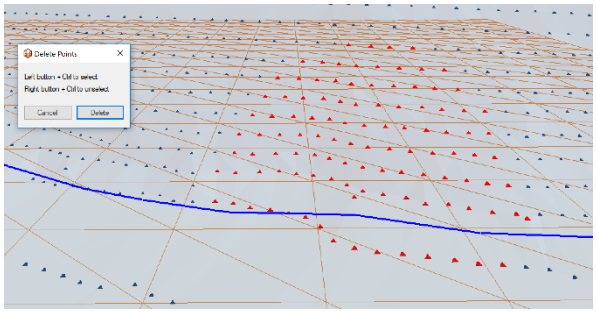

Fig. 140 - Red points: selected

8.1.10.Eliminate Triangles

This option allows the user to eliminate triangles that create the triangulation of the terrain.
After clicking in this tool, it will appear a window (Fig. 141) explaining how to use it.

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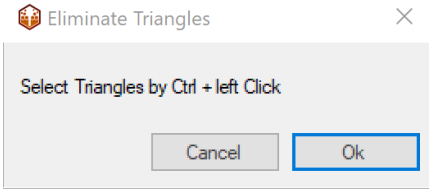


Fig. 141 - Eliminate triangles window

The user can select the triangles by clicking in **left mouse button** and **ctrl**. After that, they will turn red (Fig. 142) and if the user clicks in **OK** the triangles will be eliminated.

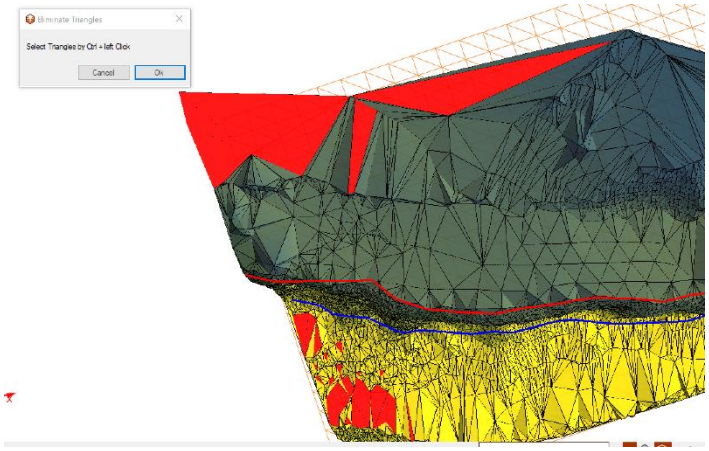


Fig. 142 - Selected triangles (in red)

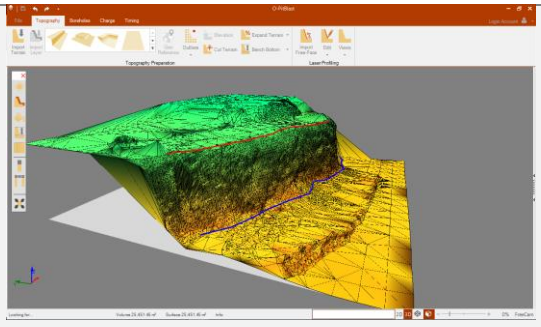
8.1.11. Views

This tool will help the user to see some important aspects of the terrain. The user will be able to see the **Free Face, the Crest and Toe, Dots or Isolines,** as shown above.

View All	View all elements in the project
View Free-Face	View free-face data
View Crest/Toe	View crest and toe reference lines
View Dots	View terrain cloud point
View Isolines	View terrain isolines

TERRAIN VIEWS

View All



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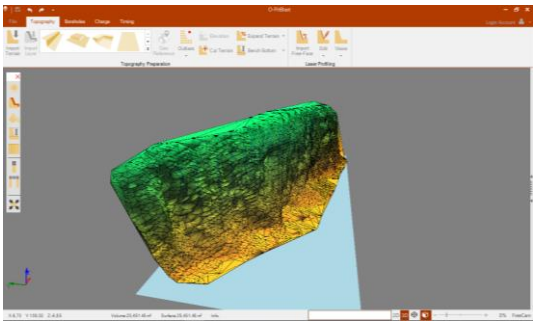
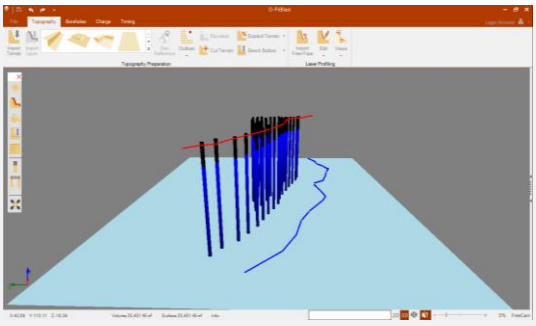
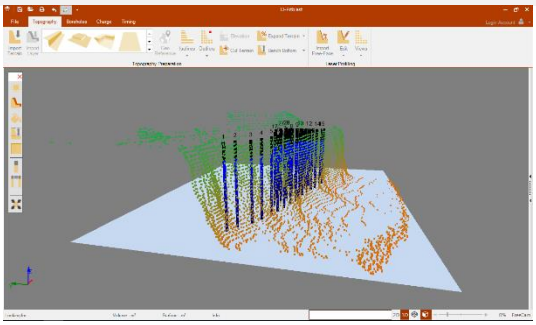
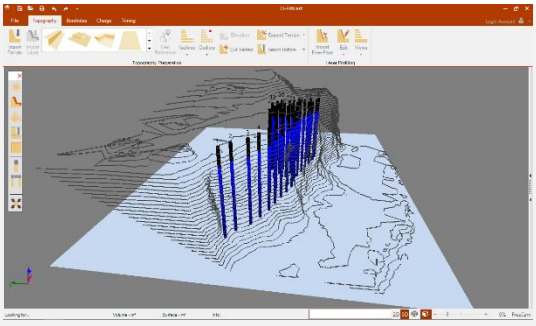
View Free-Face	
View Crest/Toe	
View Dots	
View Isolines	

8.1.12. Select Type of Rock

In this option the user can select the type of rock that it's associated to that terrain (Fig. 143).

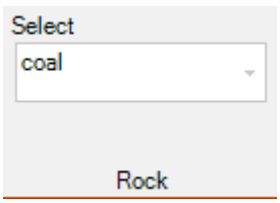


Fig. 143 - Selection of the type of rock

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9.Free-face

Free-face module includes all the important tools for the free-face importation and edition, like hole deviation data.

Fig. 144 – Free-Face Module

In the next table the user can see the main options of this module.

ICON		***DESCRIPTION***
	Import Free-Face	Free-Face importing tool – Renishaw (.FSC) and Quarryman (.CDU)
	Free Face Edit	Free Face edition tool.
	 Crest Edition	Crest definition tool. Edit previous measures – Add or remove existent points
	 Toe Edition	Toe definition tool. Edit previous measures – Add or remove existent points
	From Device	Import the borehole deviation data directly from device
	From file	Import the borehole deviation that from a local file
	Rodded	Import the rodded boretrak information
	Cabled	Import the cabled boretrak information
	Swap Hole	The user clicks on the first hole and drags the mouse until the second hole to change the holes boretrak information.
	Delete	The user can delete all boretrak information or just the information he selects.
	Select	Select a set of holes with boretrak information. The user must left-click in the terrain and build the polygon around a conjunct of holes. To finish the selection is necessary to right-click in order to close the polygon.
	Edit	The user can drag the arrow (that appears after the user clicks on **Edit** button) to point to the azimuth that he wants.
	Export RHD	Export RHD file
	All holes same position	Put all holes in the same position
	Export angle and azimuth	Export angle and azimuth

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9.1.Importing Free-Face -

In order to import a free face model, the user must select the origin of it (Fig. 145) and the correspondent codes. For *.fsc and *.cdu codes the platform has the default values, because of that the importation is automatic. Also, the user can define the bar length used (if it's not on the laser information) and which flied he wants to apply that bar length information.

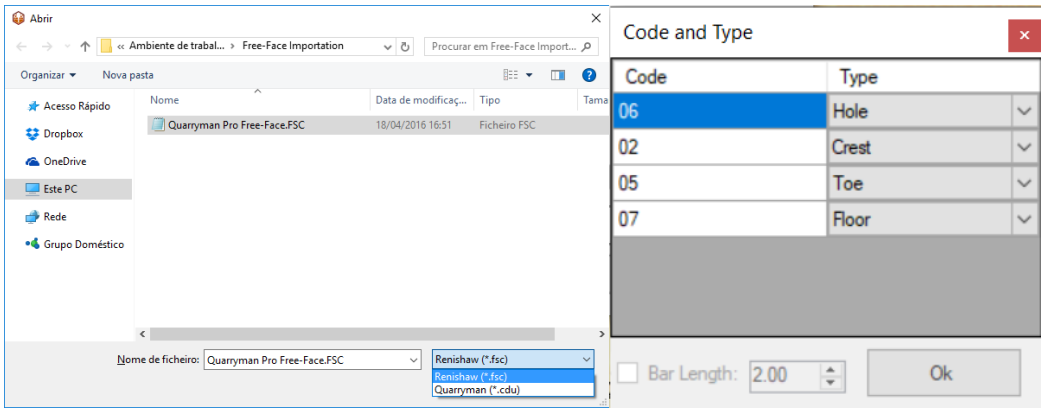

Fig. 145 - Importing free face data and code selection

The Import Data table (Fig. 146) shows the raw data divided by codes. With the objective to improve the visualization of pattern holes, O-Pitblast has a **Pattern Definition Algorithm**, which erases outliers point in the pattern area that will decrease the definition of the terrain surface. The user can select or unselect this function by clicking in the check-box in Import data window. Also, if the user used a bar length on the field and didn't insert the length in the laser can insert now (Fig. 145).

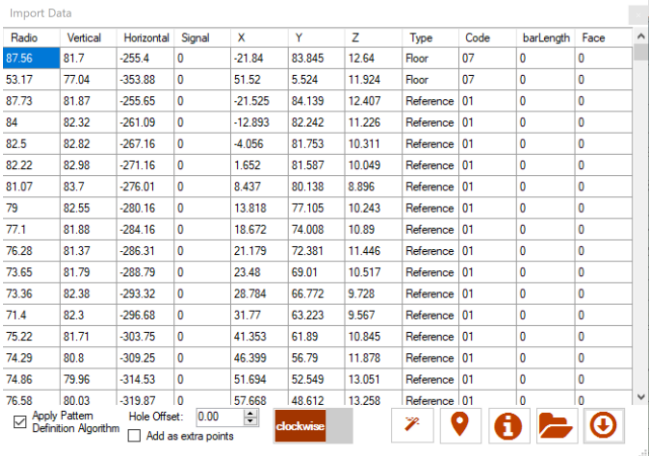

Fig. 146 - Import free-face data

3D Laser user understand that some point obtained by this tool can be out of free-face range. This outlier points can be generated by:

- Dust
- Obstructing objects
- Wide scan window

O-Pitblast has an automatic detection algorithm for these cases and, when importing a free-face, the following message is presented (Fig. 147).

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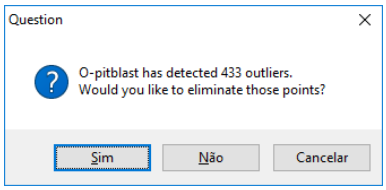

Fig. 147 - Outliers detection algorithm

The result from the use of this tool can be observed in Fig. 148.

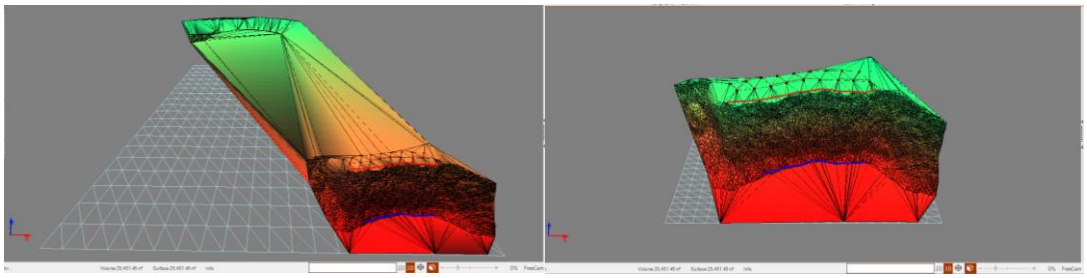

Fig. 148 - Outliers detection algorithm results (Left: without outlier detection; Right: With outlier detection)

If the imported data does not have the hole length the user is directed to choose this value. From Fig. 149 is possible to observe that there are two options:

- Select the bench bottom level and design the hole length until that level
- Select a determinate length value for all the holes

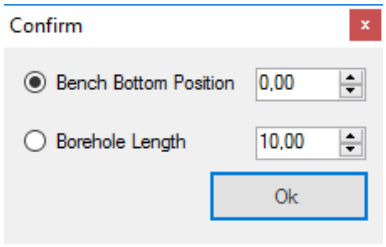

Fig. 149 - Borehole length definition

The results from the borehole length definition can be analyzed in Fig. 150.

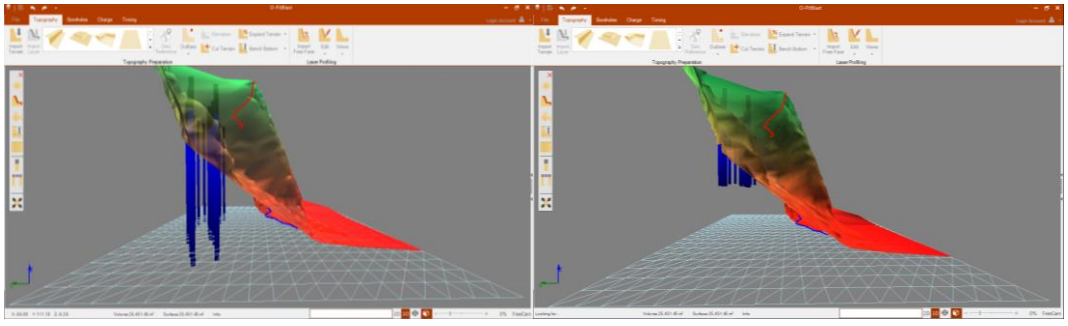

Fig. 150 - Borehole length definition (Left: Bench bottom position; Right: Borehole length)

9.1.1. Importing Options

The user, when importing a laser file, has some option to optimize the importation (Fig. 151).

- Hole Offset
- Add as extra points

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- Clockwise
- Coordinate system
- Multiple station
- Georeferentiation of the terrain

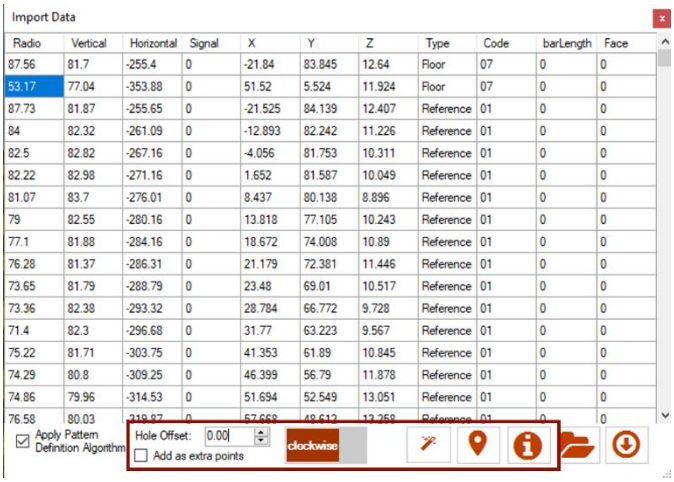

Fig. 151 - Importation option

9.1.1.1. Hole Offset

Once on the field, the conditions sometimes are difficult. If the operator can't get to the hole near to the free face, for example, can put the laser aside from the hole (with some offset) and once importing it add that information on the tool appropriate for that.

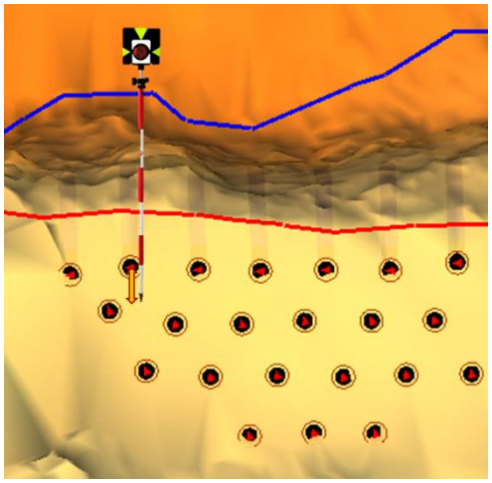

Fig. 152 - Example of the laser position (arrow is the offset)

9.1.1.2. Add as Extra Points

When importing laser information, you can **add** that data to the **actual** one. This will keep the points of the actual one and insert the new points on the terrain.

9.1.1.3. Clockwise

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If the user has **Counter Clock** option defined as default on the laser, it can turn it on here. This will define the rotation of the laser counter clock side.

9.1.1.4. Change data coordinate system

Check Topic 8.1.2 to know how to use this option.

9.1.1.5. Multiple Station

In the field sometimes, the operator needs to make multiple scans from different places. If the that that the user is importing was made using multiple stations this option must be selected. After that the user must choose the way that it was made on the field and merge the information (Fig. 153):

- GPS information for each laser position and reference;
- Two fixed references for each free face (to see how it was to be made on the field click on question button);
- Based on previous laser position (to see how it was to be made on the field click on question button).

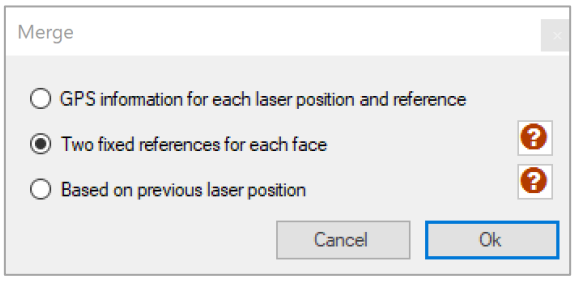

Fig. 153 - Merge information tab

9.1.1.6. General Information

Here the user can import GPS information to georeferenced the terrain (Fig. 154). It can put manually, get reference from GPS file, use previous information or use rotation option.

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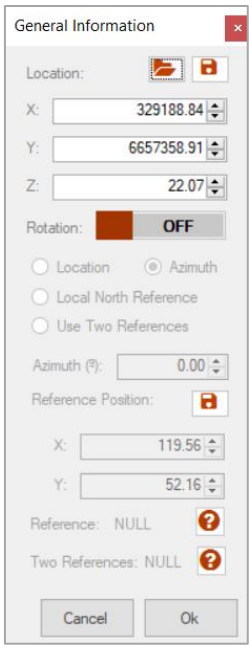

Fig. 154 - General information tab

9.2. Editing Crest/Toe -

With the Crest/Toe tool is possible to create or edit a crest and toe reference lines. When the tool is selected, using the mouse left-click in the crest or toe real points, a new reference line will be generated. To erase existent points is just right-click above them. These reference lines will be used for the calculation of critical profile/burden.

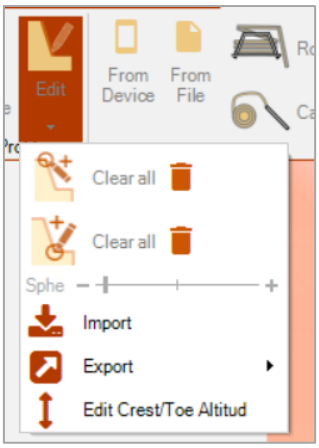

Fig. 155 - Crest/Toe tool

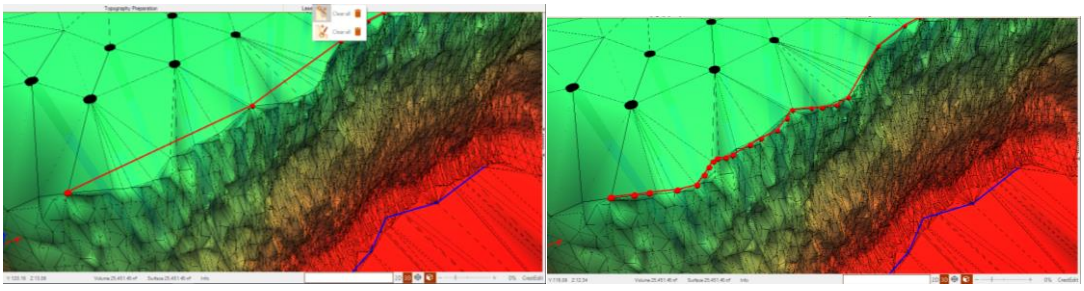

Fig. 156 - Crest reference line edition

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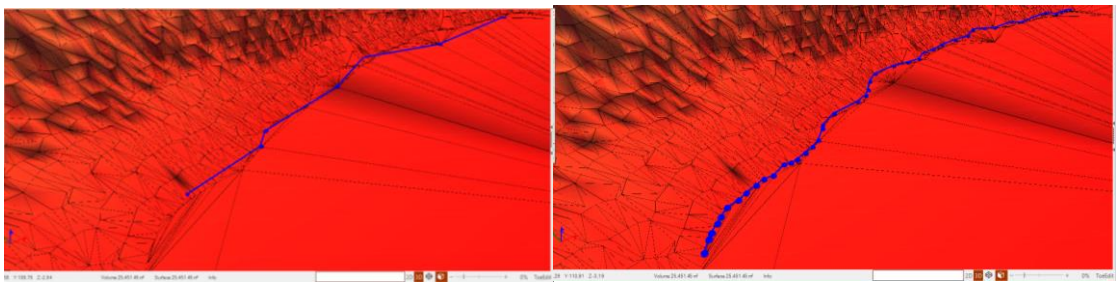

Fig. 157 - Toe reference line edition

9.2.1. Import

The user can import crest and toe directly from file.

9.2.2. Edit Crest/Toe Altitude

In this option the user can change the altitude of crest and toe.
To do this the user must choose between crest and toe, put an altitude (meters) and click in apply.

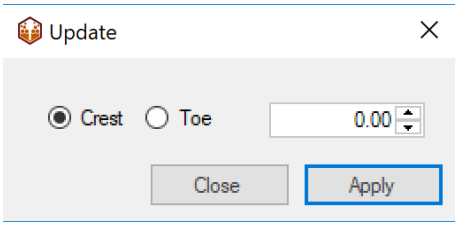

Fig. 158 - Update altitude window

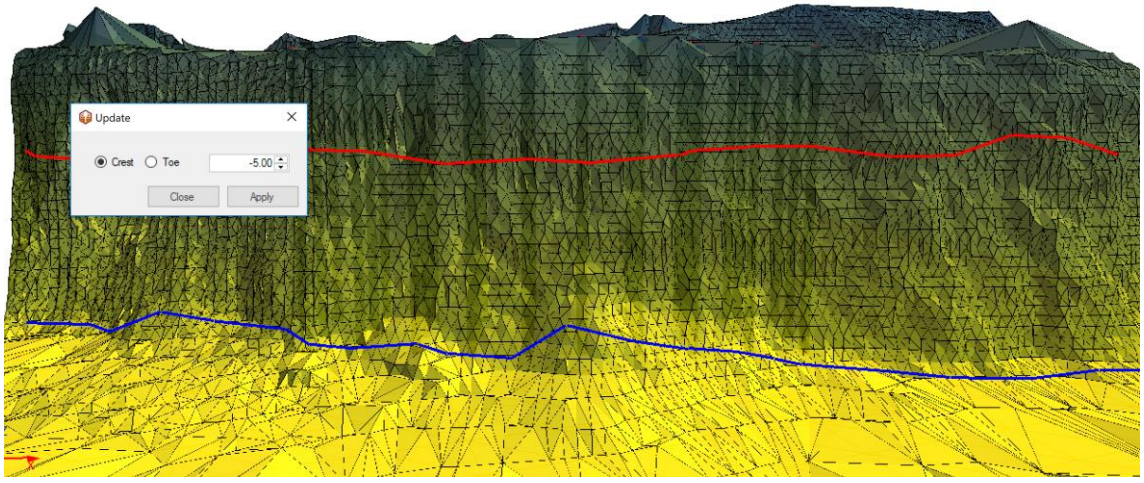

Fig. 159 - Example of changed altitude in crest (minus 5 meters from top).

9.3. Borehole Deviation Data

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With **Roddded, Cabled, Swap hole, Delete, Select and Edit** the user can import, edit and interact with boretrak information.

9.3.1. Rodded

Clicking on Rodded the user can import the boretrak information. It will pop a window like the one bellow. The user can import .cdp files to **Probe data** and .cdl files to **CDU Data.**

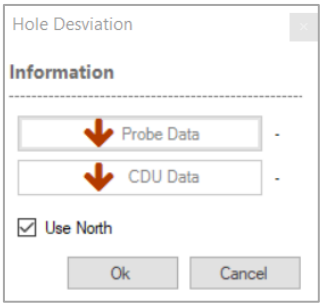

Fig. 160 - Import boretrak information window (1)

When the user inserts the data, it will appear a message saying, “Data uploaded successfully”.

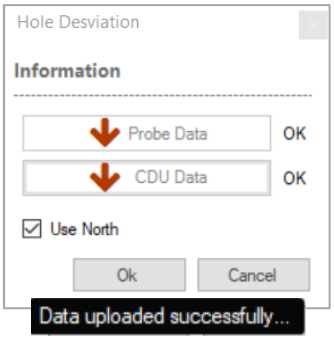

Fig. 161 – Message about the boretrak data

Then the user applies the boretrak information to the respective holes - Fig. 162 and click on the “OK” button.

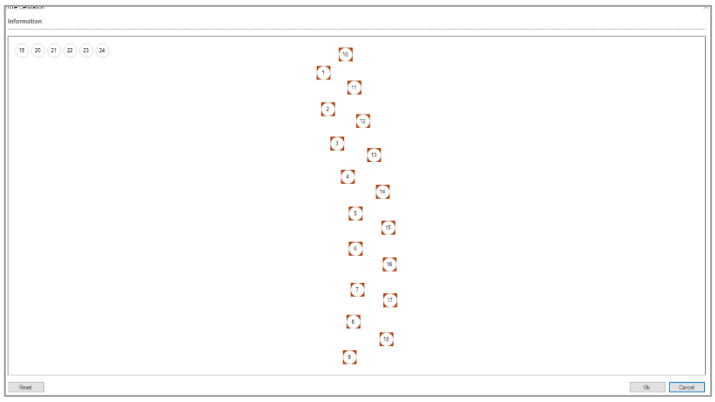

Fig. 162 - Import boretrak information window (2)

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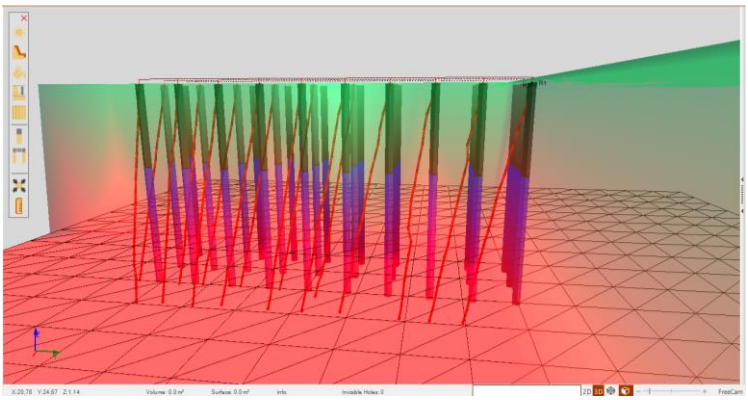

Fig. 163 - Boretrak information successfully imported

9.3.2. Cabled

The user can import cabled boretrak information. All data files must be. rhd type. When the user inserts the data, it will appear a message saying, “Data uploaded successfully”.

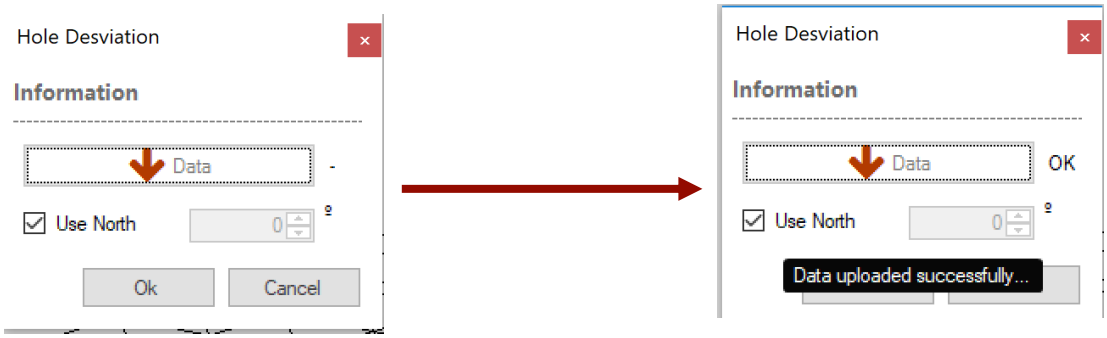

Fig. 164 – Import cabled boretrak information windows

Then the user applies the boretrak information to the respective holes (like we saw in 9.3.1) and click on the “OK” button.

9.3.3. From Device and From File

In these two options the user can import information directly from a file or by connecting the borehole deviation device directly to the computer.
First the user must connect the device to the computer, then choose the COM PORT associate with it and finally give order to the device to send the data to O-Pitblast (Fig. 165).

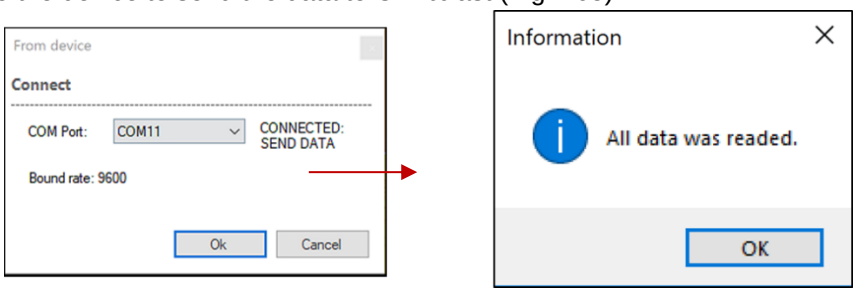

Fig. 165 – Sending data from device

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Also, O-Pitblast ask the user if he wants to save a local file from borehole deviation device (Fig. 166).

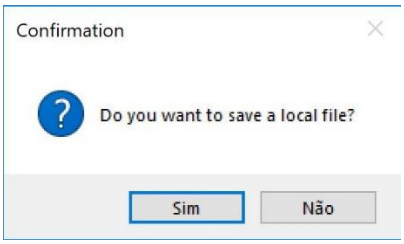

Fig. 166 - Save local file

Then the process is the same explained on the rodded and cabled.

9.3.4. Swap Hole, Delete, Select Edit, Export RHD

In the picture below the user can see the main boretrak interaction buttons from Free-Face module.

Fig. 167 – Other hole deviation buttons

10. Boreholes

The Boreholes Tab presents all the tools and applications for borehole design and edition.

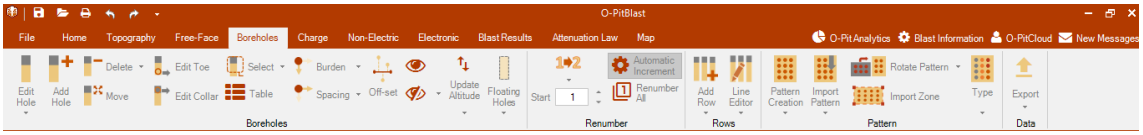

Fig. 168 – Boreholes Module

10.1. Boreholes Edition

Icon	*Description*	
	Edit Holes	Edit a single hole or a conjunct of holes
	Add Holes	Add holes to an existent terrain
	Delete Holes	Delete a single hole or a conjunct of holes
	Move Holes	Move a single hole or a conjunct of holes
	Edit Toe	Edition of toe position of a single hole or a conjunct of holes
	Edit Collar	Edit of collar position without change the toe position
	Select Holes	Holes selection tool

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Hole shape	Hole not charge
Hole Shape	Hole charged (no detonator)

10.1.1.Edit Holes -

To edit a hole, the user can either click twice over a determinate hole or recur to **Radial Menu** (Chapter 6.8) and select the edit hole icon. In a single hole edition is possible to analyze and edit several characteristics (Fig. 171).
By clicking in **Edit** icon the user will be able to choose wich type of holes he wants to change: **All Blastholes, Production Blastholes, Buffer Blastholes, Contour Blastholes** and **Ghost Blastholes.** The user can also edit the information from the **First Row** of boreholes or the information of a labeled borehole by clicking in **Label**.

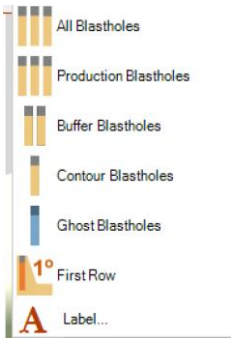

Fig. 169 – Types of boreholes that can be edit

The user can create label, a comment or a water column by double-clicking in the borehole and going to **Others** menu – Fig. 170.

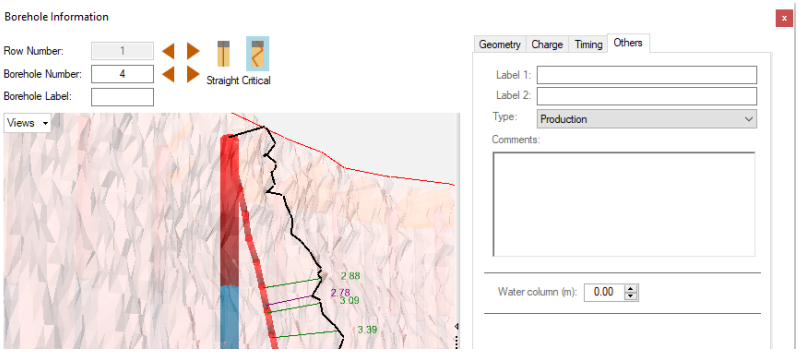

Fig. 170 – Others menu: create label (1 and 2), type, comment or water column

In the case of the selection of more than one hole the **Borehole Information Window** will be presented like the example of Fig. 172.

This screen alows the user to control the geometrical characteristics of multiple holes. To change the **Burden** and **Spacing** it is necessary an individual selection, since this option is not available in the multiselection holes edition. In the other hand, if the user pretends to change parameters like **Bench Height**, **Hole Length**, **Stemming**, **Subdrilling**, **Inclination** and **Azimuth** they can be modifiyed by checking the **CheckBox** and

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clicking in **Apply Changes**. If the checkbox, of any item, presents this shape -▣ - means that there are more than one hole with differente features.

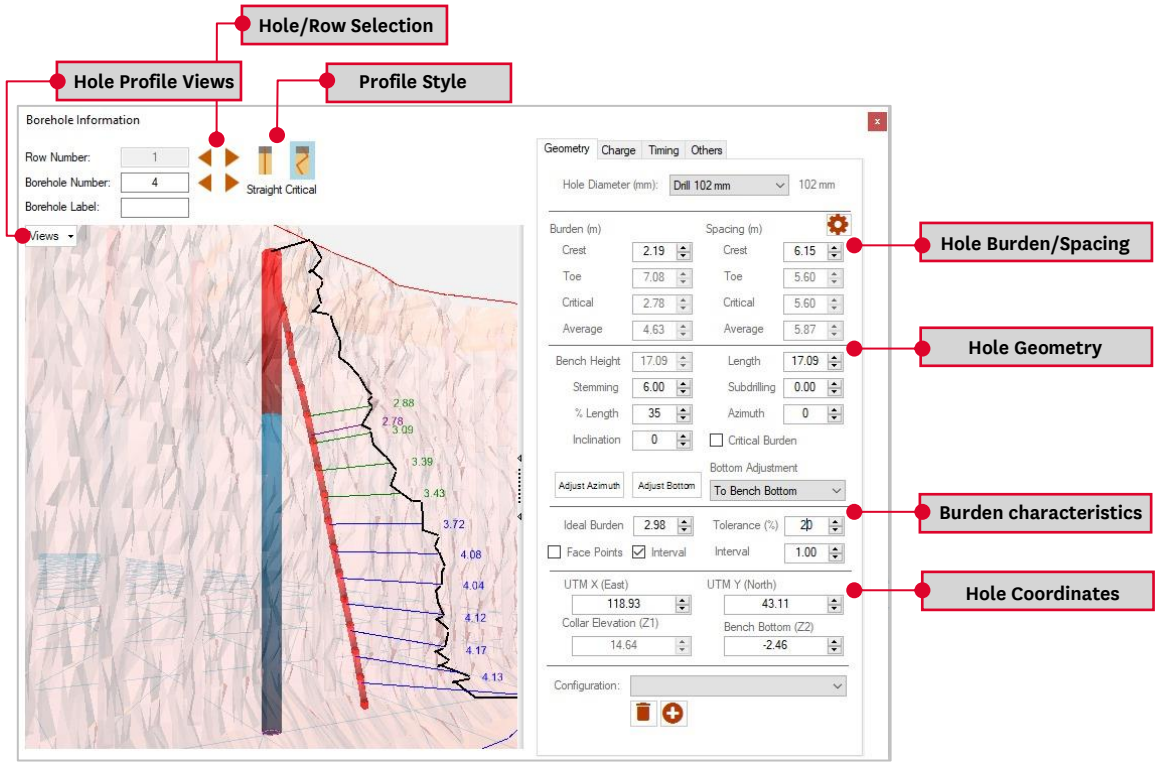

Fig. 171 - Borehole Information Window

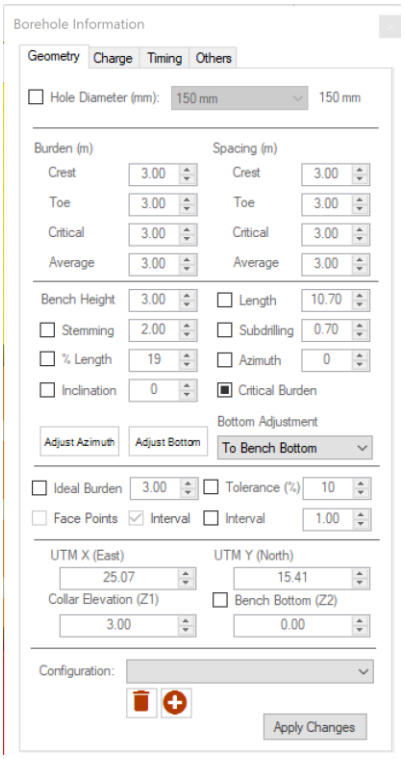

Fig. 172 - Borehole Information Window (Several holes selected)

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10.1.2.Add Holes -

To add individual holes, the user must select the **Add Hole** icon and then Left-Click in the terrain surface.

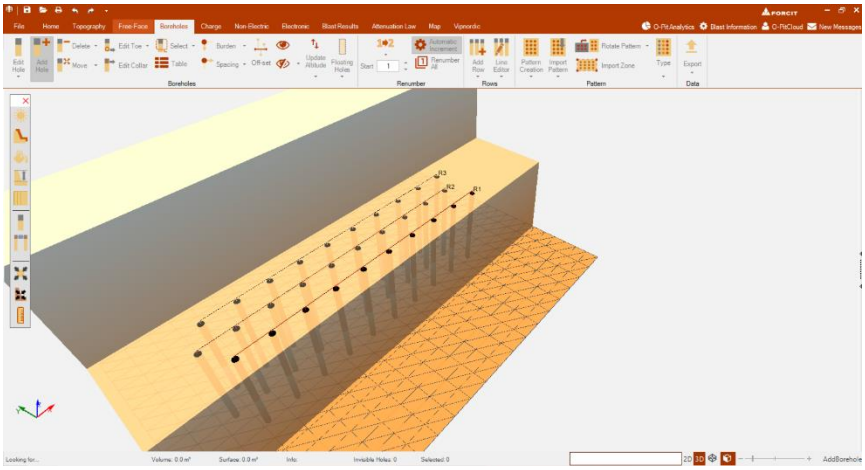

Fig. 173 - Add Holes tool

10.1.2.1.Hole Burden/Spacing

This information is showed if there is a row associated to the holes (Fig. 174). O-Pitblast calculates automatically the burden and spacing and, for that, it is necessary the definition of each row in order to identify the closest rows and neighbor holes. You can define your rows like is explained is chapter 10.7.

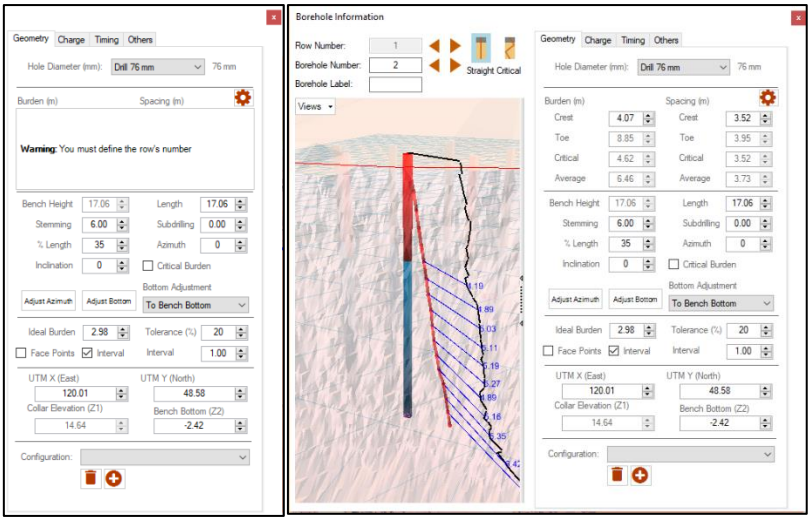

Fig. 174 - Burden/Spacing info - Rows definition

10.1.2.1.1. Holes Inclination and Bench Bottom Adjustment

To change the inclination of a set of holes the user must select them and click on the **Edit Hole** icon, check the **Inclination** Checkbox and make the desired changes. In the example of Fig. 175 is possible to observe

that the subdrill of the edited holes was not achieved. To correct this situation, the user must select the **Adjust Bottom** button and click **Apply Changes** (Fig. 176). Also, the user can choose until where he wants to adjust holes: bench bottom or layers.

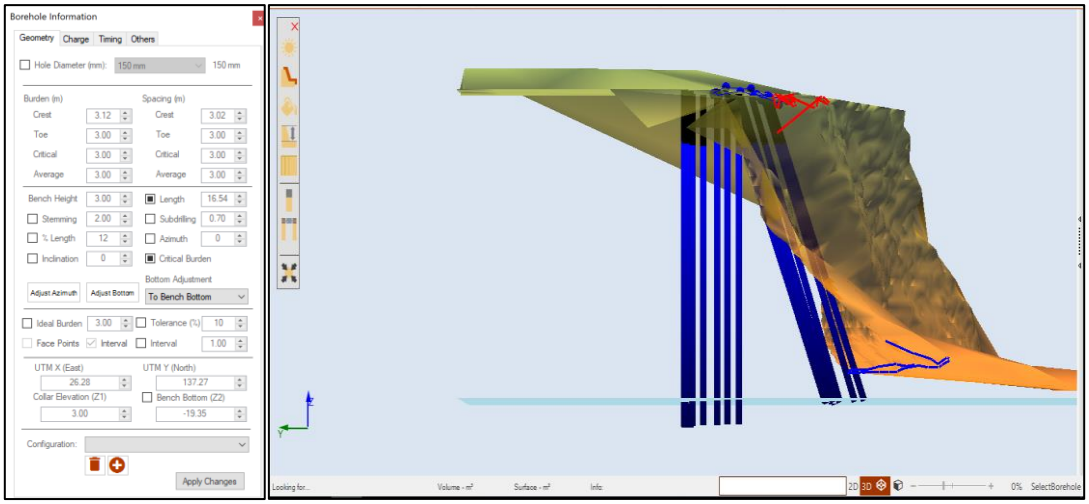

Fig. 175 - Changing holes' inclination (no bottom correction)

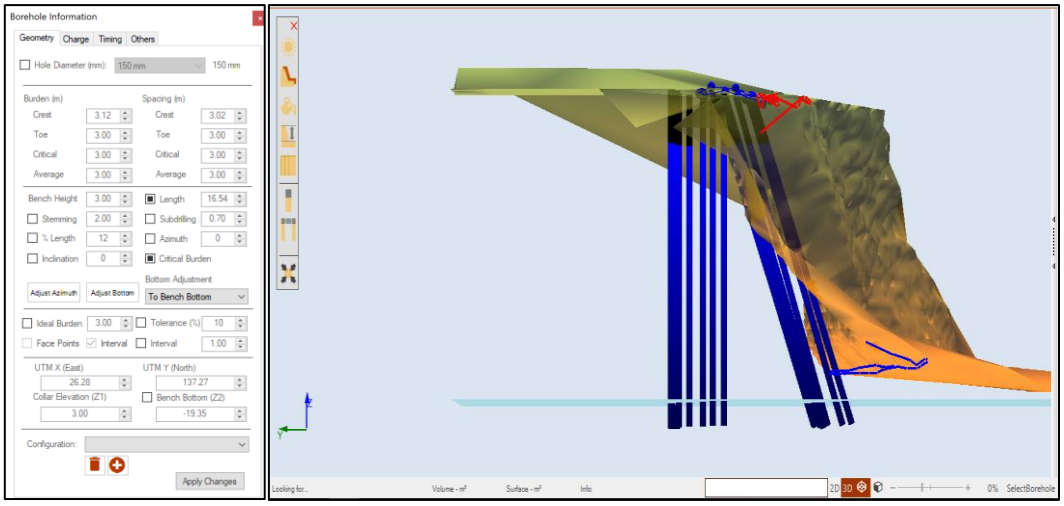

Fig. 176 - Changing holes' inclination (with bottom correction)

10.1.2.1.2. Holes Azimuth

If the azimuth of the holes is not defined, when the user changes the inclination direction can take a wrong value – Fig. 177 - A.
To correct this issue, the user can either put the azimuth value manually or, if the crest and toe are defined, select the **Adjust Azimuth** button - Fig. 177 – B.

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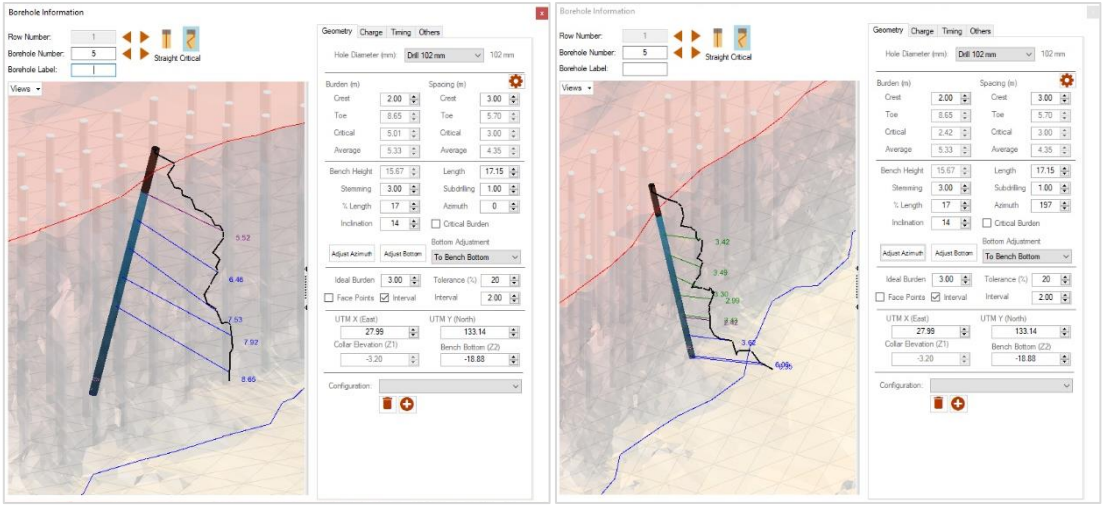

Fig. 177 - Adjusting azimuth. A (left): azimuth not adjusted; B (right): azimuth adjusted automatically

10.1.3.Delete Holes -

The **Delete** holes icon if clicked will erase all the existent holes in the project. To delete individual holes the user must use the **Radial Menu** (Chapter 6.8).
To delete a conjunct of holes is necessary to use the **Select** tool (point: 10.1.6) and click in the **Delete** icon.

10.1.4.Move Holes -

To move individual holes, the **Move** tool must be selected and then, with left-click, drag the hole to the new position (Fig. 178).

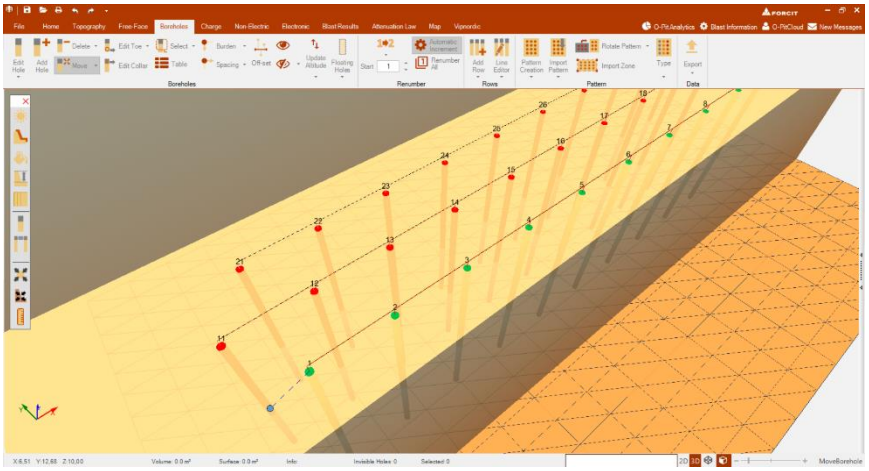

Fig. 178 - Moving a single hole

To move more than one hole is necessarily **select** polygon (point: 10.1.6), left-click in one hole and drag all the holes to their new positions.

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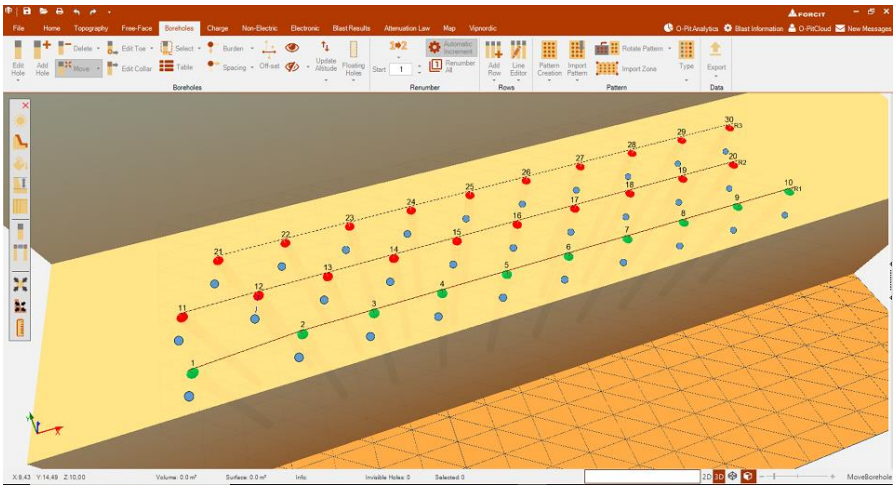

Fig. 179 - Moving a conjunct of holes

The user also has the possibility to move the holes using **move hole over line** or **proximity ring tool** (Fig. 180). Once the first option is enabled, it is just necessary left-click in one hole and the dashed lines will appear to move the hole over line (Fig. 181).

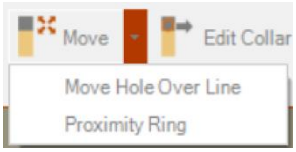

Fig. 180 – Tools within Move button

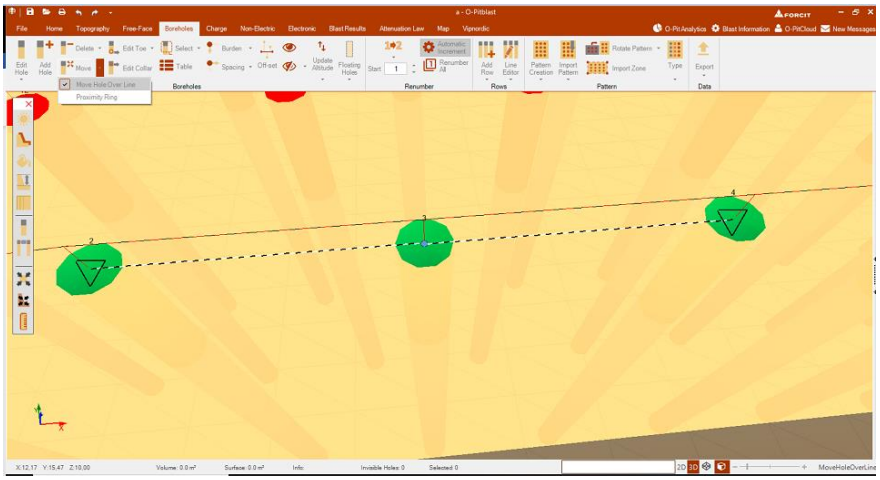

Fig. 181 – Move hole over line.

When the user clicks on proximity rings, a pop-up window will appear to select/deselect the desired radius (1, 2 and/or 3) and to assign the desired value for each one.

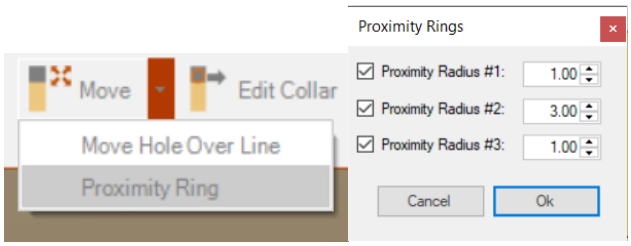

Fig. 182 – Proximity ring enabled

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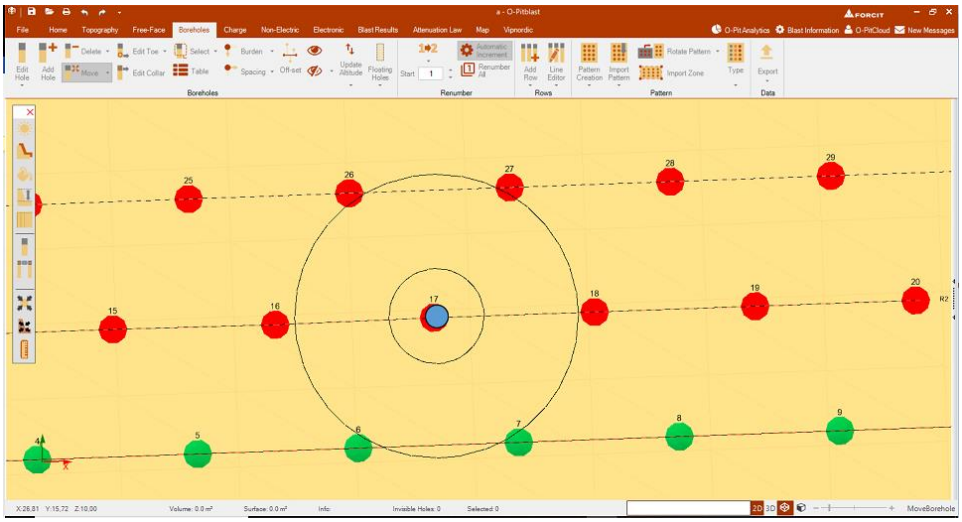

Fig. 183 – Move hole using proximity ring

10.1.5.Edit Toe -

Hole inclination is directly connected with toe position. To change it, the user must click on the **Edit Toe** and orange dots will appear on top of the hole's collars. With the left-click the user must drag these dots in order to positioning the hole's toe (Fig. 184).

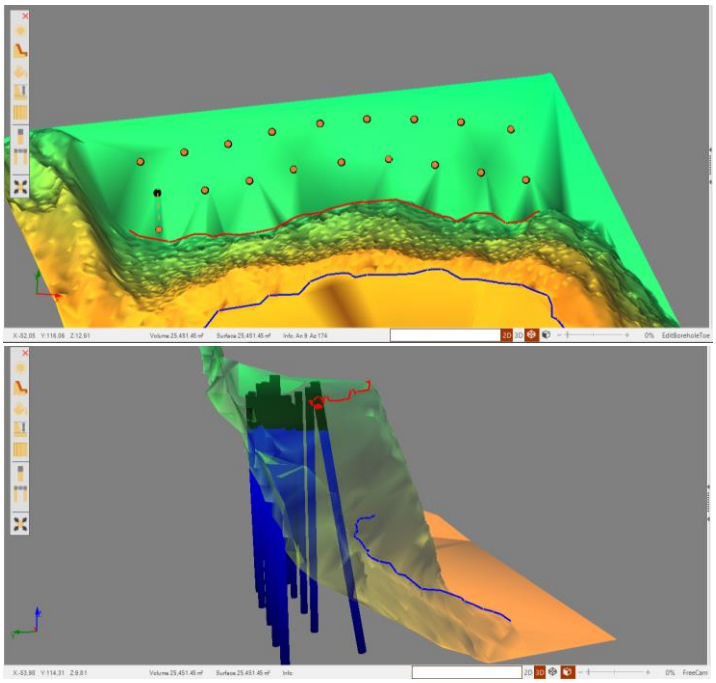

Fig. 184 - Toe Edition (Single hole)

For a conjunct of holes, the procedure is to select them (point: 10.1.6) and drag to the desired position.

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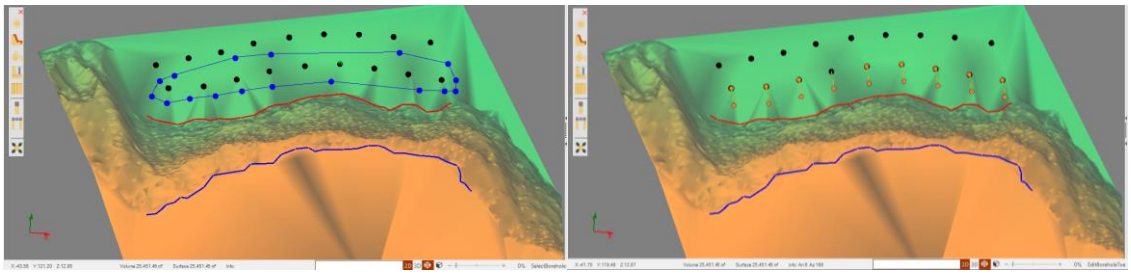

Fig. 185 – Selecting a conjunct of holes

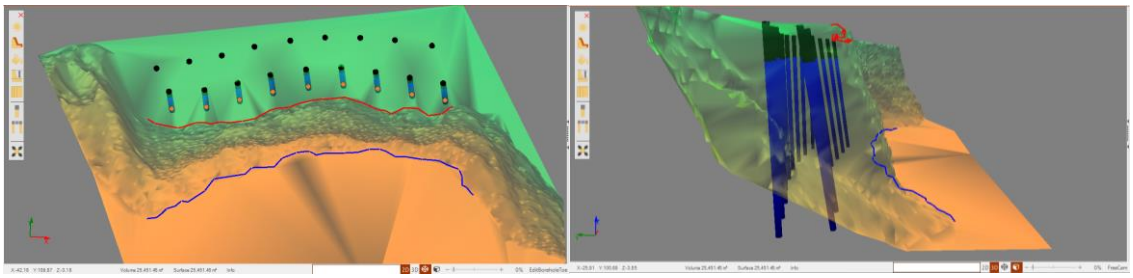

Fig. 186 - Dragging a conjunct of holes

10.1.5.1.Send Toe to the Select Line →

This resource is found within the edit toe tool (Fig. 187). It allows the user to adjust holes toe position sending them one by one to the desired line. The first step is to draw a line, where the user wants the new toe position. After that, once this option is enabled it is needed to click in the line and click the desired hole. Then, the holes will extend to the selected line (Fig. 188).

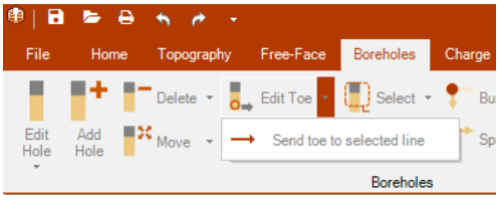

Fig. 187 – Send toe to selected line

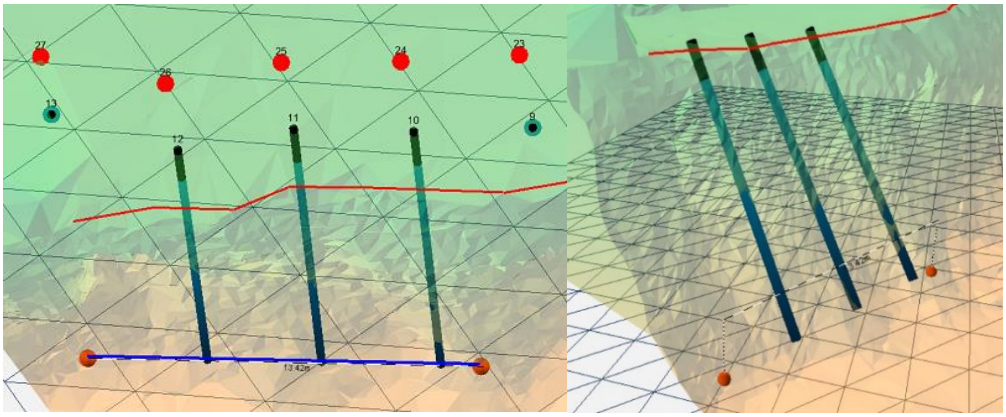

Fig. 188 –Send toe to the select line: 1) Line selected in blue; 2) Toe position changed to the new position

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10.1.6.Select Holes -

The **Select** tool allows the selection of a set of holes in order to delete them or change their characteristics. To proceed, the user must left-click in the terrain and build the polygon around a conjunct of holes. To finish the selection is necessary to right-click in order to close the polygon (Fig. 189).

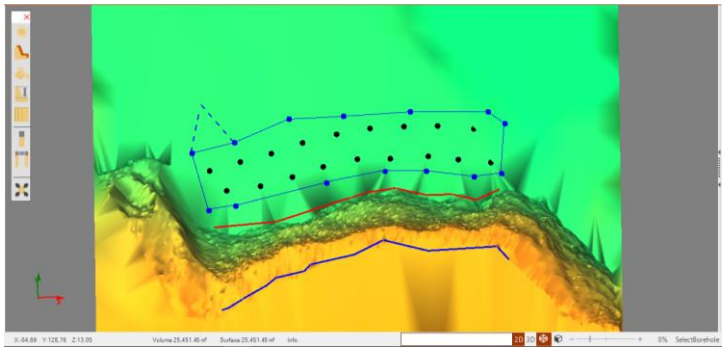

Fig. 189 - Holes Selection tool

Other way to select holes is to press **ctrl** and **left mouse button** over the holes (Fig. 190).

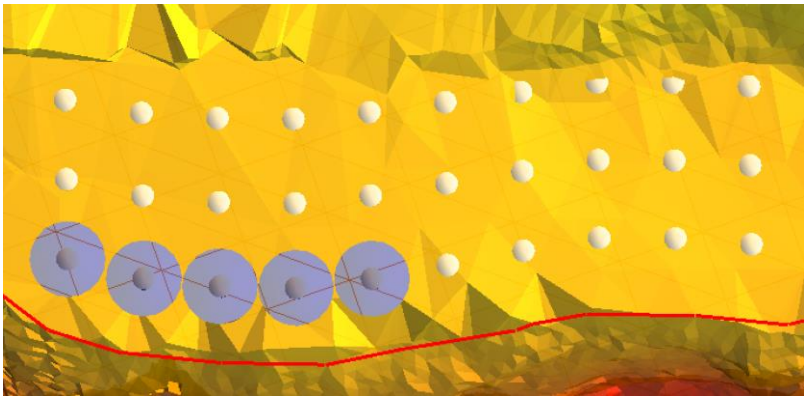

Fig. 190 - Holes selection one by one

To move, delete or add polygon points, the user must left-click on polygon points and use the **Polygon Selection Radial Menu** (Fig. 191) to proceed with the desired action.

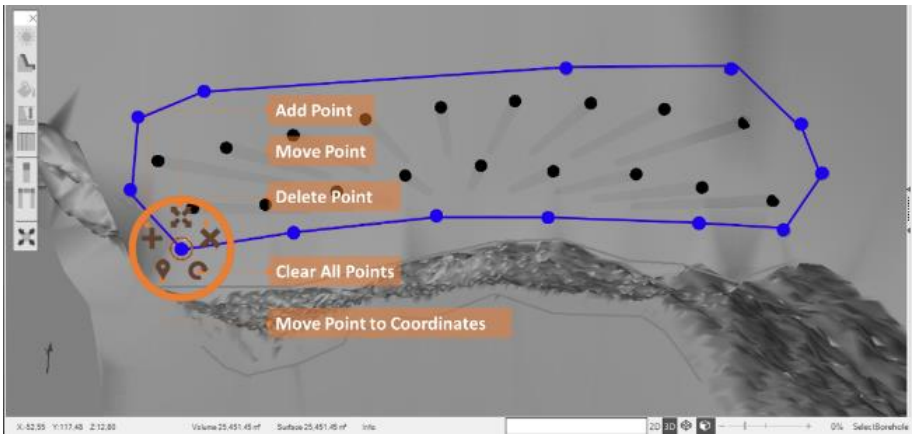

Fig. 191 – Polygon Selection Radial Menu

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10.1.6.1.Use Crest

The user can select using crest points – like shown in polygon using crest (chapter 7.2)

10.1.7.Free-Face Profile Control -

O-Pitblast® determines the free face profile for all holes. After defining the rows, the user can check each profile on **Edit Hole Window** (Chapter 10.1.1).

10.1.7.1.Straight/Critical Profile Style

This option permits select the views between a straight profile or a critical one (Fig. 192). The **Straight View** defines a straight profile in accordance with the free face. In the other hand, the **Critical** profile identifies the line that connects all the critical points along the free face.

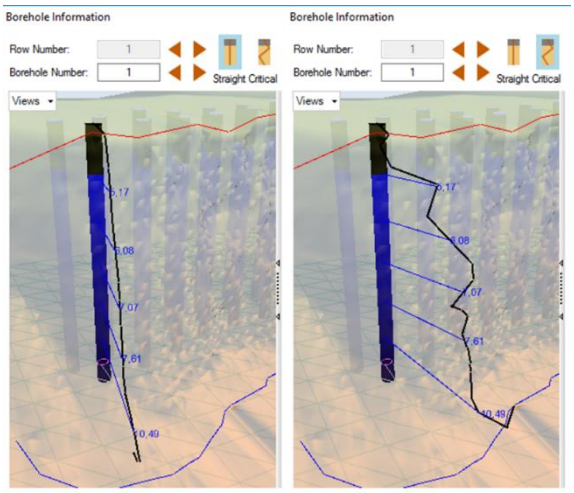

Fig. 192 - Profile Style: Straight/Critical

10.1.7.2.Analyzing Critical Burden

To analyse the critical zones of each hole the user must define the **Ideal Burden,** the **percentage Tolerance,** the **Face Points** and the visualization **Interval** (Fig. 193).

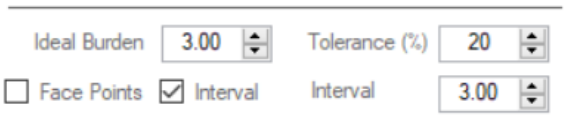

Fig. 193 - Critical Burden Definition

This info is important to identify projections potential risk zones (like the red zones) (Fig. 194). To eliminate this risk zones, the user can, in advance, adjust the crest burden or inclination of each hole.

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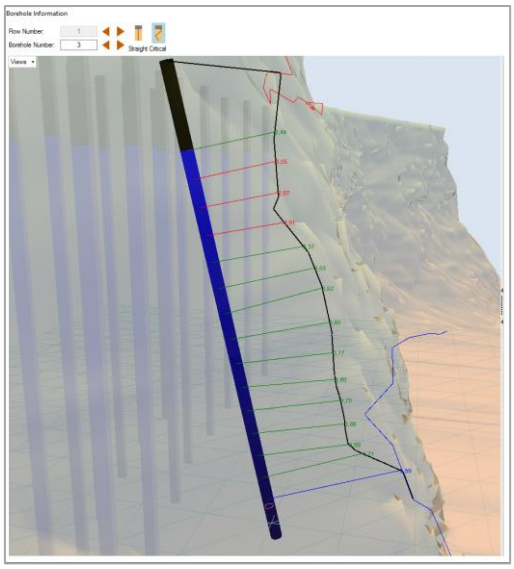

Fig. 194 - Projection potential risk zones

For better viewing by the user, is possible to define a 3D limit zones and analyse with a full definition (Fig. 195).

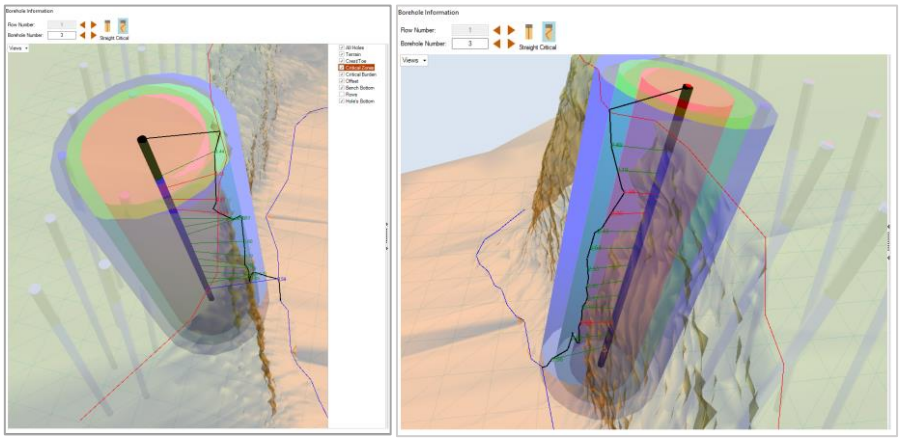

Fig. 195 - 3D Burden Limit Zones

To see the critical profile of the holes that are not in the first row the user must click on critical burden button (Fig. 184).

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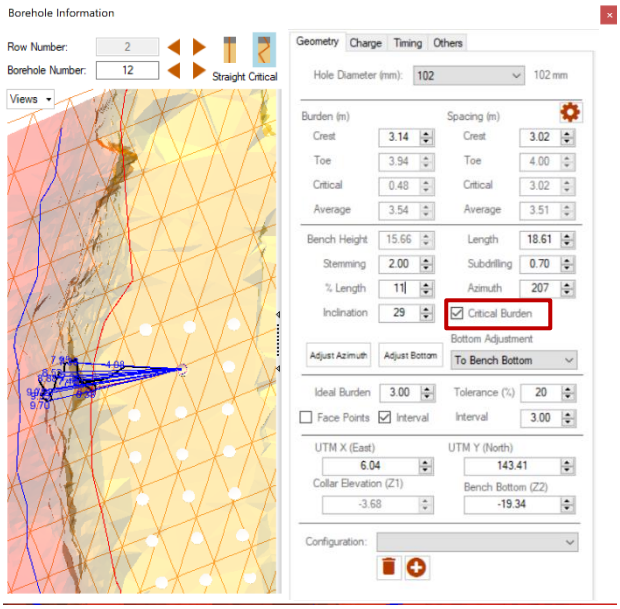

Fig. 196 - Critical burden

10.2. Table

Here the user can see all the information of the holes on a list. Also, he can put visible or invisible the holes on the terrain (one by one) by check or uncheck the option **Visible**.

Boreholes: 30

Number	Label	Burden	Spacing	Stemming	Subdrilling	Diameter	Visible
1		2.715	3.108	0.7	0	150	☑
2		2.943	3.021	0.7	0	150	☑
3		3.1	3.002	0.7	0	150	☑
4		3.138	3.016	0.7	0	150	☑
5		3.18	3.04	0.7	0	150	☑
6		3.2	3.043	0.7	0	150	☑
7		2.984	3.036	0.7	0	150	☑
8		3.014	3.001	0.7	0	150	☑
9		2.998	3.013	0.7	0	150	☑
10		2.937	3.013	0.7	0	150	☑
11		3.137	3.078	0.7	0	150	☑
12		3.145	3.015	0.7	0	150	☑
13		3.289	3.001	0.7	0	150	☑
14		3.309	3.012	0.7	0	150	☑
15		3.236	3.029	0.7	0	150	☑
16		3.16	3.031	0.7	0	150	☑
17		3.094	3.026	0.7	0	150	☑
18		3.064	3.001	0.7	0	150	☑
19		3.071	3.009	0.7	0	150	☑
20		3.101	3.009	0.7	0	150	☑
21		3.145	3.053	0.7	0	150	☑
22		3.183	3.01	0.7	0	150	☑
23		3.3	3.001	0.7	0	150	☑
24		3.314	3.008	0.7	0	150	☑
25		3.249	3.02	0.7	0	150	☑
26		3.173	3.021	0.7	0	150	☑
27		3.102	3.018	0.7	0	150	☑

Fig. 197 - List of information of the boreholes

10.3. Burden and Spacing

By clicking on this option, the user will be able to see the burden and spacing design by the topography and holes pattern (Fig. 198 and Fig. 199).

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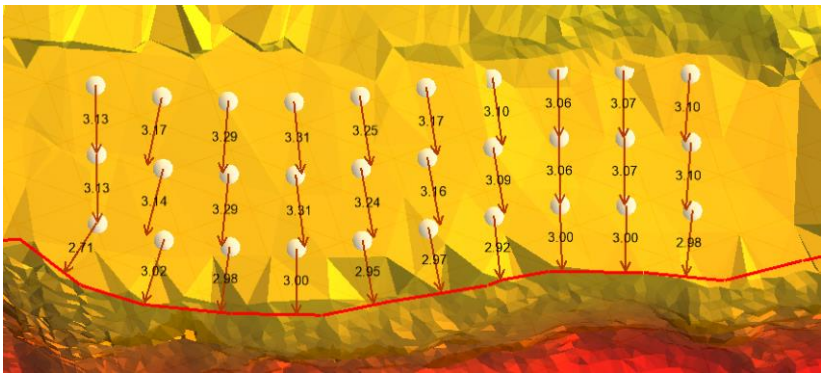

Fig. 198 - Burden tool

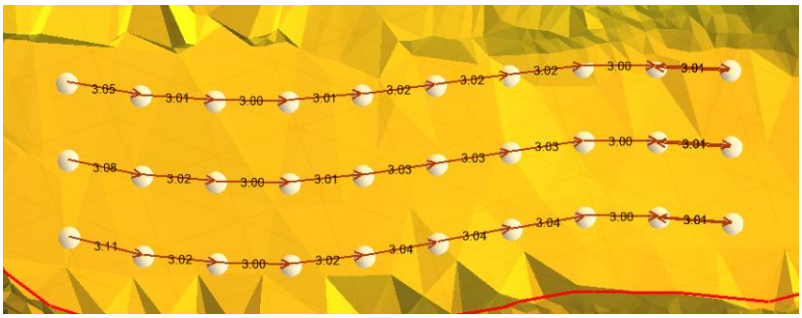

Fig. 199 - Spacing tool

If the user wants to change the burden defined by the software, he needs to click on the arrow present in burden/spacing tool near to holes and drag it to the place he pretends (Fig. 200).

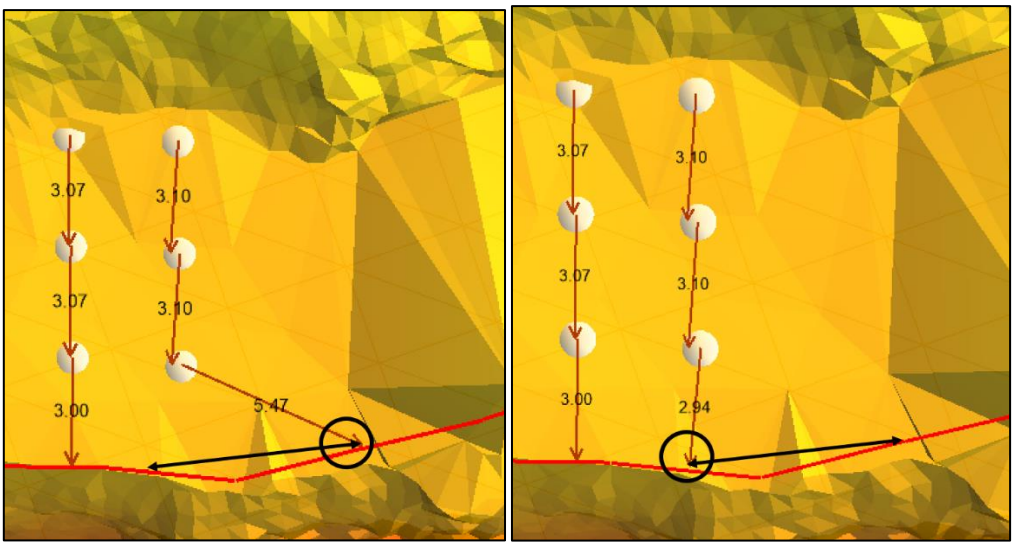

Fig. 200 - On the left: first position of the burden; on the right: new burden position

Another option inside of this tool, is the option to see the radial menu by clicking on the arrow present on burden/spacing option. The user can:

- Reset burden/spacing
- Get coordinates of the position of that burden/spacing
- See the size of burden/spacing

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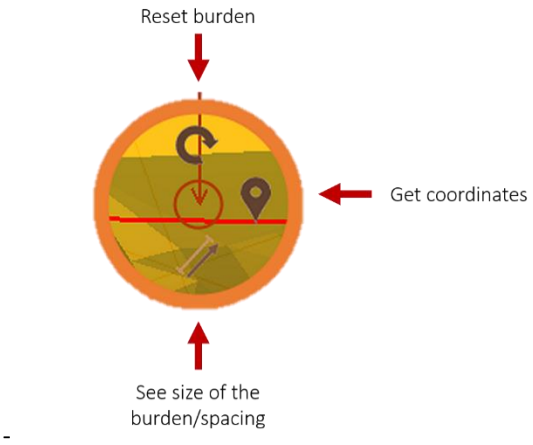

Fig. 201 - Radial menu of burden/spacing tool

10.3.1.Check Minimum Burden and Spacing

With this tool, the user can verify the minimum burden value. If the project is distant, it will approach and highlight the associated hole.

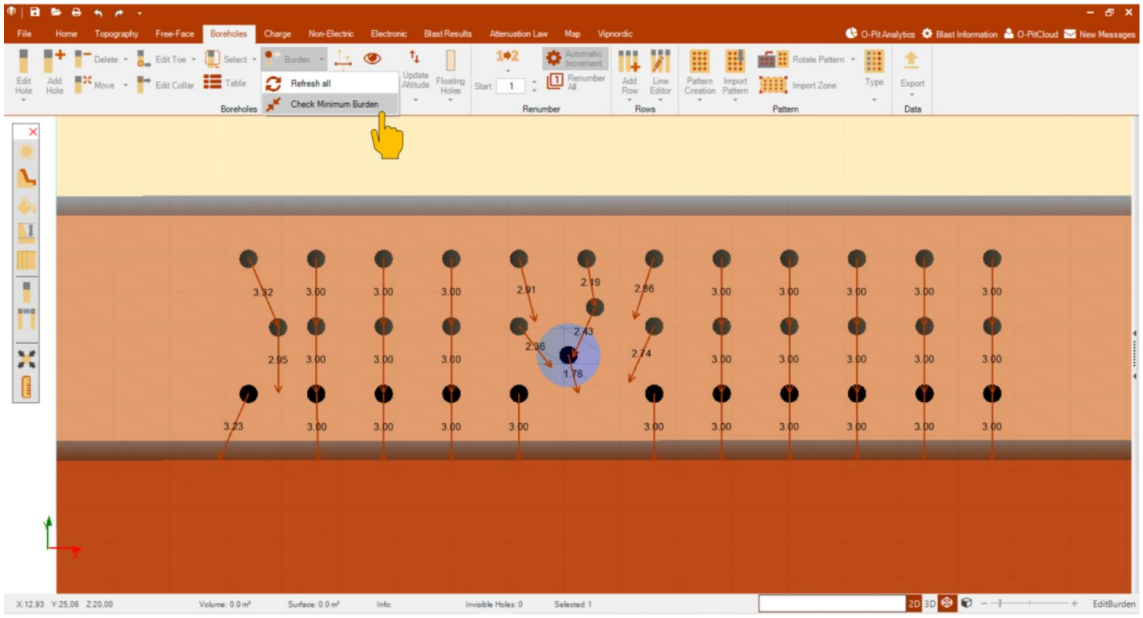

Fig. 202 – Check minimum burden tool

The user can do the same related to spacing using check minimum spacing tool (Fig. 203).

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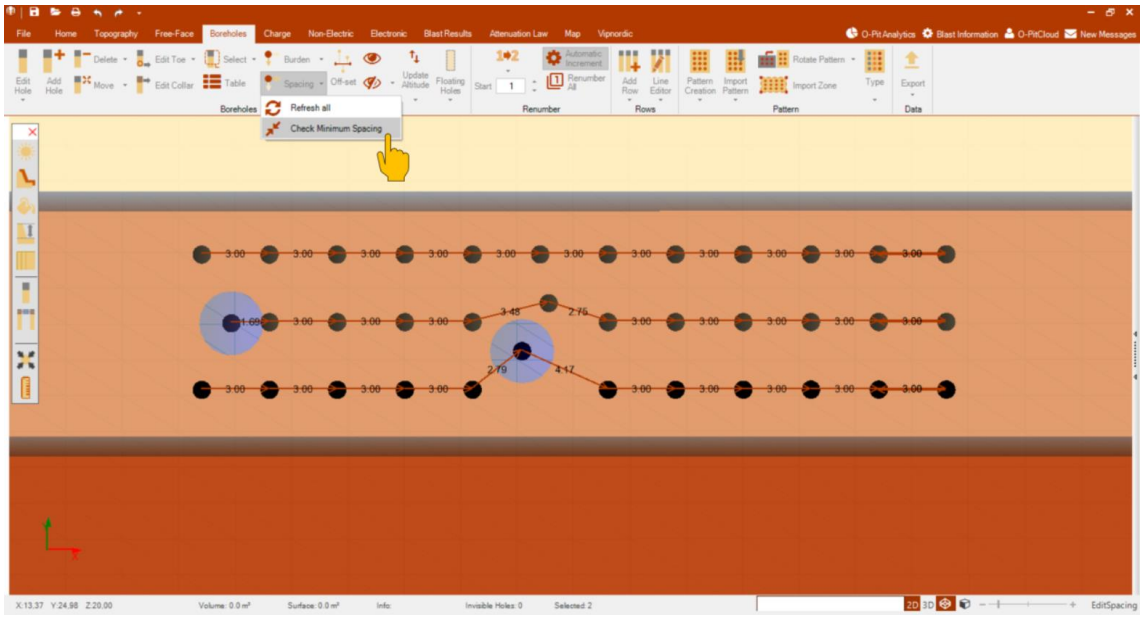

Fig. 203 – Check minimum spacing tool

10.4. Off-Set

The Off-set tool is used to create a reference line to mark the hole in the field. Once selected, an offset window will pop-up (Fig. 204). Then, the user must **select** an arrow ( ) to enable the entry of burden values ( ) – Fig. 205.

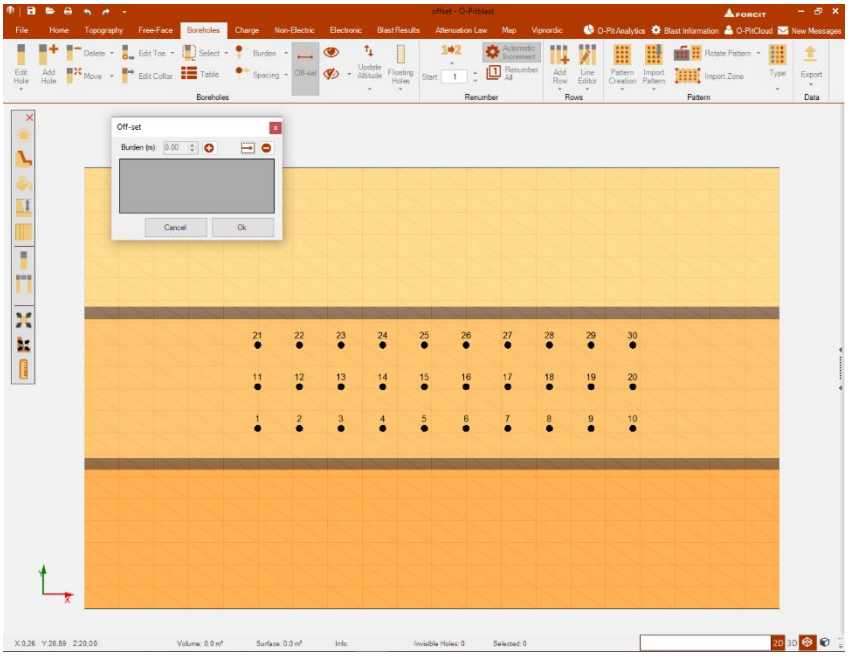

Fig. 204 – Off-set tool

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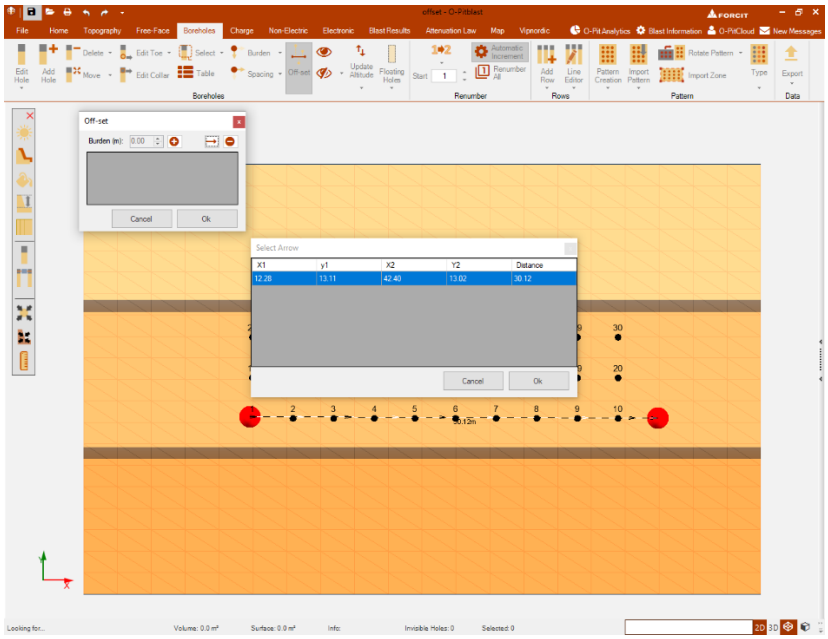

Fig. 205 – Off-set tool: select arrow

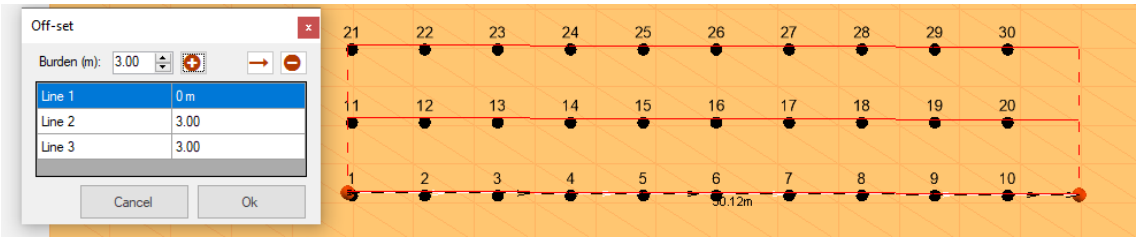

Fig. 206 – Example of entered off-set values

10.5. Visible/Invisible and Renumber

Icon		*Description*
	Visible	All boreholes get visible.
	Invisible	The selected boreholes get invisible.
	With deviation data	The boreholes with boretrak information get invisible.
1➡2	Renumber	By choosing a star point the user can renumber de boreholes that he wants. Edit's hole label
	Automatic Increment	Saves the last number that the user use to renumber the next borehole.
	Renumber all	Renumber automatically all boreholes

10.5.1. Visible or Invisibles Holes

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The user can hide the **select** holes in the terrain by clicking on the **Invisible** button ( ). To put them back **visible** just click on the **Visible** button ( ).

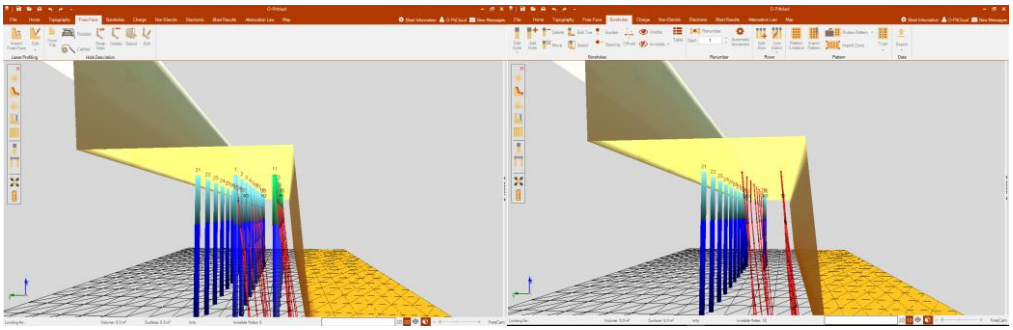

Fig. 207 – Left (a): visible boreholes; Right (B): invisible boreholes (with deviation data).

Another option inside of the Invisible button (Fig. 208) is to with all holes with borehole deviation data.

Fig. 208 . Option to hide holes with borehole data

10.5.2.Renumber

The user has many ways to renumber the holes. First way is clicking on the renumber tool ( ), choose a start number and start dragging the hole between holes (Fig. 210). If the “Automatic Increment” ( ) is **on**, when the user takes the mouse out, the starting point will be automatically update to the next number where the user was. If it is **off**, it will keep the number defined in the start point.

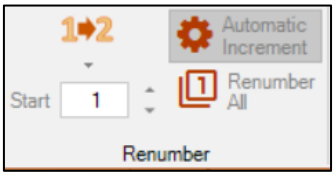

Fig. 209 - Renumber tool and start point

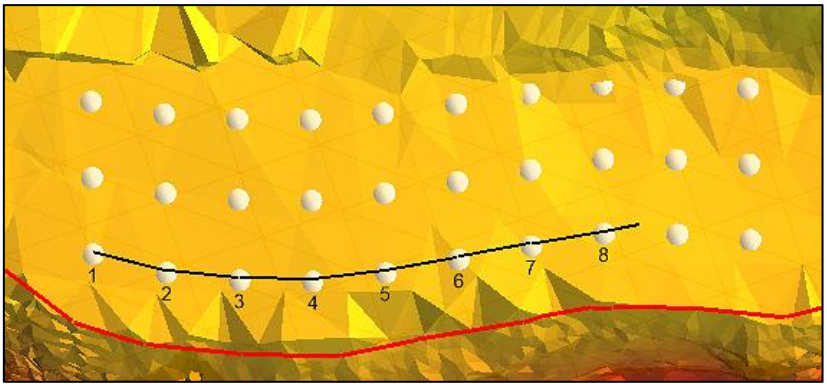

Fig. 210 – Renumber tool

If the user uses the option renumber all ( ) it will automatically update all hole’s number.

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10.5.2.1. Floating Holes

In this option the user will be able to import holes from previous blasts. It's important to remember that the user must have terrain and the holes that he's importing must be inside of the coordinates of that terrain.
After clicking on the importation option (Fig. 211) and choose X, Y and Z for collar and toe (of the floating holes), the pattern will appear like shown on the pictures (transparent).

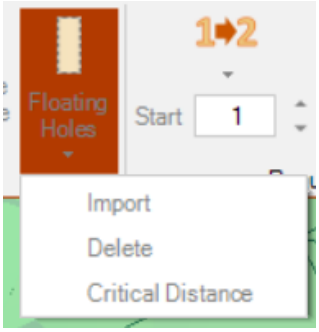

Fig. 211 – Importation of floating holes

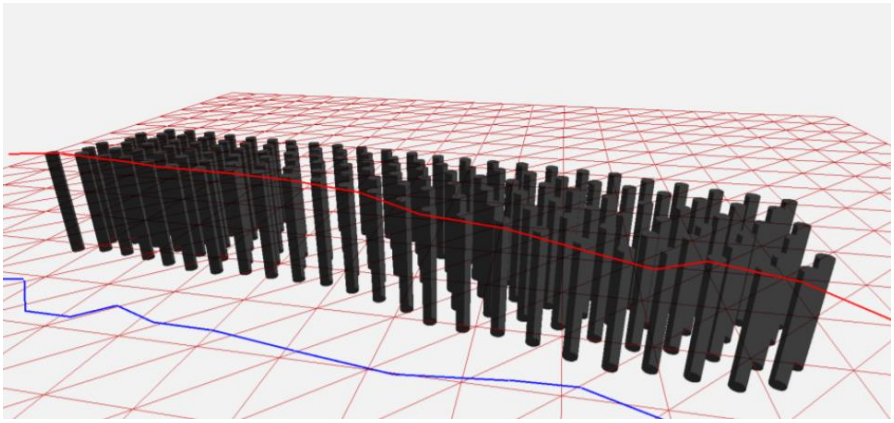

Fig. 212 - Example of floating holes

After that the user can create the new pattern based on the previous position of the previous blast and prevent, for example, deviation of the new holes during the drilling process.
The user can also delete the holes (Fig. 211) and create a critical distance (Fig. 211). This last option will allow the user to define a critical distance and O-Pitblast will calculate if the new pattern it is too close to the old pattern.

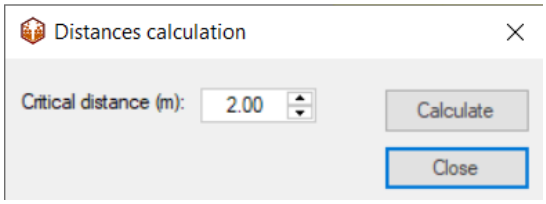

Fig. 213 - Option to define the critical distance

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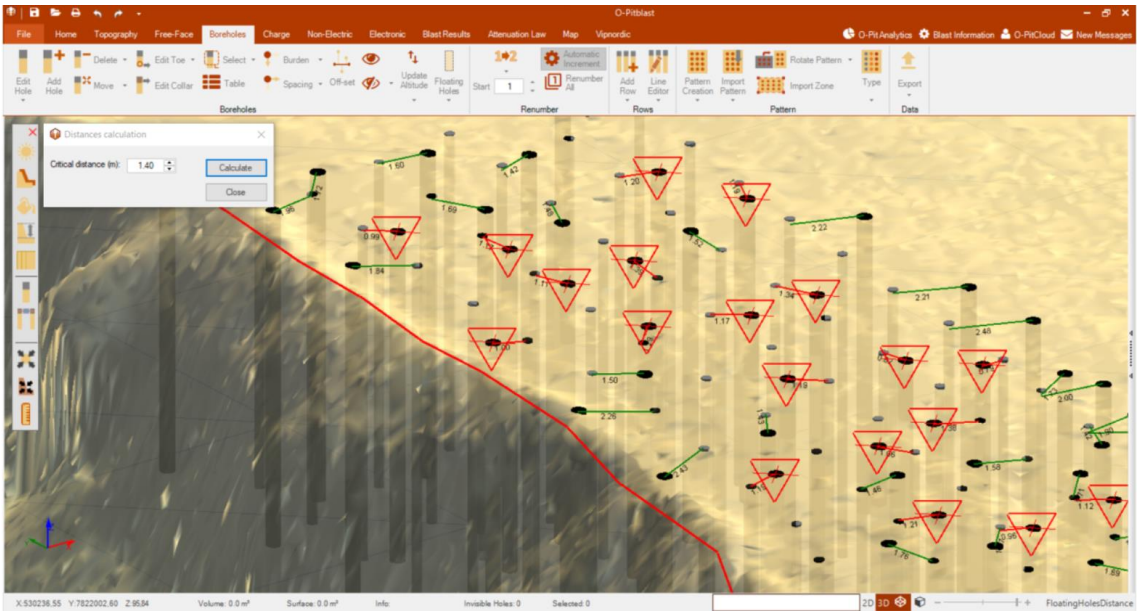

Fig. 214 - Critical distance between previous hole (from previous blast) and new hole (for the new blast)

In the case shown in Fig. 214, it was defined a critical distance, for example of 1.40 meters between holes. In this case, a green line it is shown when the holes are at a bigger distance than the entered value. If the holes are positioned less than 1.40m apart, warnings will appear in red.

If the user moves each hole, the software will recalculate the critical distance again.

10.5.2.2. Edit Hole's Label

In this tool the user can create a label hole by hole or automatically.
If the option **one by on**e is checked, the user can choose a **text**, a **number** to attached to the text and if he wants that number to **increase automatically** (if yes must click on" Increase Number").

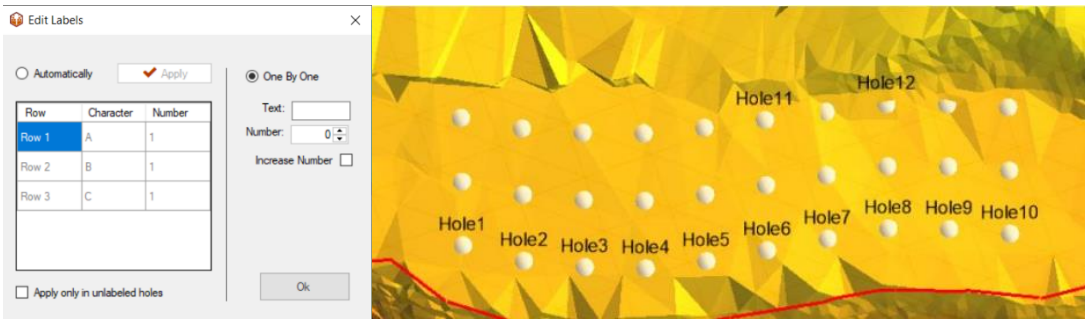

Fig. 215 – One by labeling

If the option **automatically** is checked, the user must define for each row what **text** he wants, the **number** that will start in each hole (of a row) and after that click in **apply**.

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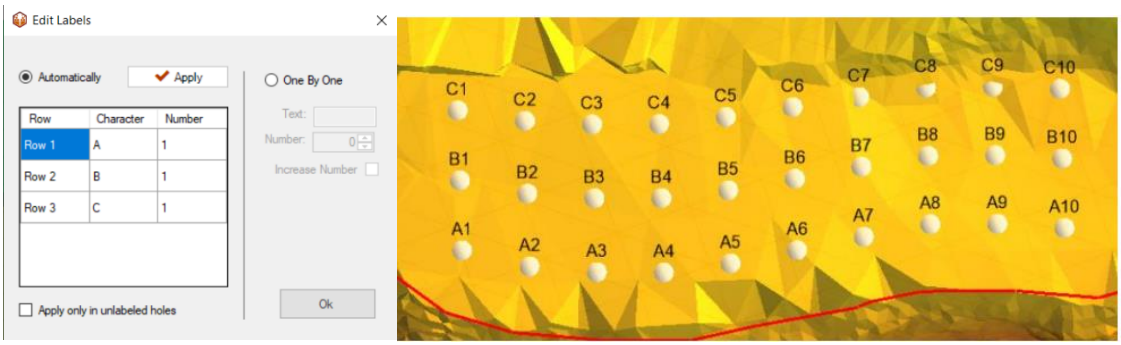

Fig. 216 - Automatic labelling

10.6. Update Altitude

This option allows the user to update the altitude of the boreholes. Clicking in this tool it will appear an option to open a file (**this file must contain hole numbers and new altitude of the hole**). After choosing the file it will pop up a window to connect hole number with altitude (Fig. 217). After that the user clicks on the download button and the altitude of the holes will be updated.

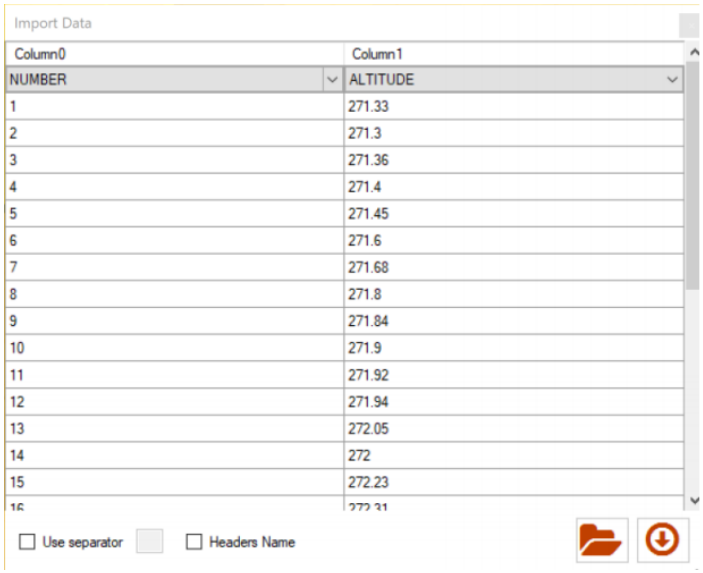

Fig. 217 - Update altitude window

10.7. Rows: Creation and Edition

Icon		*Description*
	Add row	Create a new row
	One by one	Create a row near to other
	Line Editor	Select holes to define from which row they are.
	Hole by Hole	Define rows by holes individual select
	By line	Define rows by drawing a line over a conjunct of holes

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	Clear all	Eliminate all rows

10.7.1.Add Row

When the user clicks on the **Add row** icon ( ) it will pop up a window to define the row number and the spacing between the holes.

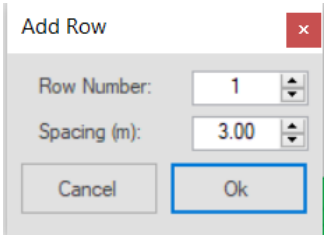

Fig. 218 - Add row window

After defining the parameters, the user must click one time on the field (1) and then drag the mouse until the place where he wants to build the row (2) - Fig. 219.

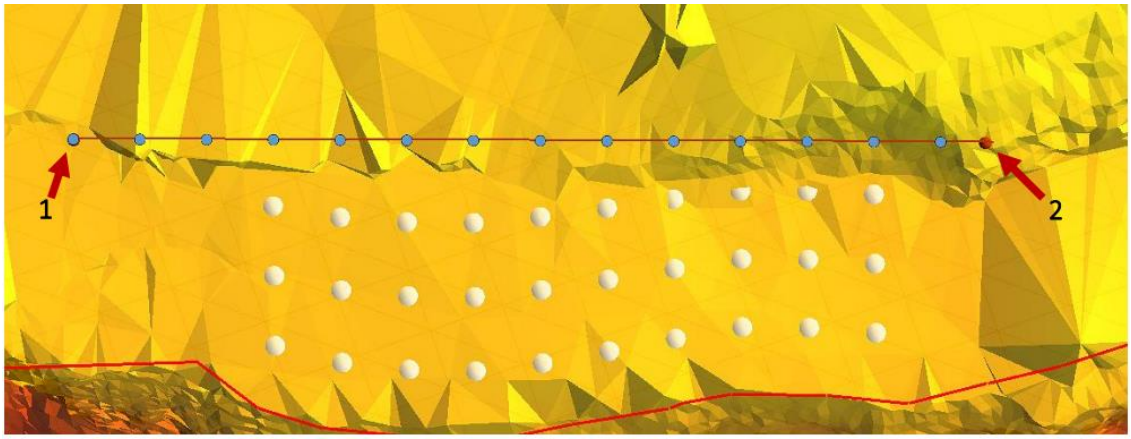

Fig. 219 - Creating new row

On the other hand, if the user wants to create a row near to other it has one option for that. On **create row near to another** ( ) the user it will be forwarded to a window with the option to define **spacing**, **burden**, **after which row,** he wants to put the new one, **the row number** and **type of pattern.**

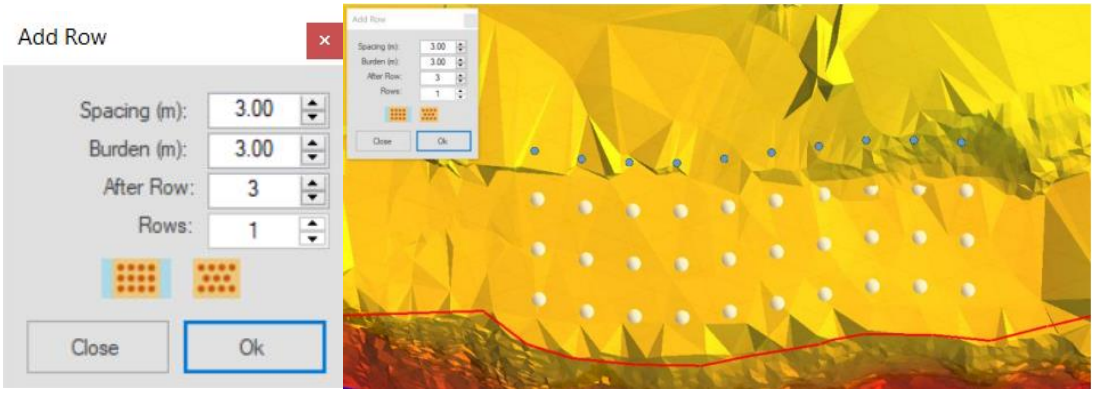

Fig. 220 - Create row near to another

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10.7.2.Line Editor

The Line Editor tool permits the attribution of a row ID to each hole. There are two main options:

- **Hole by hole**: The user must define the row number in the **Row Control Box** and drag the mouse over a hole to assign a row ID (Fig. 221).
- **By line**: The user must define the row number in the **Row Control Box** and draw a line over a set of holes to assign a row ID (Fig. 222).

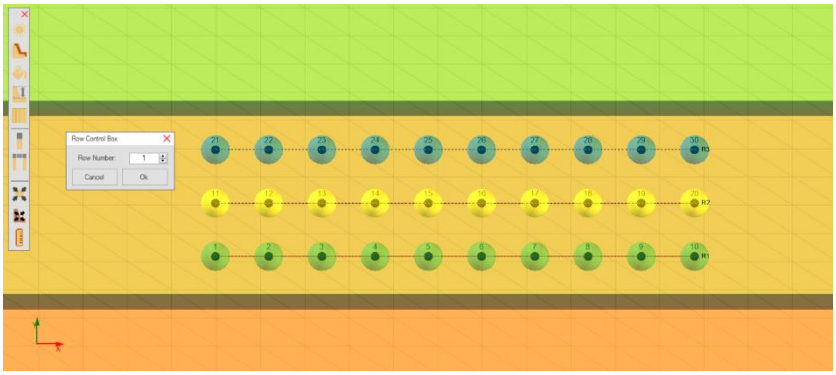

Fig. 221 - Line Editor: Hole by hole

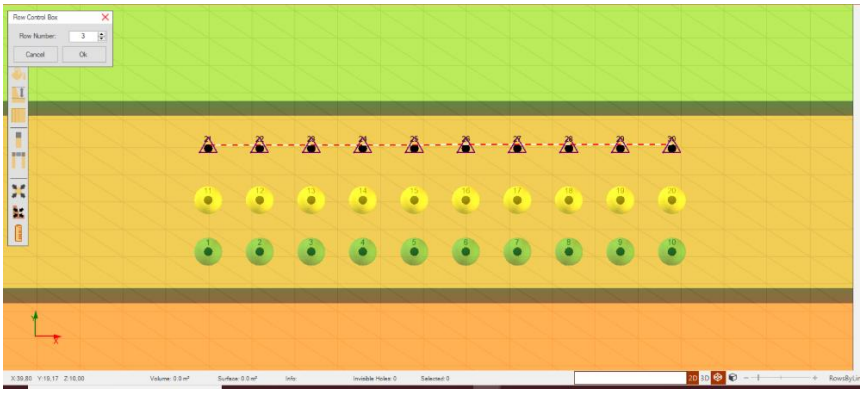

Fig. 222 - Line Editor: By Line

- Purple triangles illustrate that the rows are not assigned.
- To delete the information of the rows the user just must click on **Clear All** button.

10.7.3.Prepare Rows

When the user uses this option, it will pop up a window that works the same way as the **Row Control Box.** If select a row or numerous rows the holes with hole deviation measurements will appear all align on the report (as they were on the same row). To delete the information of these tool just click on reset button.

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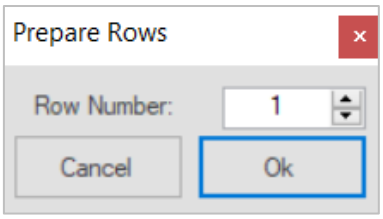

Fig. 223 - Prepare rows window

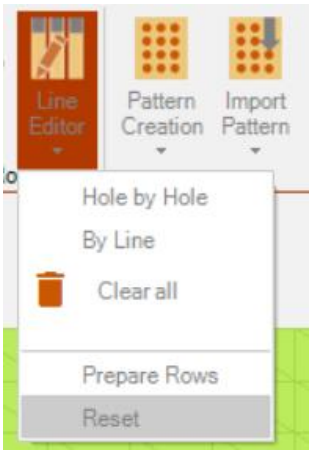

Fig. 224 - Reset tool

10.8. Pattern

Icon		*Description*
	Pattern Creation	Create a pattern over an existent terrain
	From Back	Create a pattern from back based on a line angle or a single point or a line
	Edit Burden and Spacing	Auto edit of burden and spacing through a previous pattern
	Along line	Create holes along line
	Between Line_Crest	Create a pattern between one specific line and the crest.
	Between Line_Crest Polygon	Create a pattern between crest line and line back of a polygon
	Import Pattern	Import holes from file
	Rotate Pattern	
	Rotate 90º to the Right	Rotate the entire pattern or a conjunct of selected holes 90º to the right
	Rotate 90º to the Left	Rotate the entire pattern or a conjunct of selected holes 90º to the left

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	Turn Vertically	Turn the entire pattern or a conjunct of selected holes vertically
	Turn Horizontally	Turn the entire pattern or a conjunct of selected holes horizontally
Import Zone		Import blast polygon from file
Type		
	Production Blastholes	Attribute the Production Blasthole ID to a hole or a conjunct of holes
	Buffer Blastholes	Attribute the Buffer Blasthole ID to a hole or a conjunct of holes
	Contour Blastholes	Attribute the Countour Blasthole ID to a hole or a conjunct of holes
	Ghost Blastholes	Attribute the Ghost Blasthole ID to a hole or a conjunct of holes
	1st Hole	Attribute the 1st hole ID to the holes that where defined as the first row
Export		Export your borehole information (only .csv files)

10.8.1.Pattern Creation -

For the simple pattern creation, over an existent terrain, the user must select the **Pattern Creation** tool. It is necessary select the pattern characteristics on the **Pattern Window** (Fig. 225) and then, left click in the terrain.

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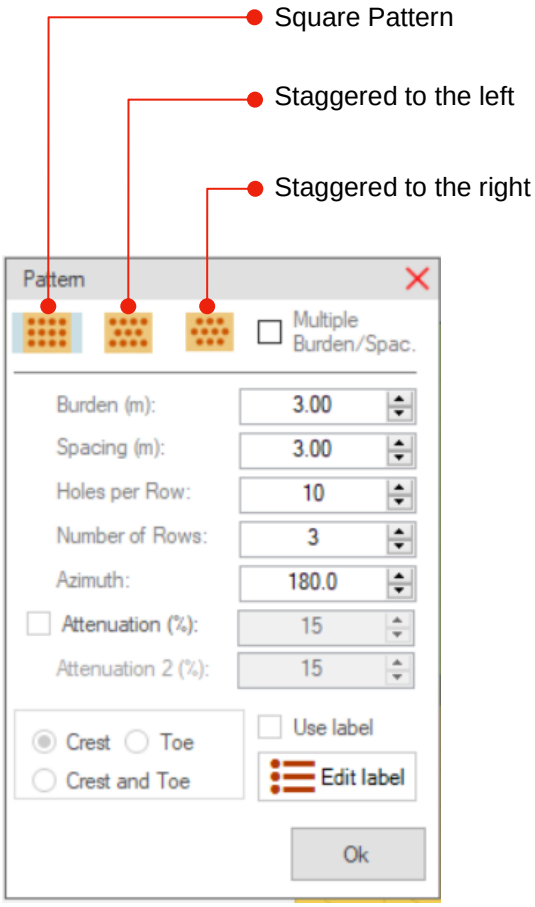

Fig. 225 - Pattern Characteristics Window

The user can pre-visualize the hole's position in the terrain (by clicking on the terrain once) and do changes in the characteristics before confirming the final position (Fig. 226).

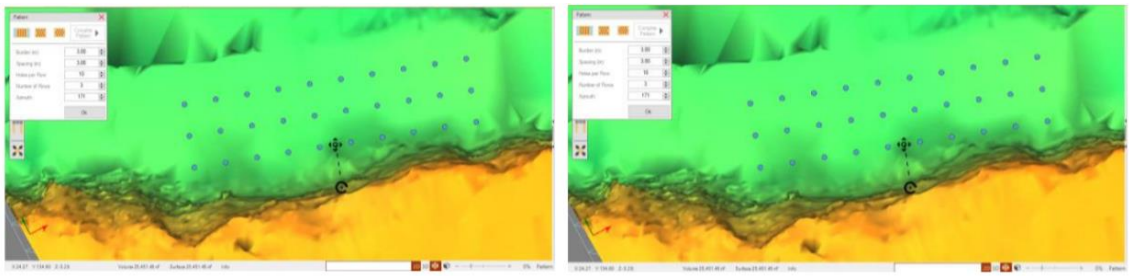

Fig. 226 - Changing Pattern Characteristics

Besides that, the pattern position can be manualy adjusted by moving the **Pattern Position Adjustment** icon and the azymuth can be changed in the **Pattern Characteristics Window** or by dragging the **Rotating** icon .

The user can check the option **Multiple Burden/Spacing** to creat a pattern with multiples burdens/spacings between rows.

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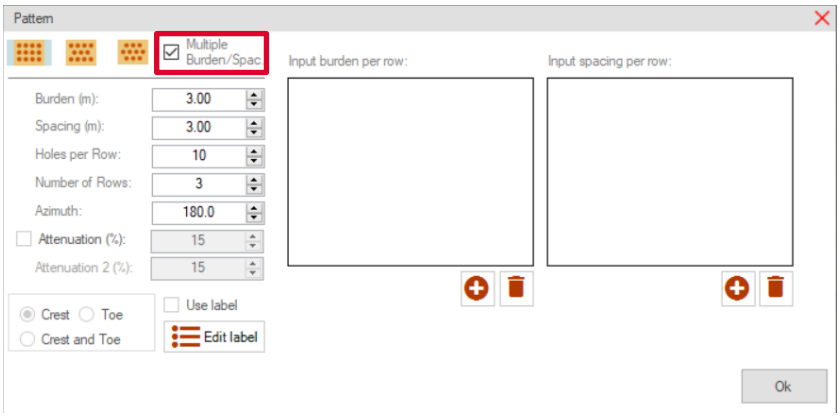

Fig. 227 – Multiple burden/spacing per row

The user clicks on the **Plus** button to add the number the rows that he wants. To delete just click on the **Delete** button. To change the burden just click on the row you want to change and write the number of burdens/spacings.

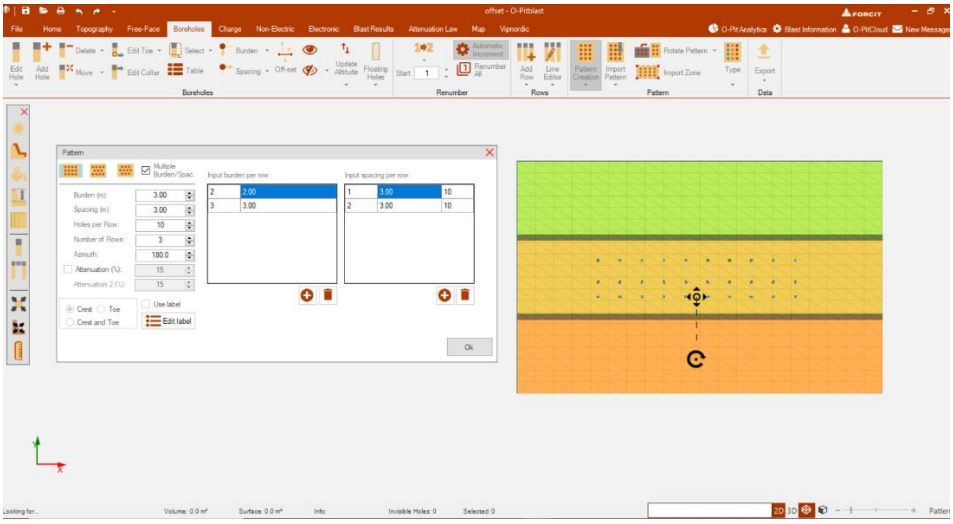

Fig. 228 – Editing the burden/spacing per rows

10.8.2. Attenuated Pattern Adjusted to Crest, to Crest and/or Toe

In this option the user can (if the crest and toe is defined) attenuate the pattern to the crest, toe or both.

10.8.2.1. Attenuation

If this option is on, the user will have an attenuation on the burden. This value means that the burden in attenuated by, for example, 15% in each row (Fig. 229).

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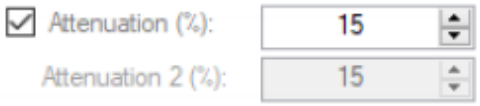

Fig. 229 - Attenuation option

For example, if the user wants the last line horizontal, the attenuation between rows must increase (Fig. 230).

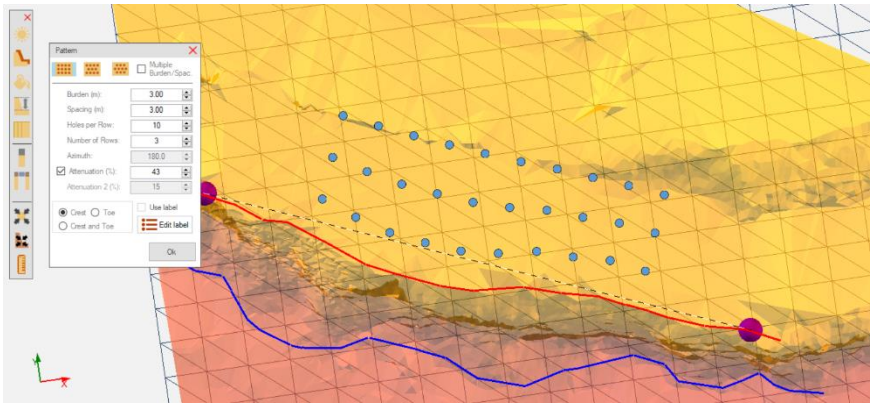

Fig. 230 - Last row horizontal

After that the user has three options. Adjust only to crest (Fig. 231), only to toe (Fig. 232) or crest and toe (Fig. 233).

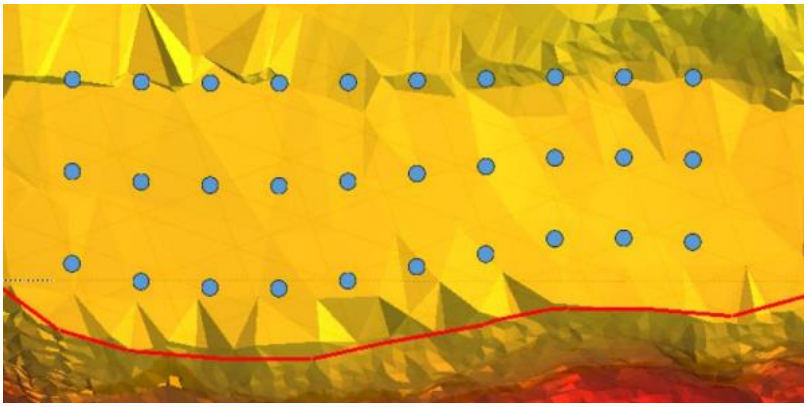

Fig. 231 - Adjusted to crest

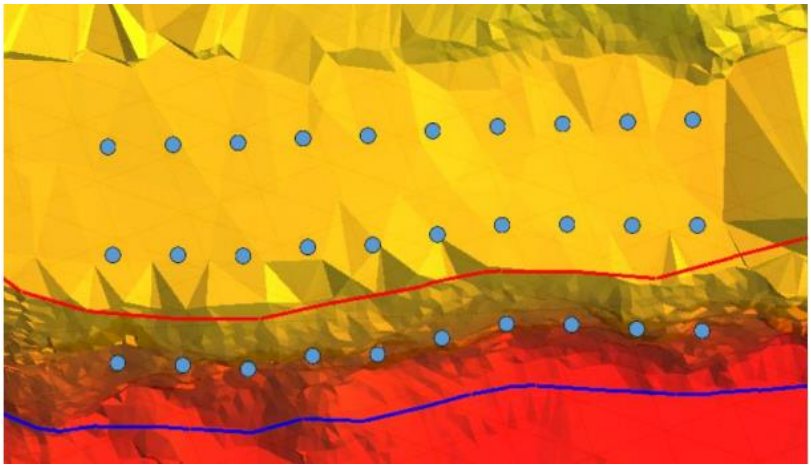

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Fig. 232 - Adjusted to toe (the blue circles represent the toe of the borehole)

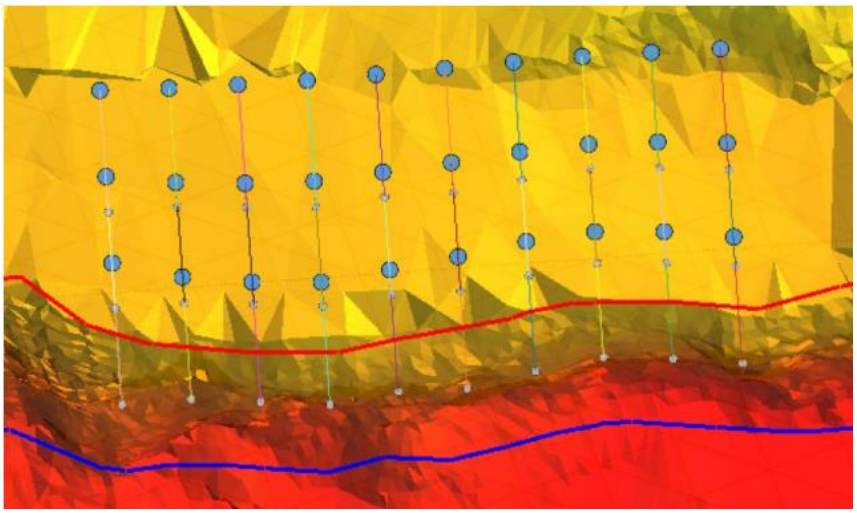

Fig. 233 - Adjusted to crest and toe

If the user clearly sees that the line from one point of the blast to another (on the free face is not well defined can change it) by right-clicking on the purple spheres (Fig. 234).

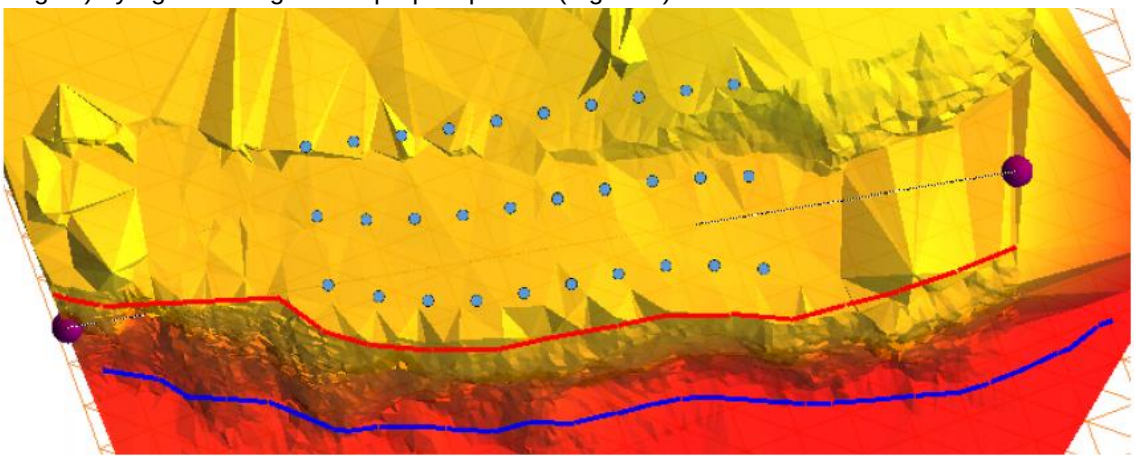

Fig. 234 - Purple spheres (on both sides)

It will pop up a radial menu where the user can:

- Move the point
- Eliminate the point
- Clear all points
- See the coordinates of the points

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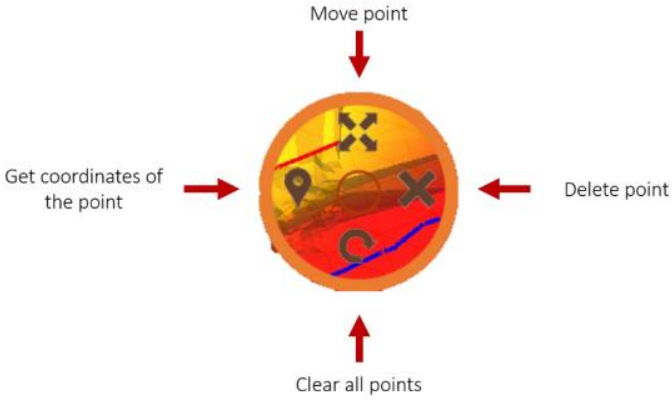

Fig. 235 - Radial menu of attenuation points

10.8.3.Pattern Creation Tools

10.8.3.1.From Back

The user can create a pattern using from back tool. Once this tool is selected, the following window it will appear:

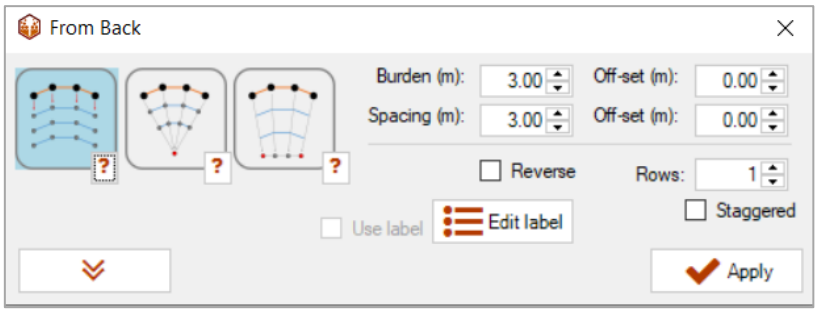

Fig. 236 – Editing the burden/spacing per rows

Basically, first it is needed import/create a back line. Then, it is possible use three mechanisms to create pattern from this resource: based on a line angle; based on a single point; and based on a line.

- Based on a line angle:
  - Select the back lines (left click on them) and choose the angle
  - Choose burden, spacing and number of rows
  - Define the offset (distance of the 1st row from the back line)
  - If needed, the user can choose the burden/spacing per row

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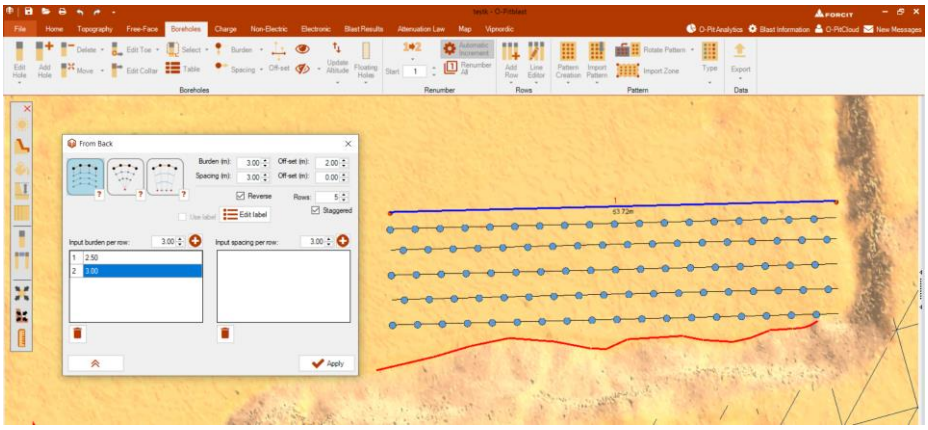

Fig. 237 – Pattern creation using from back based on line angle

- Based on a single point:
  - Select the back lines (left click on them) and then, left click on the terrain to select the point to converge your pattern
  - Choose burden, spacing and number of rows
  - Define the offset (distance of the 1st row from the back line)
  - If needed, the user can choose the burden/spacing per row

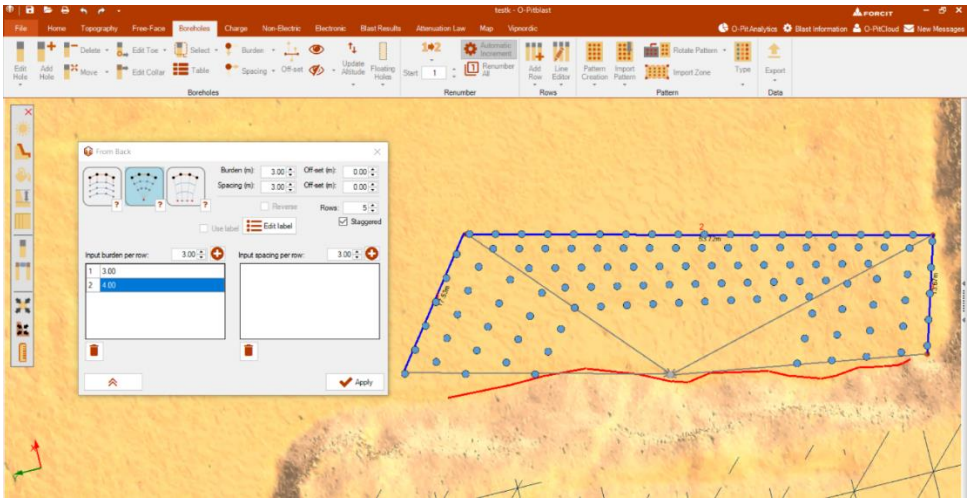

Fig. 238 – Pattern creation using from back based on a single point

- Based on a line:
  - Select the back lines (left click on them). Then, right click on the terrain and drag the mouse to create a line
  - Choose burden, spacing and number of rows
  - Define the offset (distance of the 1st row from the back line)
  - If needed, the user can choose the burden/spacing per row

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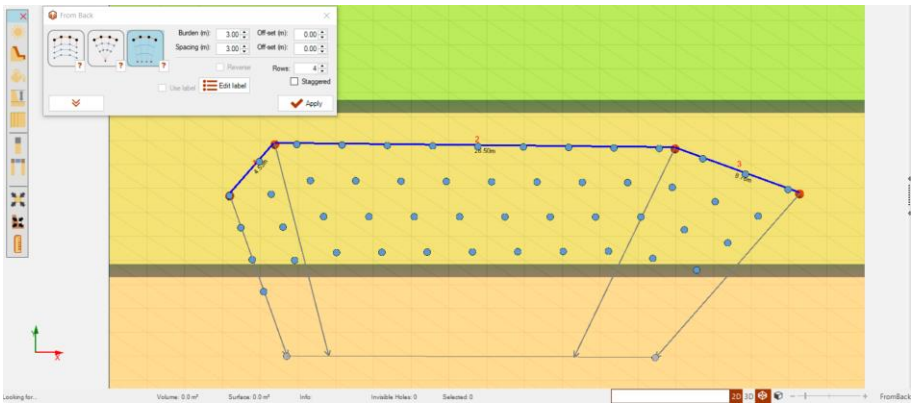
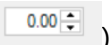


Fig. 239 – Pattern creation using from back based on a line

10.8.3.2.Edit Burden and Spacing

Edit burden and spacing tool will make it possible to modify a previous pattern. The user can enter with an increment related to burden and/or spacing per row () inside the edit window.

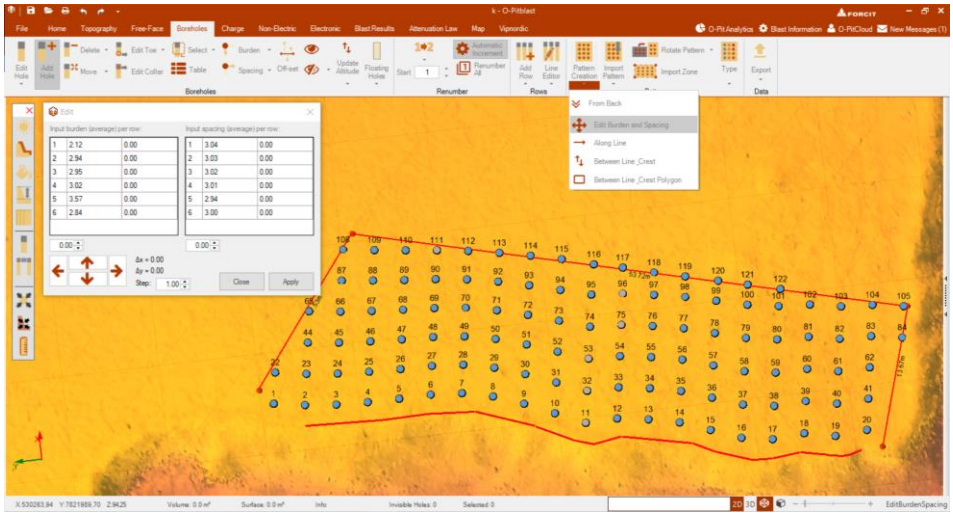


Fig. 240 – Edit burden and spacing tool

The arrow icons inside this window also enable to move the blast to left, up, down or right. And the step entry means the value to be added to the Δx and Δz increments according to the user clicks on some arrow.

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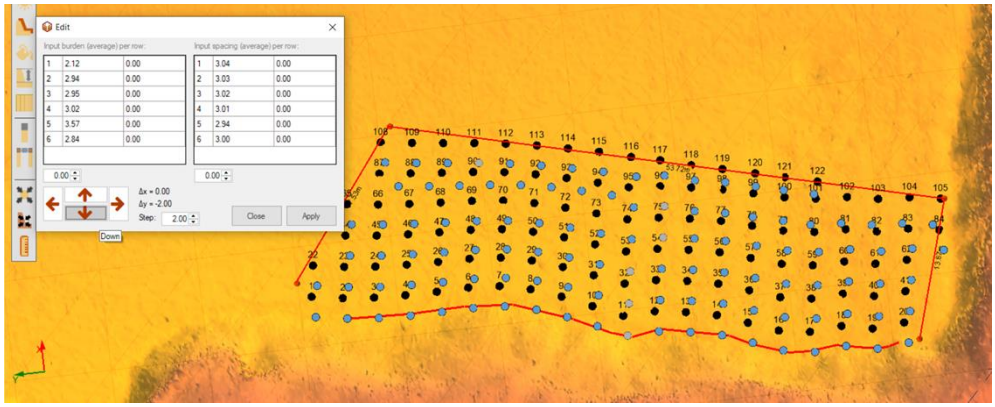

Fig. 241 – Edit window: moving down the blast with step of 2 on the y-axis.

10.8.3.3.Along Line

The user can create or import a line. Once there is a line, then it is possible to create a pattern using the along line tool. After clicking on this tool, a holes along line window will appear to define spacing and offset as desired. With just one click, the line will be selected and with double-click on the line, the holes will appear according the adjust (Fig. 242).

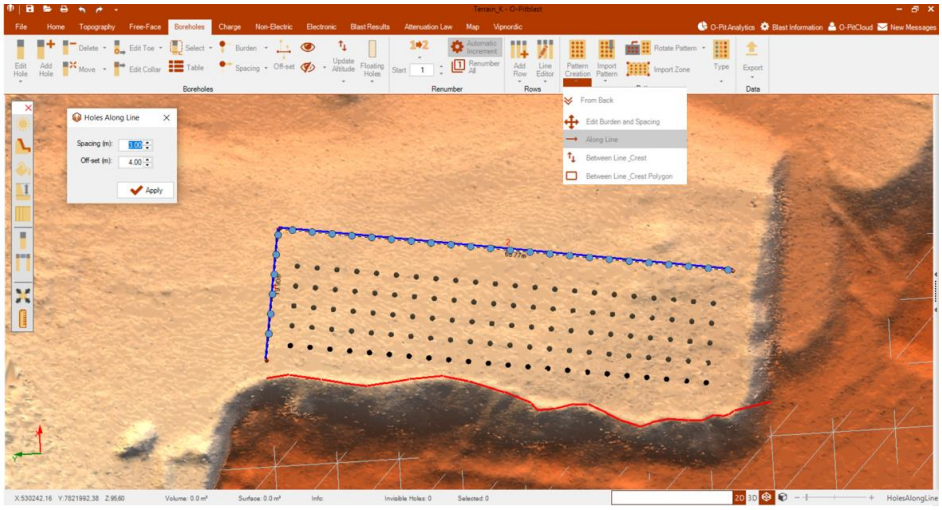

Fig. 242 – Pattern creation using along line

10.8.3.4.Between Line_Crest

This tool will help the user can create a pattern between one specific line and the crest (Fig. 243). First, it is needed to create/import a crest and line. After this button is selected the crest appears automatically enabled and it is only necessary to select the line back for pattern creation. Then the user can choose the geometry and other parameters as illustrated in the picture below and to finish click on the apply button

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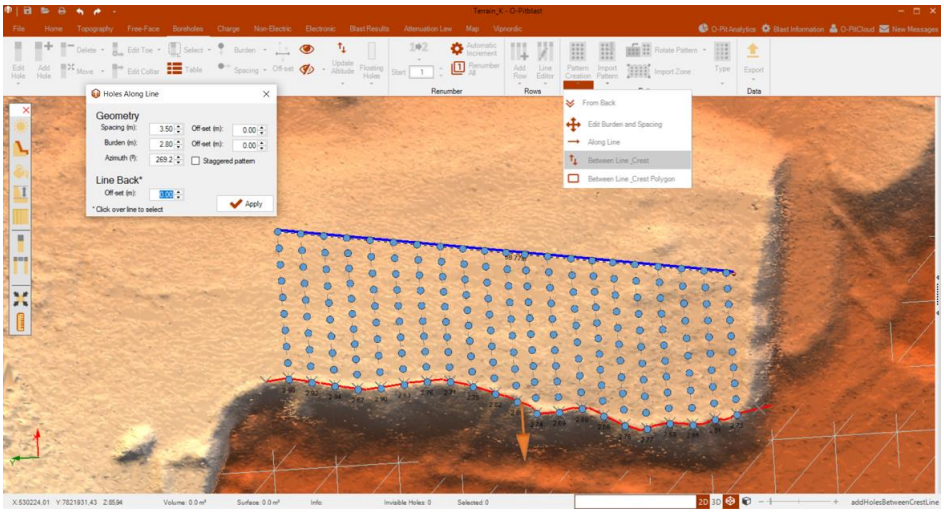

Fig. 243 – Pattern creation using between Line_crest

10.8.3.5.Between Line_Crest Polygon

To create a pattern through this feature, first of all the user must create or import a polygon. After selected, the polygon selection window will open. Then the user will make the selection of crest line and line back. And can also change geometric properties – spacing, burden, azimuth – give an off-set and select/deselect stagered pattern (Fig. 244).

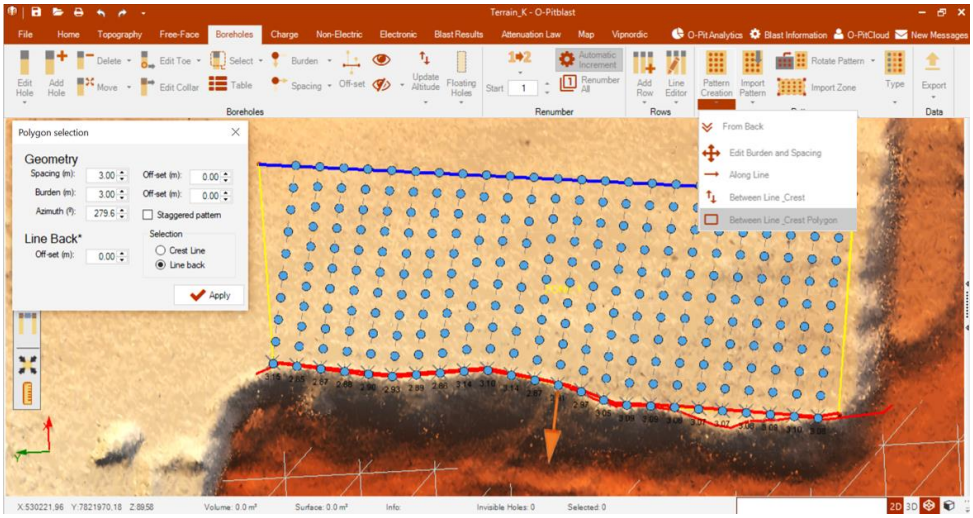

Fig. 244 – Pattern creation using between Line_crest polygon

10.8.4.Import Pattern -

To import a pattern, the user must have a list with hole coordinates. This list can be imported by pressing the **Import Pattern** icon in order to open the importation window (Fig. 245).

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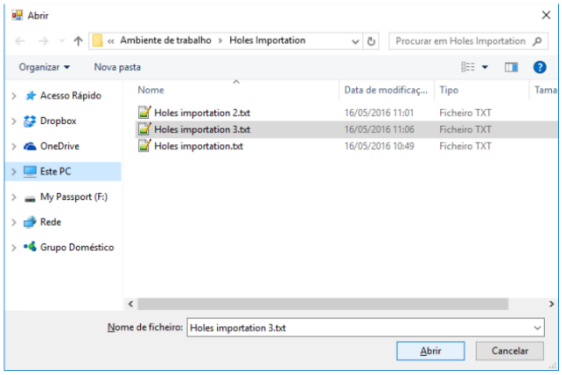

Fig. 245 - Selecting hole coordinates file for importation

The user must define the X, Y and Z coordinates (Fig. 246) and all parameters in Fig. 247 and define if the terrain can be generated by the borehole's collar position (Fig. 248). Also, the user can change the diameter units and change the coordinate system (see chapter 8.1.2).

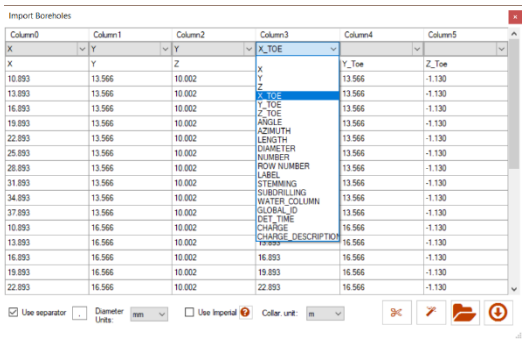

Fig. 246 - X, Y and Z coordinates definition

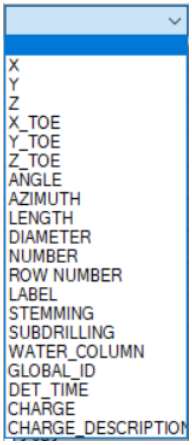

Fig. 247 - Parameters to import holes

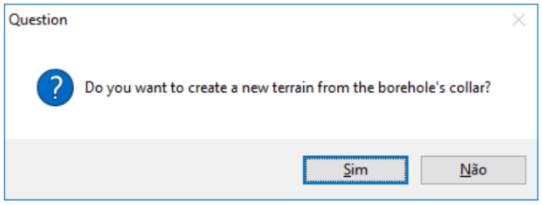

Fig. 248 - Terrain from borehole's collar

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The final stage of hole's importation, and if the hole's length was not imported, it is necessary to define it. It can be possible by defining the **Bench Bottom Position** or by establishing a **Borehole Length** (Fig. 249).

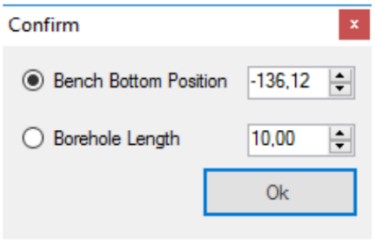

Fig. 249 - Borehole length definition

10.8.4.1.From Picture

The user also has the option to import pattern from picture (Fig. 250). Once this tool is selected, a window will open and then the user is obligated to import the external file.

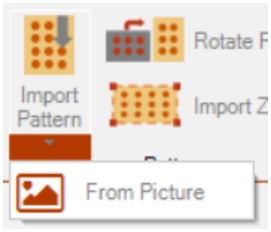

Fig. 250 – Import pattern from picture

After the importation, the user can centralize ( ) the picture and zoom it or zoom out by scrolling the mouse or using the buttons (,). With the right click the user can mark the holes in the picture and them they will appear as blue points. There is the clear holes button ( ) to delete all these points. And to delete just one of them it is necessary to right-click again in each point.
When set scale is enabled, the user can draw a line between two points and enter with the respective scale (m) and hole length (m) values to generate the pattern (Fig. 251).

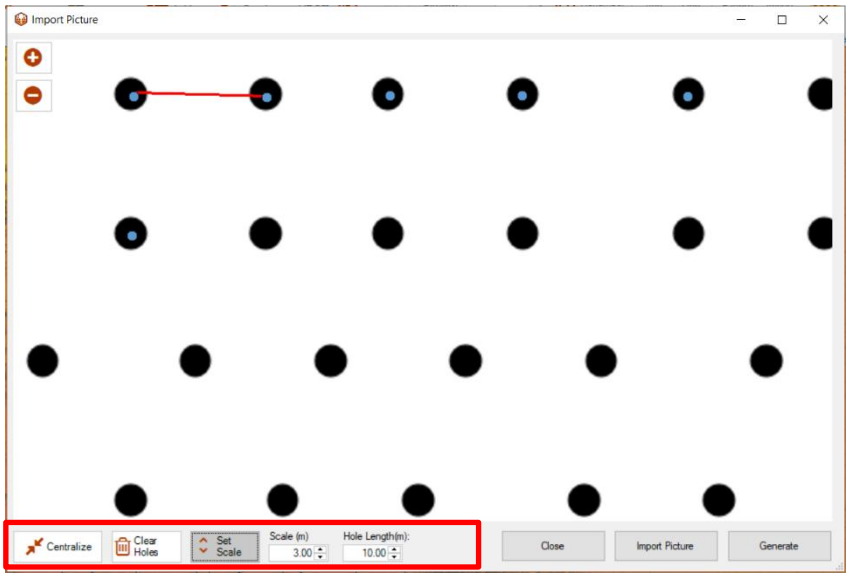

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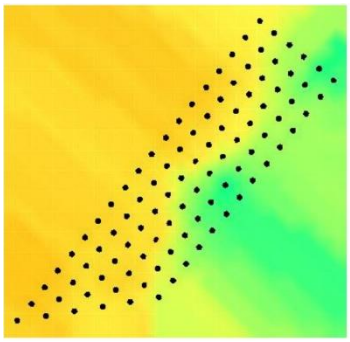
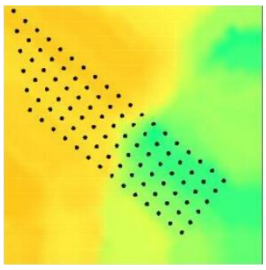
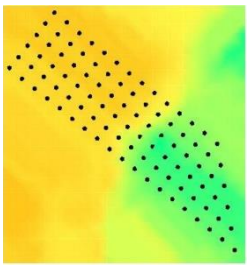
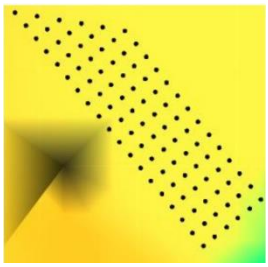
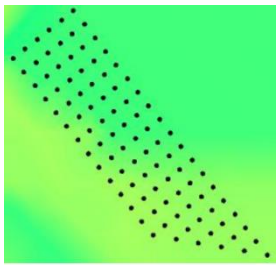
Fig. 251 – Import picture window and its features

10.8.5.Rotate Pattern -

The **Rotate Pattern** tool allow the user to rotate each pattern in the following ways:

- Rotate 90º to the right
- Rotate 90º to the left
- Turn vertically
- Turn horizontally

Original Pattern			
			
Rotate 90º to the right	**Rotate 90º to the left**	**Turn vertically**	**Turn horizontally**
			

To use this tool is necessary to have one point into consideration: if the transformed holes are positioned out of the existent terrain they will not be moved. For that the user must expand the terrain previously to the pattern transformation.

10.8.6.Import Zone -

To import a blast polygon, the user must select the **Import Zone** icon, selecting the polygon file and define the X and Y coordinates (Fig. 252).

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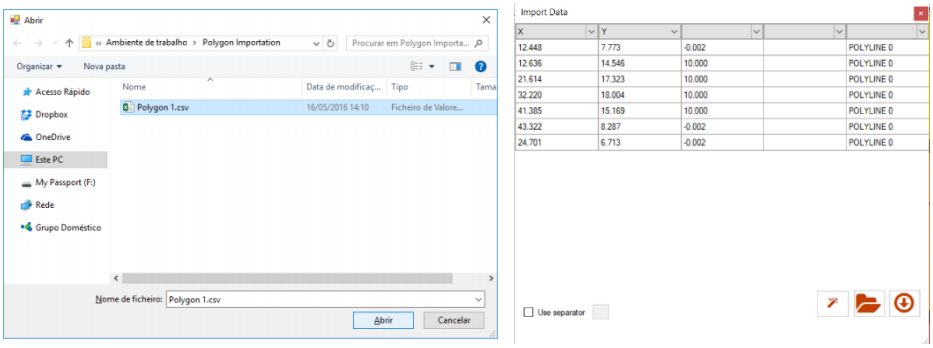

Fig. 252 - Polygon importation (file selection)

After import the polygon, the user can generate holes inside the polygon by the **Radial Menu** (Chapter: 6.8) or any other tool as desired.

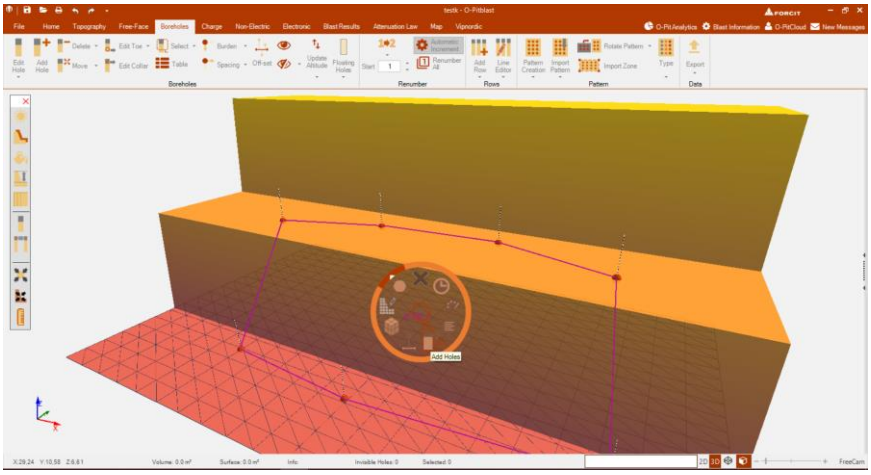

Fig. 253 - Edition of polygon pattern

10.8.7.Type -

In order to define the hole type ID (for a conjunct of holes), the user must do a selection around a set of holes and, in the **Type** expansion tab, select the color for each selection (Fig. 254).

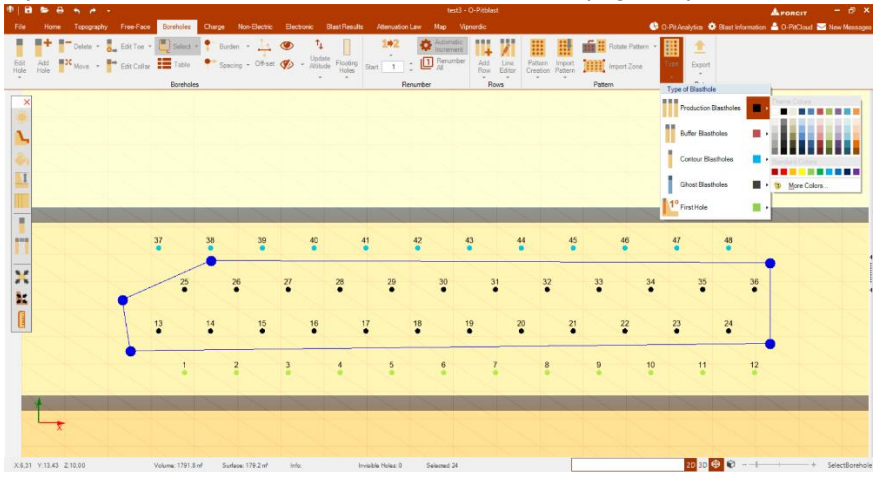

Fig. 254 - Hole type selection

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To edit the Type ID to an individual hole the user can appeal the Radial Menu.
Note: the ghost holes will appear in a different way, like shown on picture bellow.

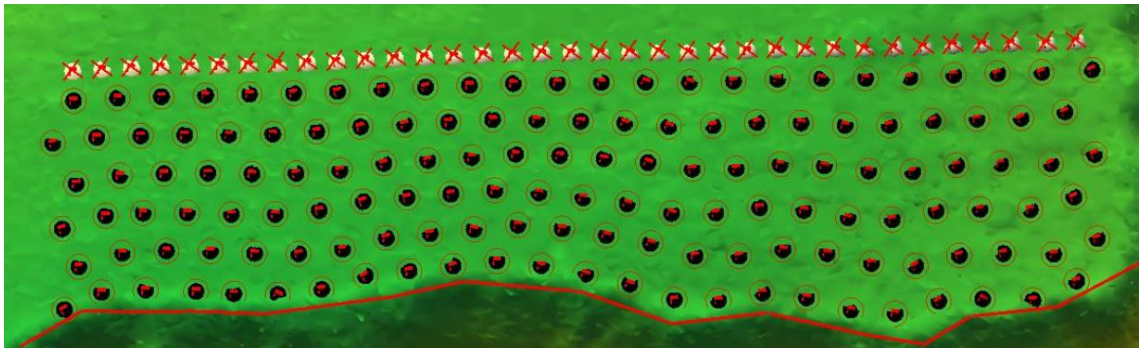

Fig. 255 - Ghost holes (with a cross on top of the holes).

10.9. Export Pattern

The user can export the pattern no .csv, IREDES or .dxf. Also, it can export the coordinates of the center of the blast in .txt.

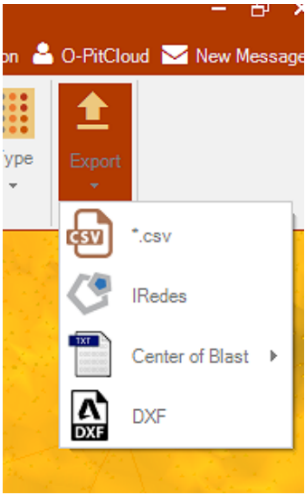

Fig. 256 - Export pattern options

When exporting, the user has the option to choose between some fields that he wants to be exported (Fig. 257).

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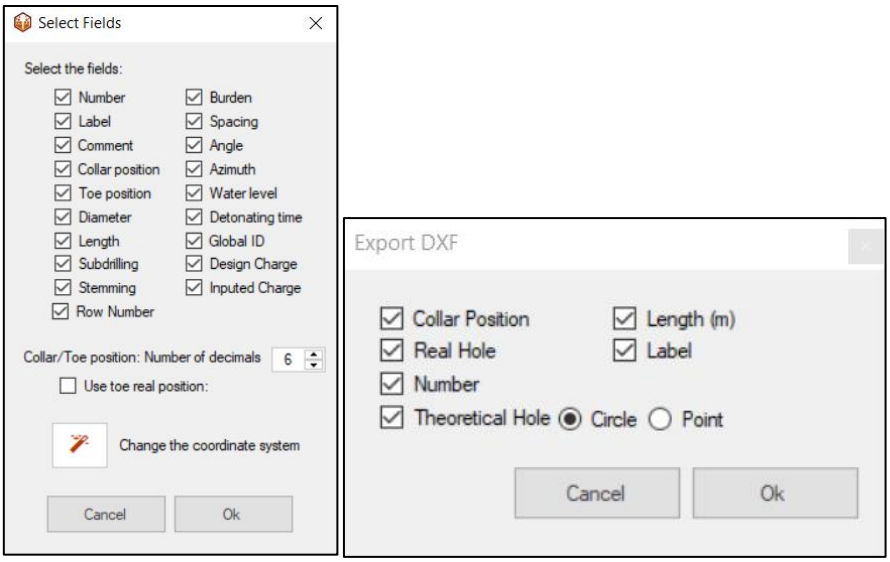

Fig. 257 -.csv and.dxf fields to export

P.S: The use toe real position is an option to select if there were boreholes measured in the field and this information about deviation has been imported into O-Pitblast.

11. Charge

On this module the user has multiple options to help him charging the holes in different ways.

Icon		*Description*
	Edit Rule	Edit charge rules
	Select by Length	Select charge rule by Length
	Add Charge	Add charge
	Discharge	Unload holes
	Select	Select holes
	Import charge	Import a local file with charge information
	By powder factor	Charge your holes by defining a limit of powder factor
	Manually feeding	Use total charge information to load the holes

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Complete charge	Distribute charge by the unloaded boreholes
Extra Charge	Add more charge to the blast

11.1. Add Charge -

In the charge edition panel, the user will be able to define the charge of individual or a conjunct of holes. When the holes are charged, a red circle will appear around the holes. Through the **Radial Menu** the user can access to the charge tab of each hole and apply the desired charge by adding elements in the **Quantity of Elements** option (Fig. 258).

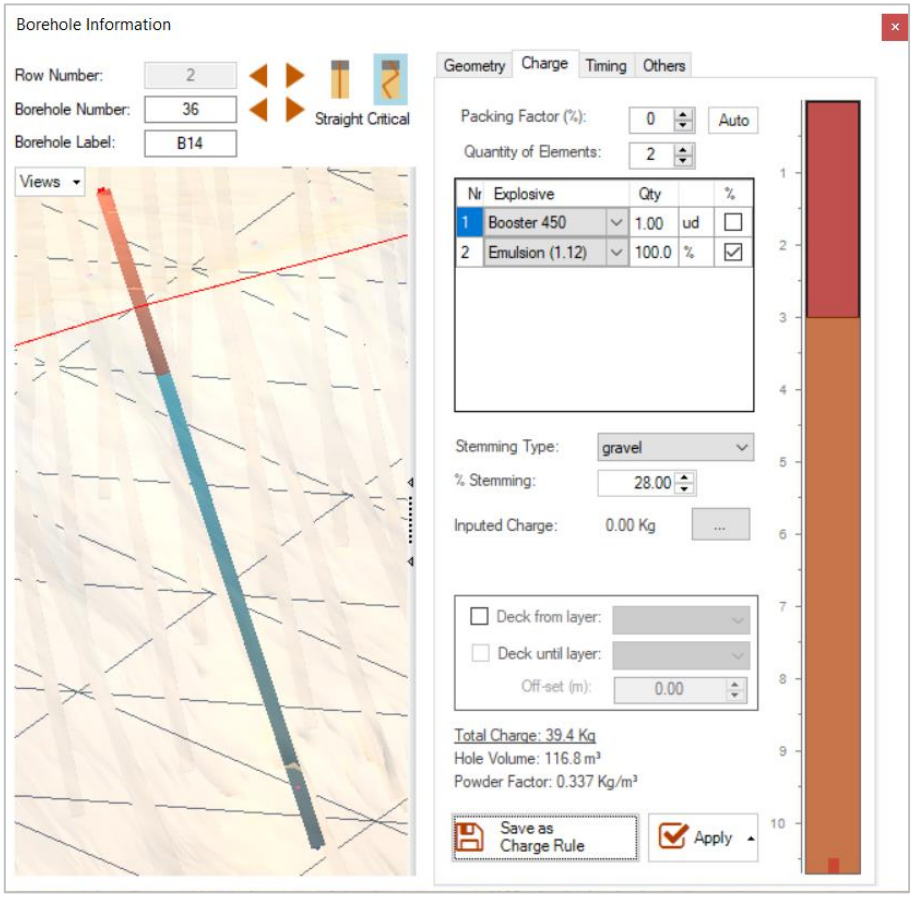

Fig. 258 - Charge Tab Window

In this tab above, the user can also select stemming type (air, water, gravel, cuttings, airbag, paraplug) and attribute percentage to it in this tab. And introduce an imputed charge: kg for explosives and units for boosters. This last information it will appear on the comments of the blast report (borehole information).

P.S: In the case of some holes having their charges modified on the field, when updating holes through the server (O-PitCloud), the new information related to their charges will appear within the inputted charge field (Fig. 259).

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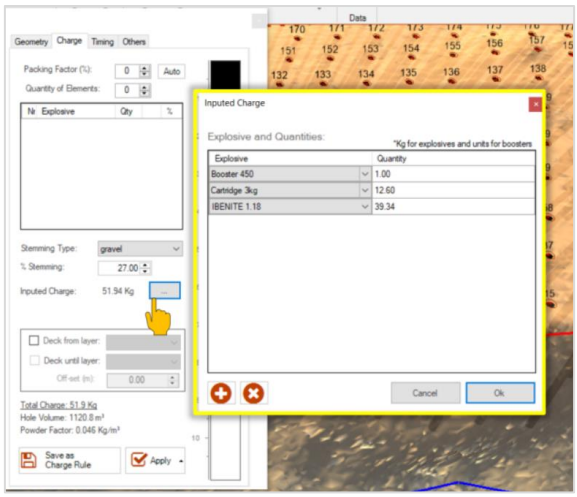

Fig. 259 – Inputed charge with the information updated

11.1.1.Add Primer (Booster)

To add a primer (booster) the user must select it from the dropdown list of the added element and introduce the quantity of the components. The percentage (%) is not available for this element.

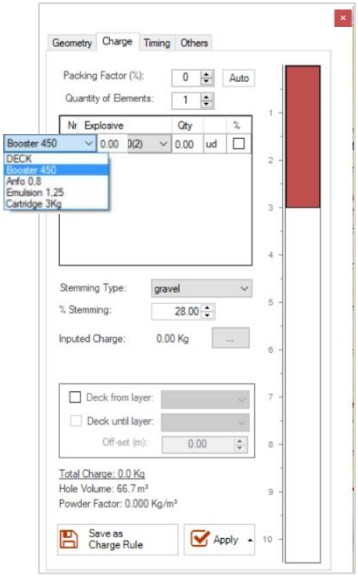

Fig. 260 - Adding primer

11.1.2.Add Column Charge

To add the column charge, the user must add another element and select from the dropdown menu the desired component. There are two options to add cartridges or bulk explosives:

- by percentage: the user selects the hole percentage to be filled by the product (Fig. 261 A)
- by meters: the user selects the meters to be completed by using the product (Fig. 261 B)

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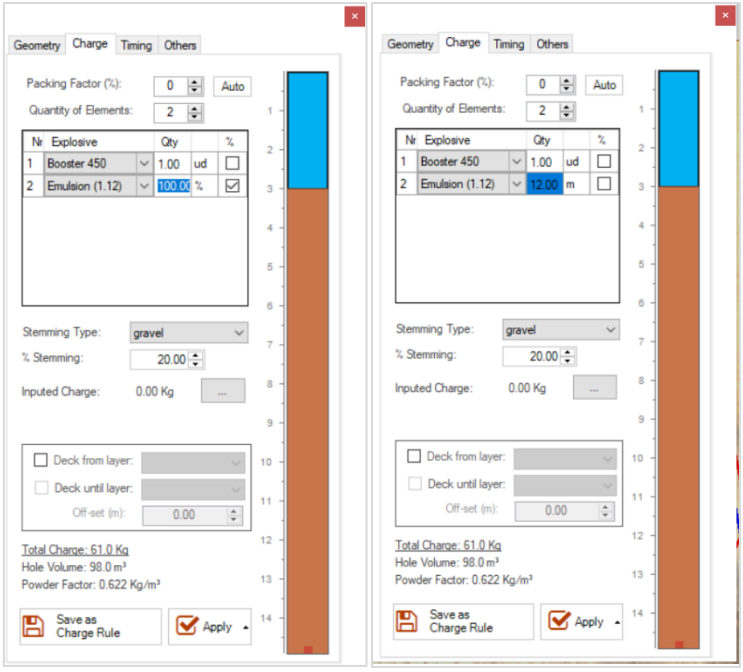

Fig. 261 - Left (A): Adding column charge by percentage; Right(B): Adding column charge by meters

11.1.3.Add Cartridges

The addition of more than one product must follow an order, this means, that the first element to be added will be plotted in the bottom of the hole and the following ones above each other's.
To add a cartridge, the user can also select by quantity or percentage. Nevertheless, in this case the charge model will present the number of cartridges to be loaded (Fig. 262). After creating the charge column, the user can apply a **packing factor** to all boreholes (on the top of the page) and define the percentage that he wants.

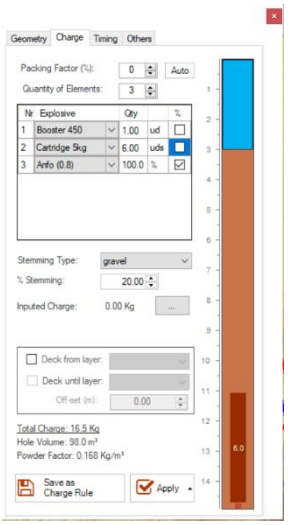

Fig. 262 - Add Cartridges and packing factor

11.1.4.Apply Charge Rule

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The user can mark the option **Apply** and choose which holes he wants to apply the charge rule.

Fig. 263 – Apply button

To enable the option to apply a saved rule to a set of holes, the user must check the **Checkbox** on the **Charge Tab** (Fig. 264).

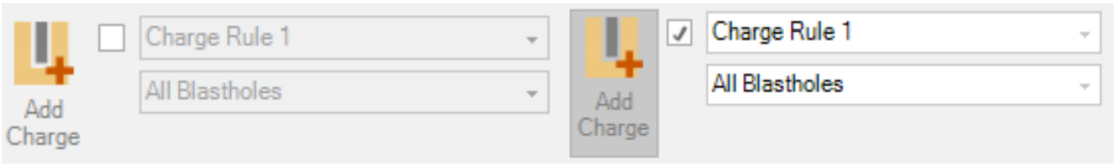

Fig. 264 - Applying Charge Rule

The user must select the charge and the selection to apply the rule and click in the **Add Charge** icon (Fig. 265).

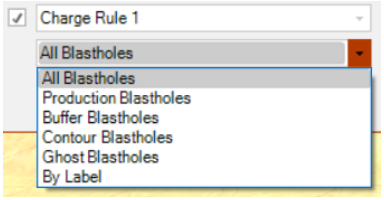

Fig. 265 - Apply Charge rule to a type of holes

11.2. Edit Charge Rule -

To create a rule, the user must define it by selecting the elements on the **Borehole Information Window**. With the charge defined, the user must click on the **Save Charge Rule** button and generate a new charge rule - Fig. 266.

To edit a current rule, the user must click on the **Edit Rule** icon, select the rule to be update, change its parameters and click in the update icon - - Fig. 267

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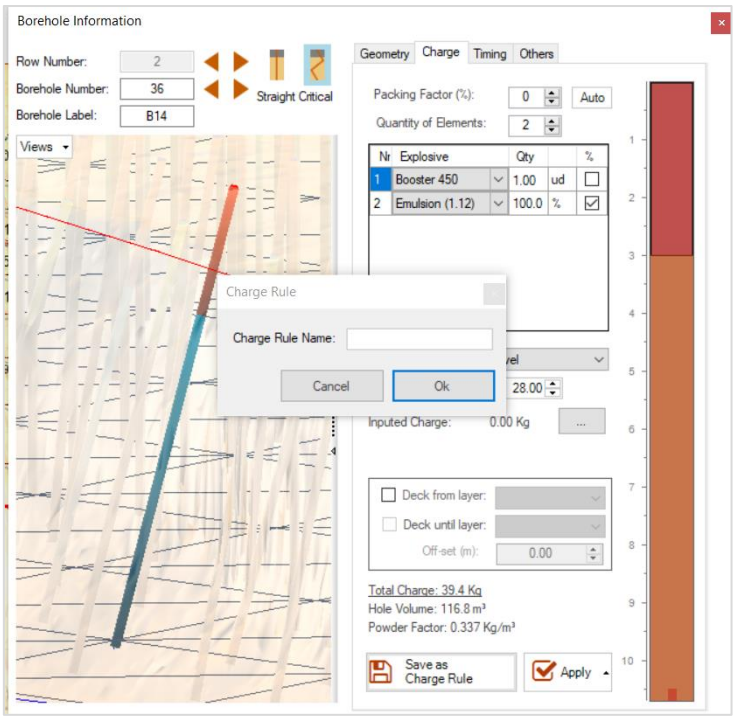

Fig. 266 - Create Charge Rule

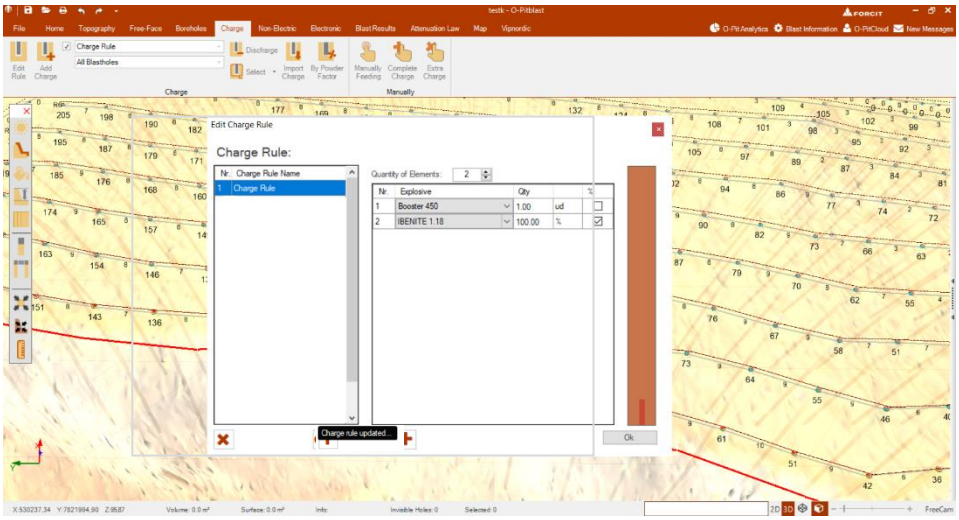

Fig. 267 - Edit Charge Rule Window

11.2.1.Discharge -

The **Discharge** option, when clicked, will eliminate all the charge from the totality of holes or a selection of them.

11.2.2.Select -

The **Selection** tool allows the user to select a set of holes and apply or erase a charge rule (Fig. 265). The user can also use the crest to select, like shown on the polygon (chapter 7.2).

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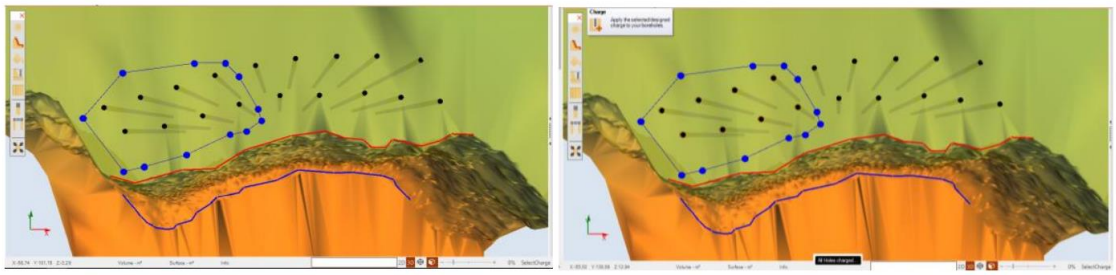

Fig. 268 - Applying charge rule to a selection of holes

11.3. Select by Length -

The user has the possibility to assign the specific charge rule based on different length ranges (Fig. 269).

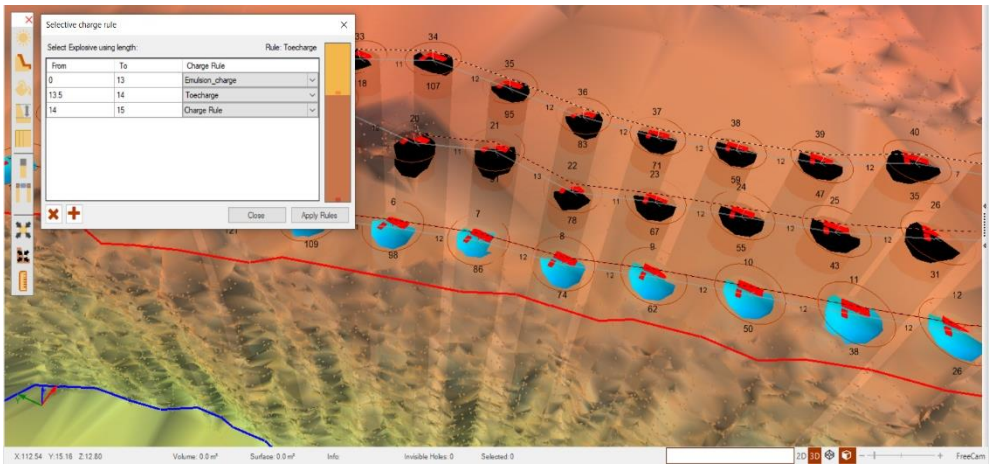

Fig. 269 – Applying different charge rule using length as parameter.

11.4. Import Charge

In this option the user can import a local file with boreholes charge information. First, it will open a window to connect the information to the hole number and the respective charge (Fig. 270). Then the user has to select the type of explosive (Fig. 271) and then, select the holes that wants to be charged with that explosive (Fig. 271).

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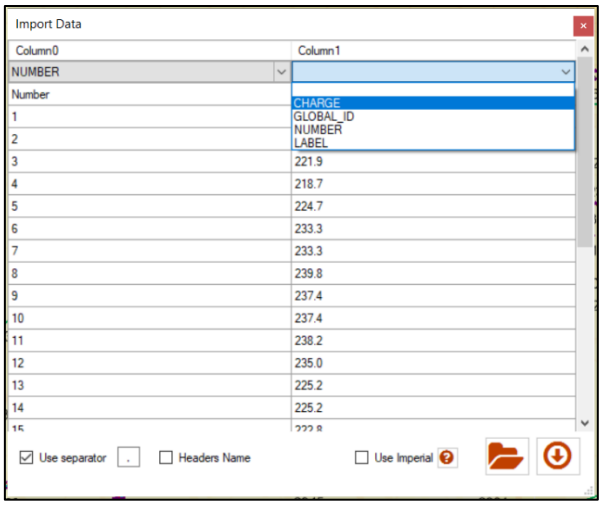

Fig. 270 - Import data (charge) window

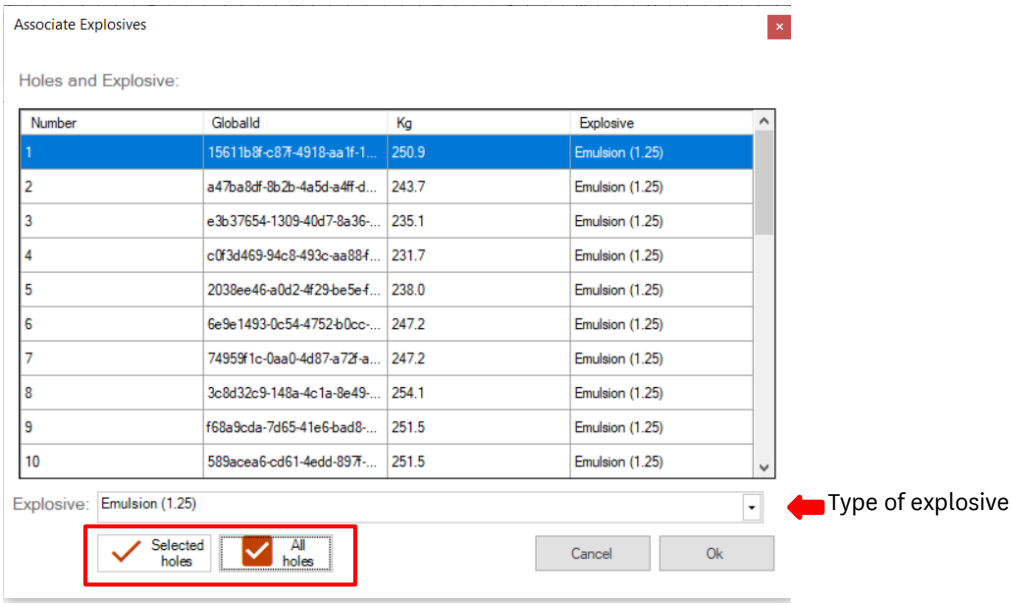

Fig. 271 - Choose type of explosive and associate to boreholes

11.5. By Powder Factor

The user can charge the holes up to a limit of powder factor. First, needs to choose the type of explosive that he wants to charge the holes. Then needs to define the limit of powder factor to be apply **to every hole**. Finally clicks on **Apply changes**. All holes will be charge **only until the limit** of powder factor (considering the borehole length of each hole).

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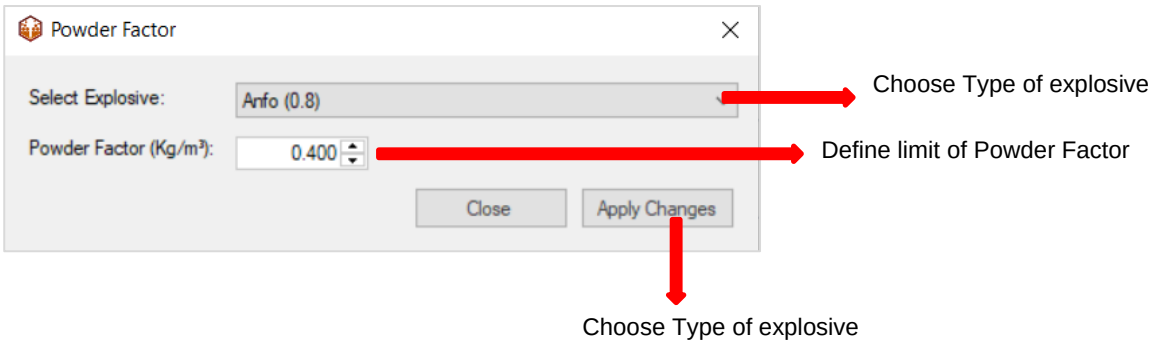

11.6. Manually Feeding -

The user can charge the holes manually.
First, he needs to add (✚) the number of products that he wants to use. To delete must click on the cross (✖).

After that, the user chooses the **total quantity** of explosive that he wants to use, and it will automatically have the kg that will be distributed **per hole in average**. To complete the action, just needs to click on **Apply.**

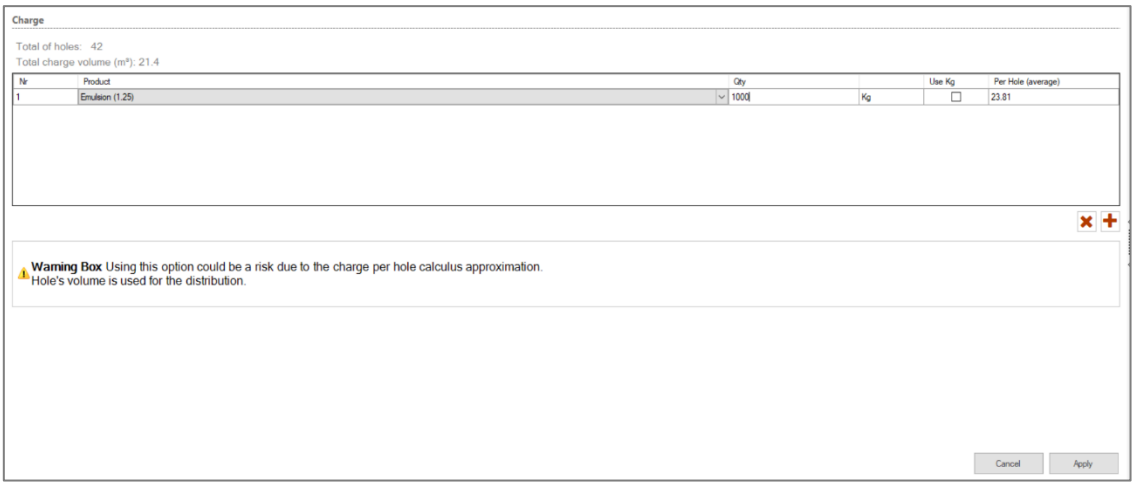

Fig. 272 - Manually charge window

*This information will also appear in the inputed charge window.

11.7. Complete Charge

If in the end the user has some left boreholes that need to be charged with a certain quantity of explosive, he can use this option.
It will open a window equal to **Manually Feeding** but it will open apply the explosive to hole not charged yet (topic 11.6 to know how to use this window).

11.8. Extra Charge

If the user wants to order extra charge to the supplier, just need to add it here. It only appears the extra charge on the report (this charge will not charge the holes) as extra charge.

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To use it, the user must add (+) the how many types of explosives he wants to order, the type and associate a quantity (Fig. 273).

To delete needs to click in the button.

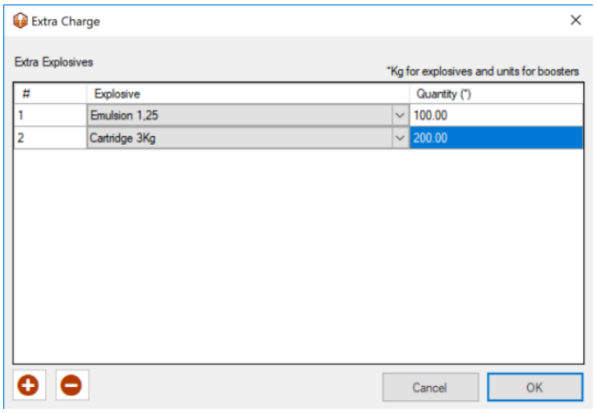

Fig. 273 - Extra charge window

12. Non-Electronic

This tab will allow the user to add, edit and delete timing to the boreholes with non-electronic detonators.

Fig. 274 – Non-electronic detonators module

Icon		***Description***
	Add Timing	Add a single connection
	Line	Connect holes by drawing a line over them
	Edit Timing	Edit In-hole delay
	Initiation Hole	Select the Initiation point
	Time Tool	Make connections by giving a choose interval between the holes
	Delete	Delete connection
	Select	Select a conjunct of connections
	Surface Detonator	Surface detonator delay selection
	In-hole Detonator	In-hole detonator delay Selection
	Dual Detonator	Dual detonator delay selection
	Extra Initiation System	Add more extra detonators
	Hole Shape	Hole not loaded with dual detonator

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Hole Shape	Hole with deck and dual detonator
Hole Shape	Hole not loaded with In-hole detonator
Hole Shape	Hole with deck and in-hole detonator
Tie-up Warning	Hole not connected/without detonator
Tie-up Warning	Extra Dual Detonator inside a hole
Tie-up Warning	In-hole and Dual Detonator inside a hole
Isolines	Show time isolines
Histogram	Show histogram
Play	Play blasting simulation
Pause	Pause the blasting simulation

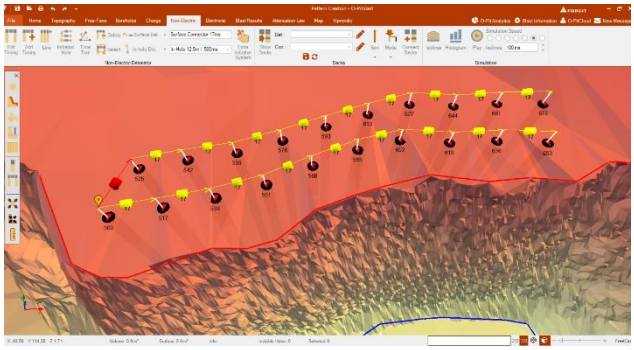

Fig. 275 - Non-Electric connections

12.1. Non-electric detonators

12.1.1.Add Timing -

To add a connection, the user must select the surface detonator, in-hole detonator or dual detonator to be used on it. Then, with the **Add Timing** icon selected, is just draw a line between two holes to connect them (Fig. 276).

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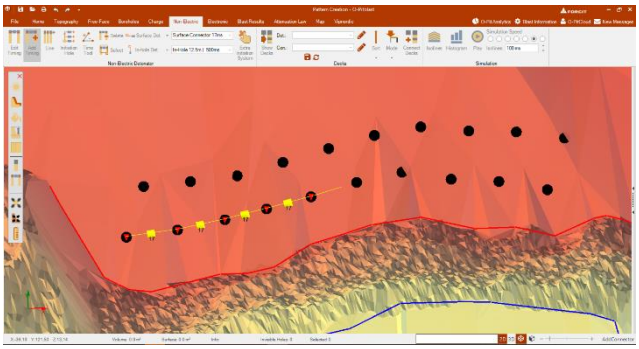

Fig. 276 - Single hole connection

12.1.2.Line -

The **Line** button allows the user to draw a line over a set of holes and connect them automatically. To increase the hole's influence area (in the **Toolbox** Chapter: 6.4) is possible to enhance the hole diameter scale, to facilitate the line connection.

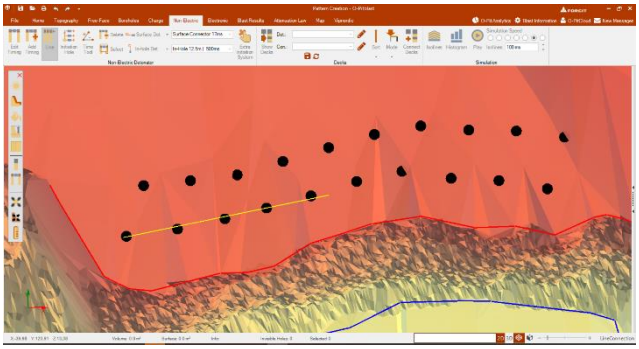

Fig. 277 - Line connection

12.1.3.Edit Timing -

The **Edit Timing** tool allows the user to change the in-hole detonator of each hole or a set of them (Fig. 278). This option can be accessed by the **Radial Menu** (Chapter: 6.8) or by the **Timing Tab**.

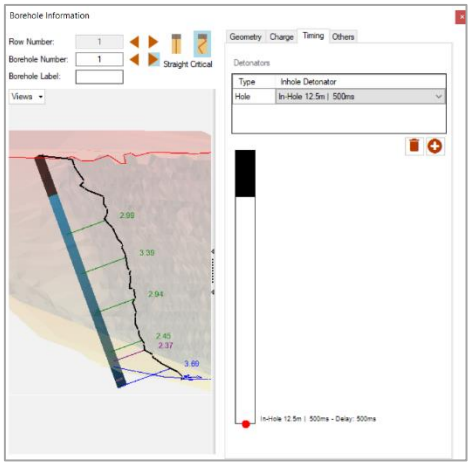

Fig. 278 - Editing in-hole detonator

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12.1.4.Initiation Hole –

To define the initiation hole, the user must select the **Initiation Hole** icon and left click on the desired hole. The initiation hole will be marked with the symbol and it is possible to mark several initial holes.

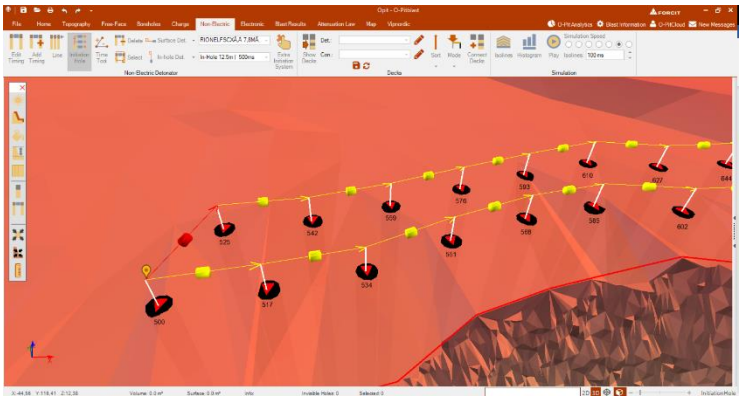

Fig. 279 - Initial hole

12.1.5. Time Tool -

With this tool the user can make connections with a giving interval between holes. To use it the user must input the number of **Jump Holes** in the tab that will pop-up and click in the hole he wants/or make line.

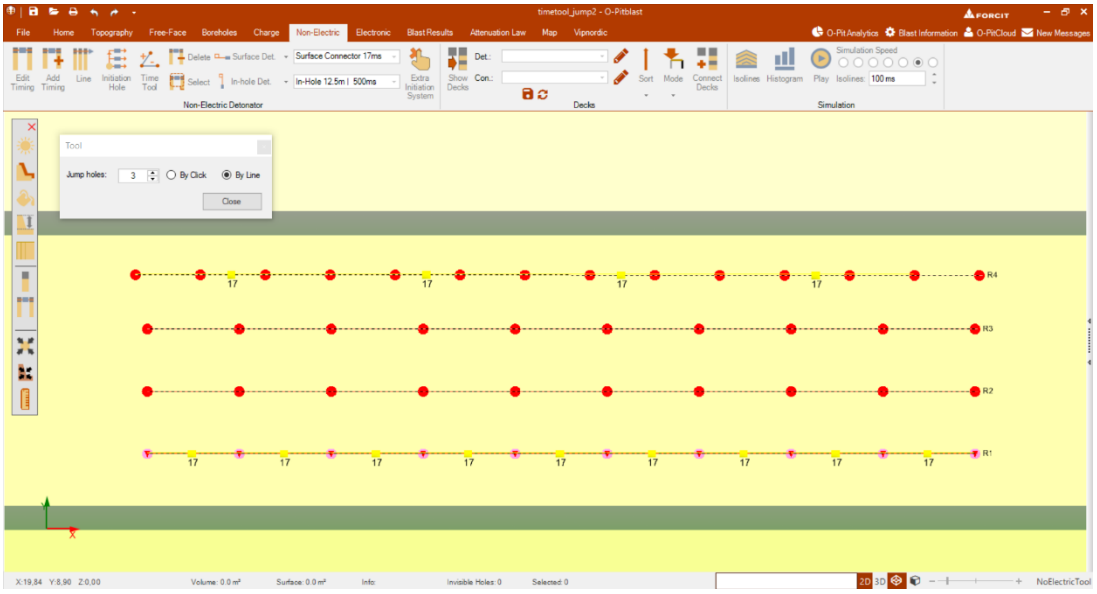

Fig. 280 – Time tool window: first row number of "Jump holes" equals 1; fourth row number of "Jump holes" equals 3

12.1.6.Delete Connections –

Clicking in the **Delete Connections** icon, a prompt-message will appear confirming to delete all connections.

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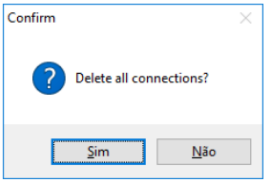

Fig. 281 - Deleting all connections

To delete a single connector, the user can right-click above the connector's cylinder.
In order to delete a conjunct of connections the user must create a selection area (Point: 12.1.7) and click on **Delete Connection** icon (Fig. 282). Note: the detonator cylinder must be inside the selected area.

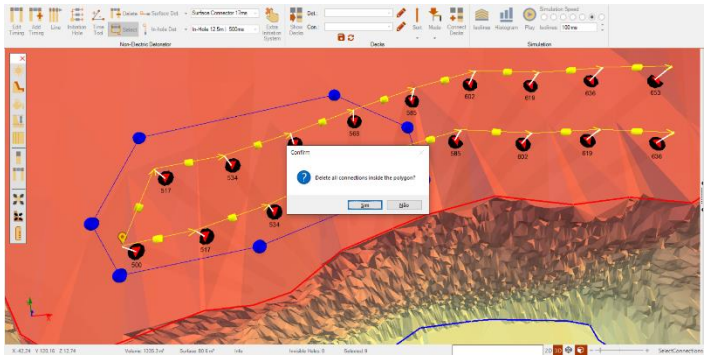

Fig. 282 - Delete a conjunct of connections

12.1.7.Select Connections –

The **Select** tool allows the selection of a set of connections to delete them or changer their characteristics. To proceed, the user must left click in the terrain and build the polygon around a conjunct of connections (the cylinder must be inside the polygon boundaries) (Fig. 283). To finish the selection is necessary to right click to close the polygon.

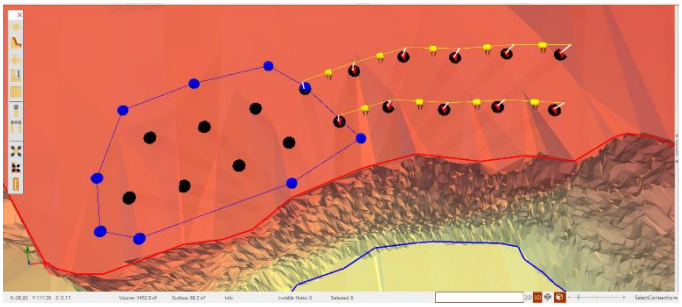

Fig. 283 - Selecting detonators

12.1.8.Surface & In-Holes Detonators –

Surface detonators are use in the connections of down-lines in each hole. To design a time sequencing recurring a surface connector and in-hole detonators it is necessary to select each item from the validation boxes in the **Boreholes Tab**.

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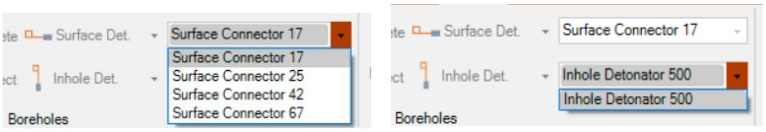

Fig. 284 - Selecting Surface Connector and In-hole detonator

Two holes connected with a surface delay and in-holes detonators presents the scheme of Fig. 286.

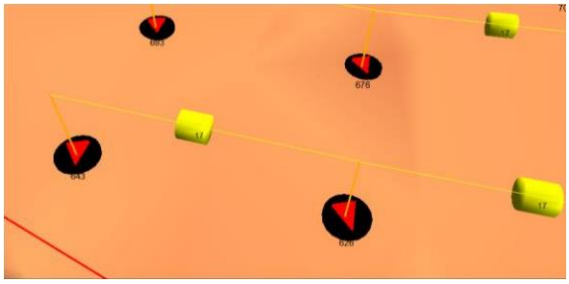

Fig. 285 - Surface delays and in-hole detonator visual feedback

12.1.9.Dual Detonators -

Since the application of dual detonators don't require the usage of in-hole delays, so that, the option to select it is blocked (Fig. 286).

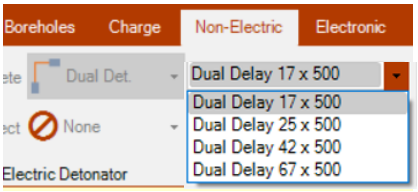

Fig. 286 - Dual Detonator Selection

For dual detonators the visual feedback is presented in the Fig. 287.

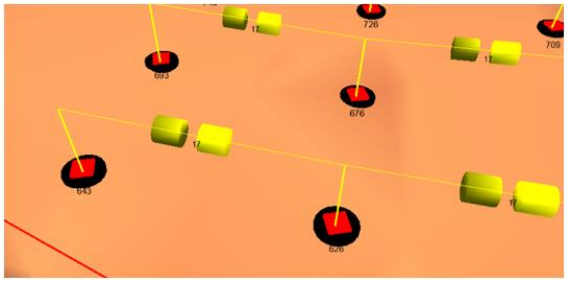

Fig. 287 - Dual Connectors visual feedback

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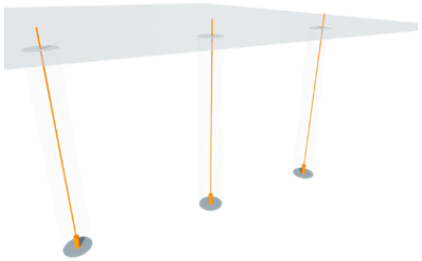
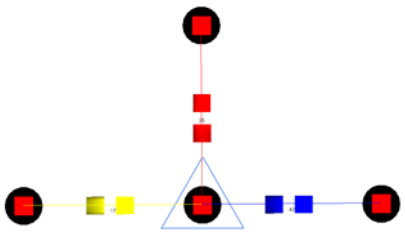
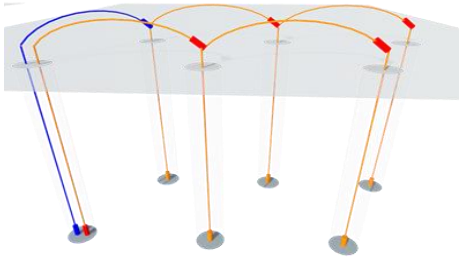
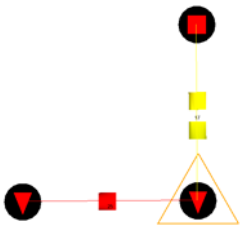
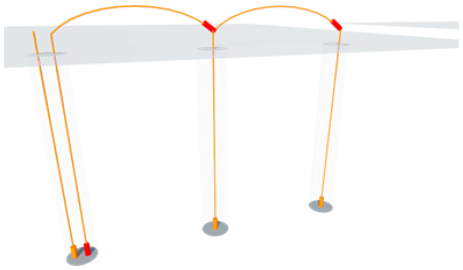
12.1.10. Tie-Up Warnings - △ △ △

O-Pitblast has sever warning signs. The objective of these visual feedbacks is to indicate some tie-up mistakes to the blast engineer (Tab. 1).

Tab. 1 – Tie-Up Warnings

Warning Sign	O-Pitblast	Example	Description
			Hole not connected/without detonator
			Extra Dual Detonator inside a hole
			In-hole and Dual Detonator inside a hole

12.1.11. Extra Initiation System -

This option will allow the user to add an extra detonador to your initiation system. Once selected, the window to enter with this/these extra will appear (Fig. 288).

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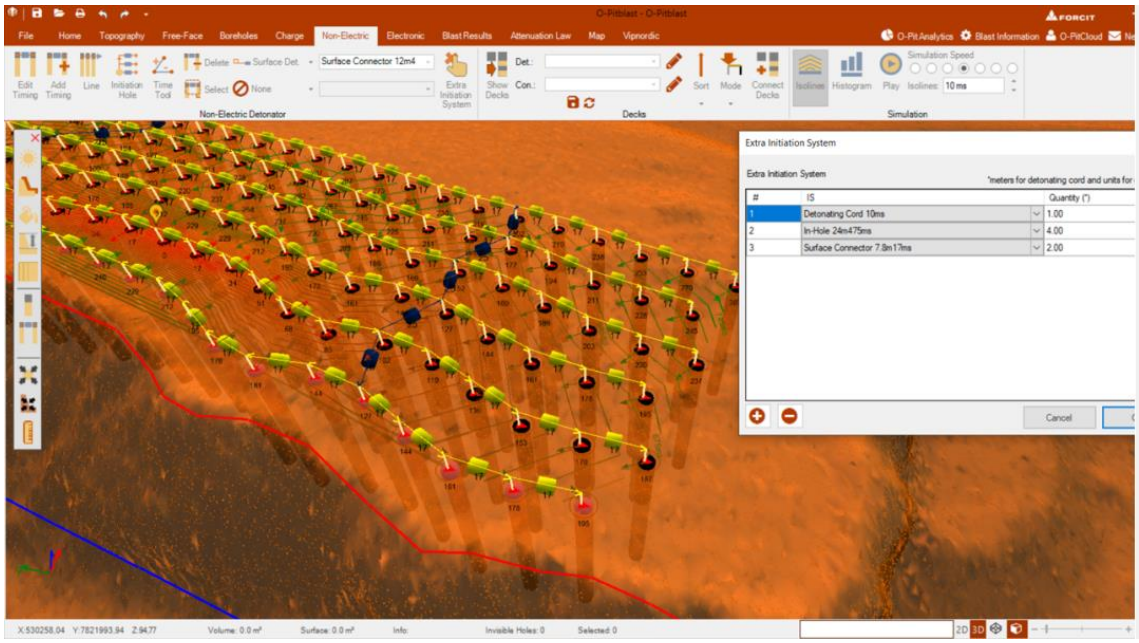

Fig. 288 – Extra initiation system

All the information entered will be shown in the blast report (Fig. 289).

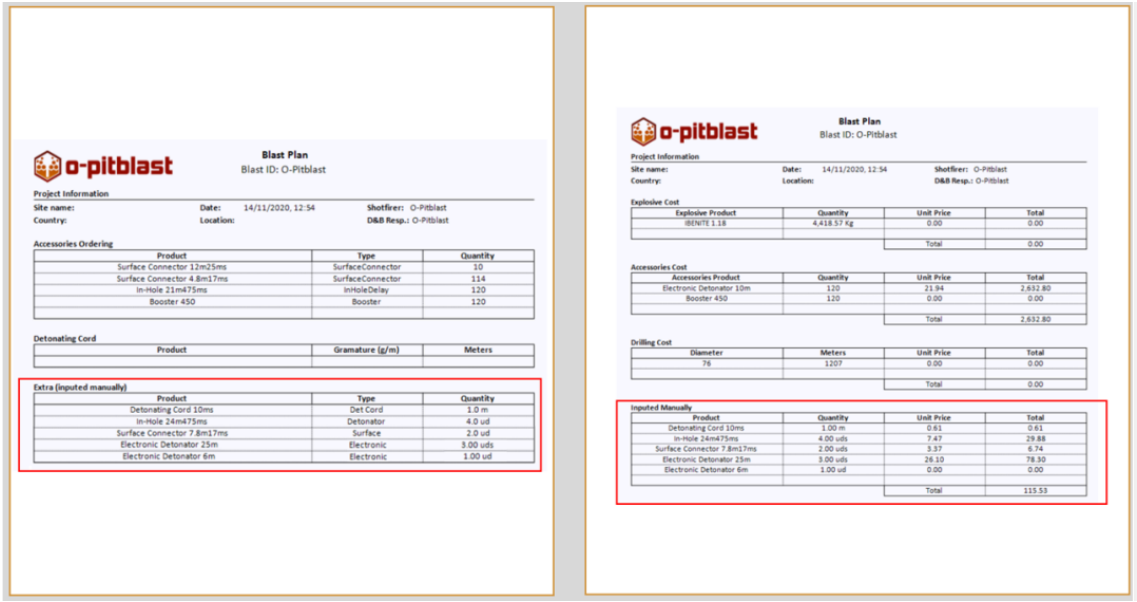

Fig. 289 – Extra initiation system

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12.2. Decks

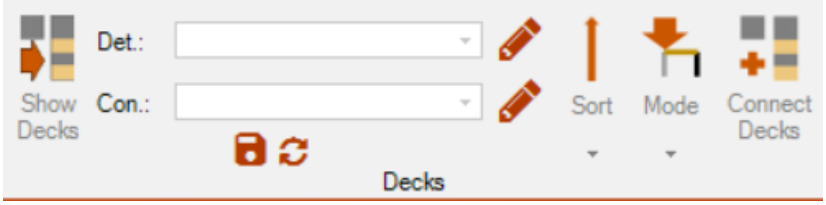

Fig. 290 - Decks options

This option allows the user to add timing to holes with decks. First, the user must choose the decks that he wants to use by clicking on the pencil ( ). The user chooses the detonators that he wants to use on decks and add them by click on the arrow ( ).

Fig. 291 - Add detonator window

After choosing the time for the decks, the user must define if wants to connect from the bottom or from the top ( ). Then chooses the **Mode** to connect decks: surface in-hole, dual in-hole or in-hole connection (Fig. 292).

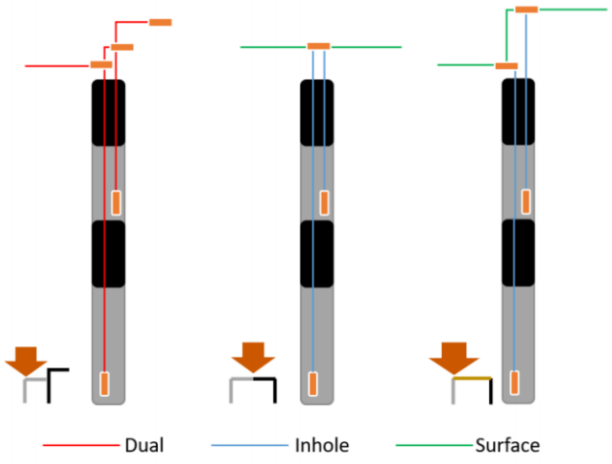

Fig. 292 - Type of deck connections

After those steps, the user clicks on connect decks button ( ) and left click on the holes he wants to connect.

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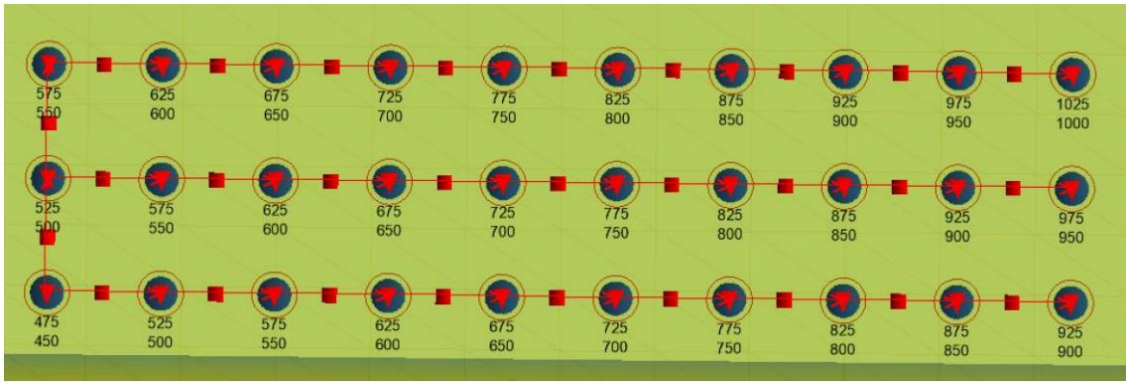

Fig. 293 - One deck per hole (decks with connector of 450ms)

If the user clicks on **Show Decks** will see how many decks every hole has and the timing.

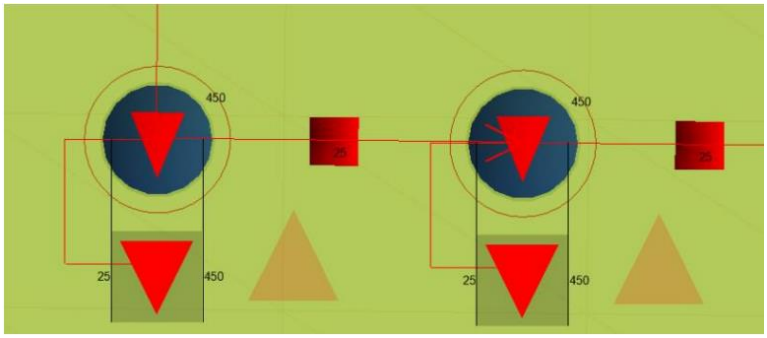

Fig. 294 - Show decks option

P.S: A green hole warning (triangle shape - △) means presence of decks.

12.3. Simulation

12.3.1.Isolines -

After defining the **Initiation hole** (Chapter: 12.1.4) and activating the **Isolines** icon the user will be able to observe the time isolines (Fig. 295).

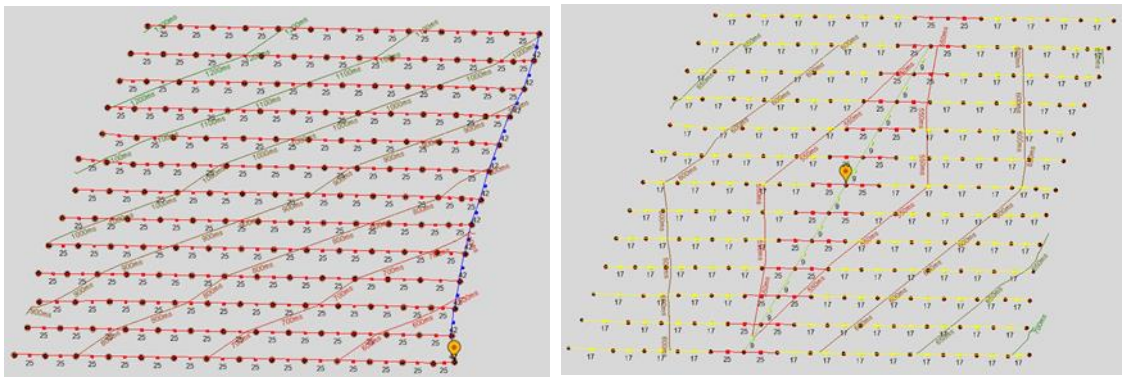

Fig. 295 - Time Isolines

To change the time isoline's interval, in the **simulation** section, the user must adjust the box presented in the Fig. 296.

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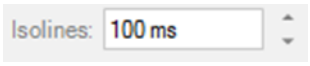

Fig. 296 - Adjust Isoline's Interval

12.3.2.Histogram -

The Histogram gives a graphic feedback of the behaviour of the tie-up applied to the project. Analysing the blast histogram is possible to identify the number of holes initiated at the same time and the maximum instantaneous charge (MIC) (Fig. 298). For the last one, the user must check the **Use Charge** checkbox.

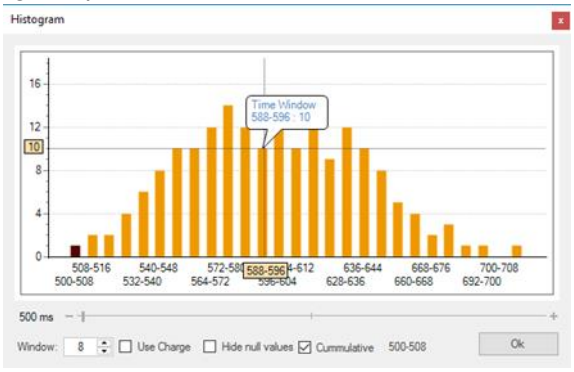

Fig. 297 - Histogram - Number of Holes per Delay

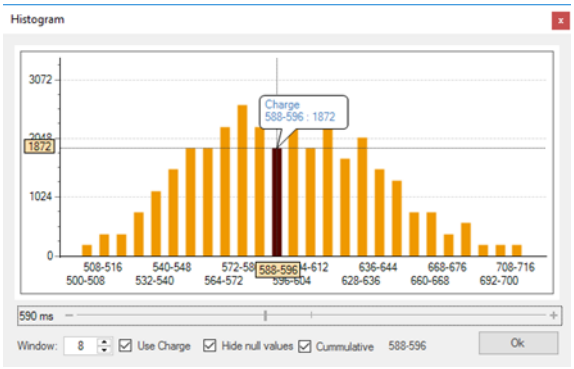

Fig. 298 - Histogram - Charge per Delay

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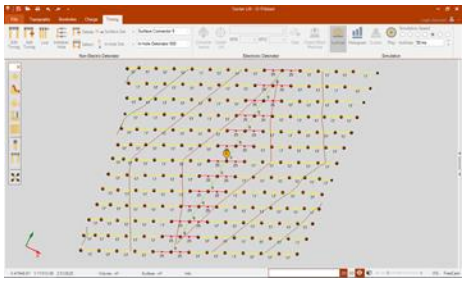
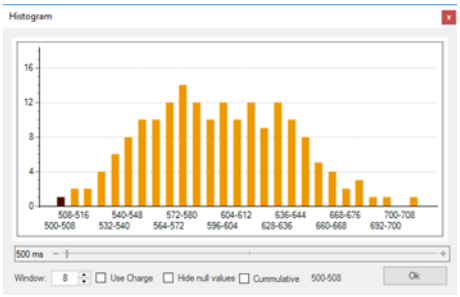
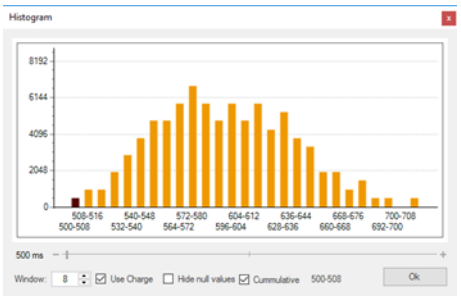
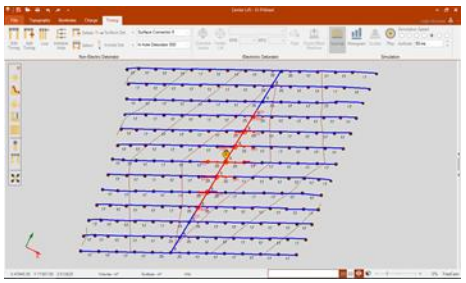
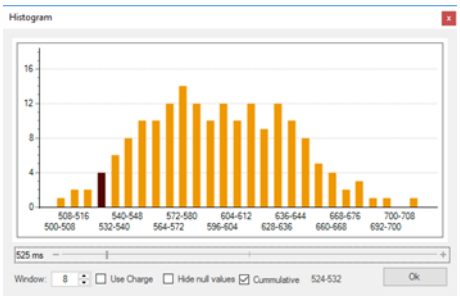
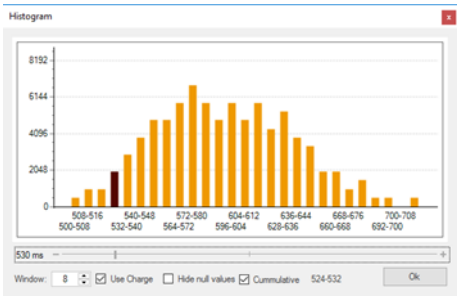
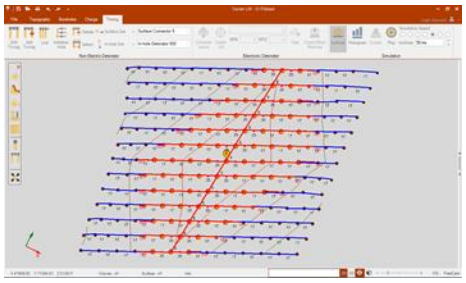
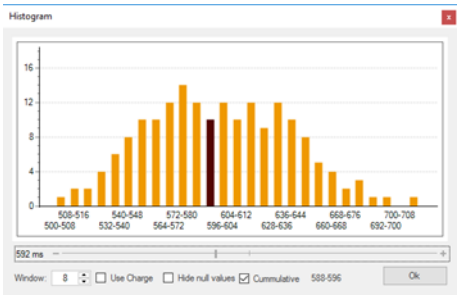
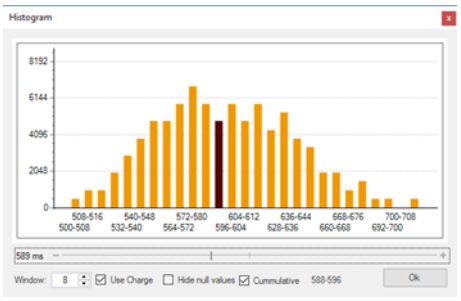
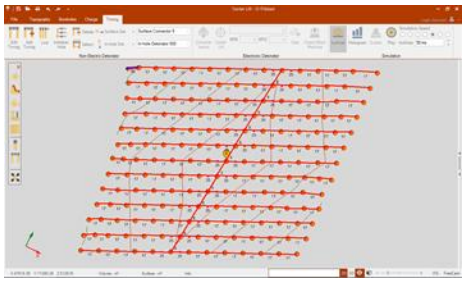
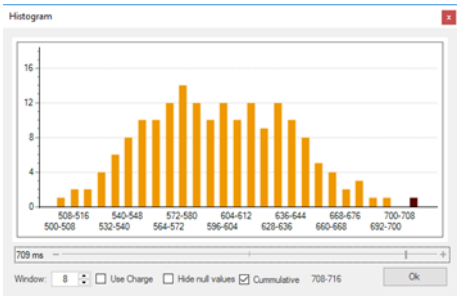
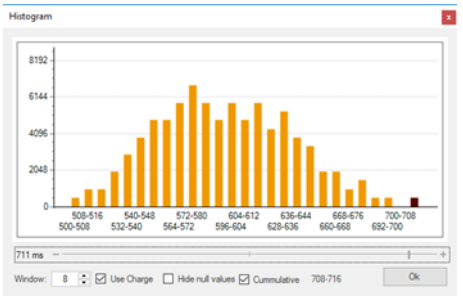
Tab. 2 - Simulation

Simulation	Histogram – Nº Holes/Delay	Histogram – Charge/Delay
		
		
		
		

12.3.3.Play -

The **Play** button will start the blasting simulation. During the simulation, user can press the play/pause button to freeze the image and evaluate possible issues from the time design.
By the Simulation Speed buttons, it is possible to adjust the simulation velocity (Fig. 299).

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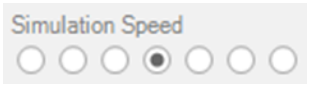
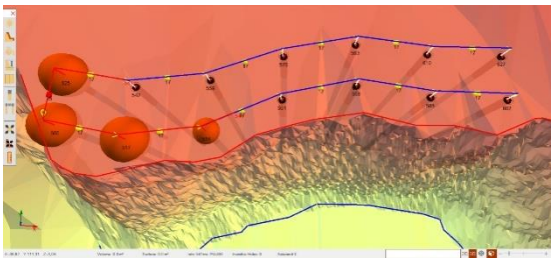
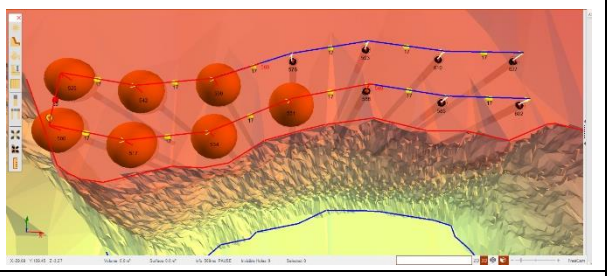
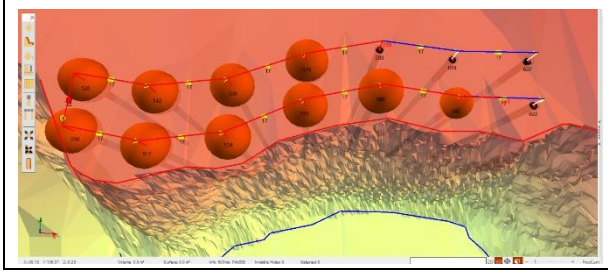
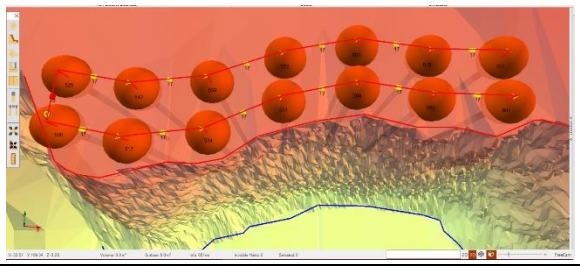


Fig. 299 - Simulation Speed Adjustment

Tab. 3 - Blasting Simulation

Blasting Simulation	
	
	

12.4. Add Extra Detonators

The user can add extra detonators in one (or more) holes. Just needs to left click twice in one hole and open the timing tab.
He clicks on plus sign (⊕) to add extra detonators and left clicks along the hole to position them. To delete just clicks inn the garbage sign (🗑).

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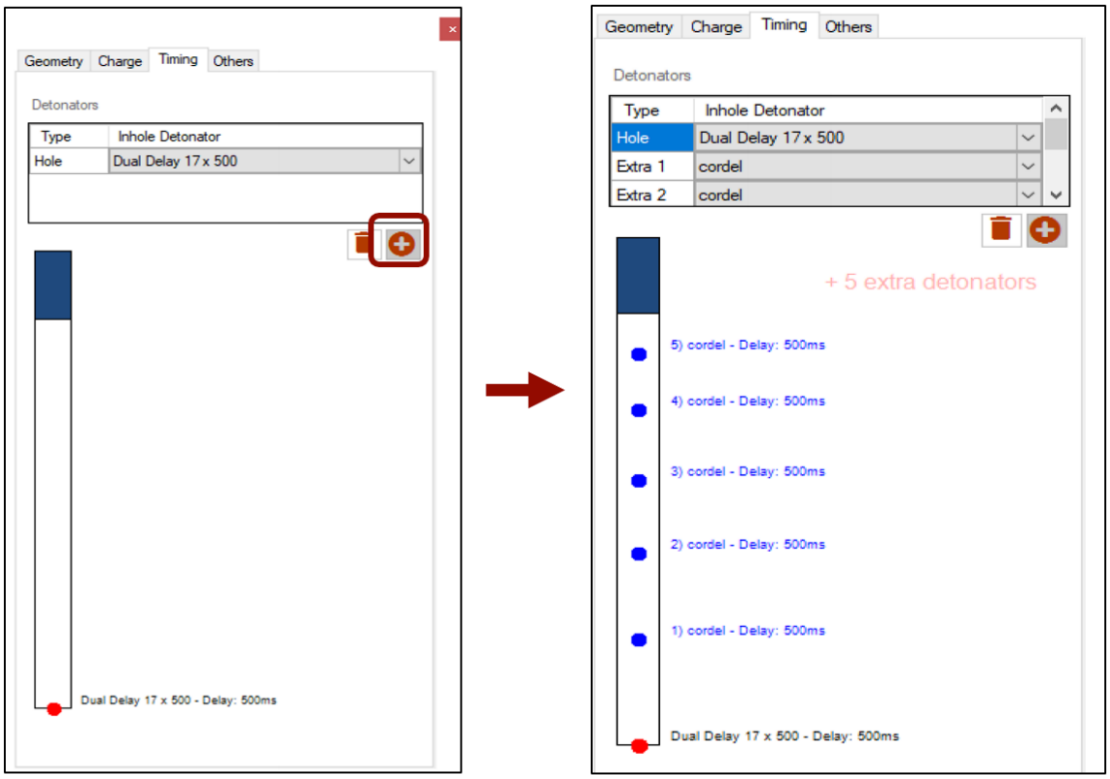

Fig. 300 - Adding extra detonators

13. Electronic Detonators

This tab will allow the user to add, edit and delete timing to the boreholes with electronic detonators.

Fig. 301 – Electronic Detonators Module

Icon		***Description***
	Direction Vector	Make connection with the possibly to define the direction of the blasting
	Center Lift	Make a center lift blasting
		Multiple directions
	Time Tool	Make Inter-Rows and Inter-Holes connections
	Edit Time	Change time connections individually (hole by hole)
	Delete	Delete connection
	Isolines	Show time isolines

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	Histogram	Show histogram
	Play	Play blasting simulation
	Pause	Pause the blasting simulation

13.1. Direction Vector

To use this button the user must have boreholes. Then the user must select the direction that he wants for the blast.
Is possible to change the **Burden Relief Burden (BRB), Burden Relief Spacing (BRS), Angle** and **Azimuth** of the vector that the user wants for the blast.

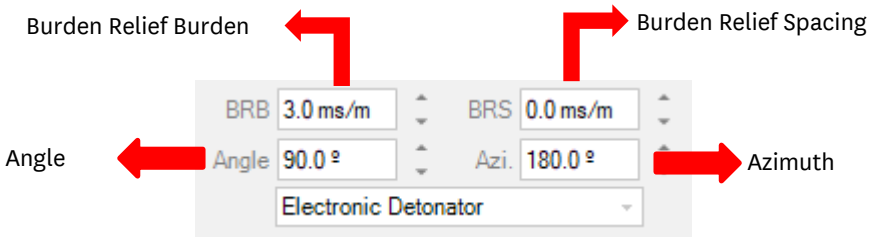

Fig. 302 – Parameters that change the direction vector

The user can move the arrow or point it to anyplace he wants.

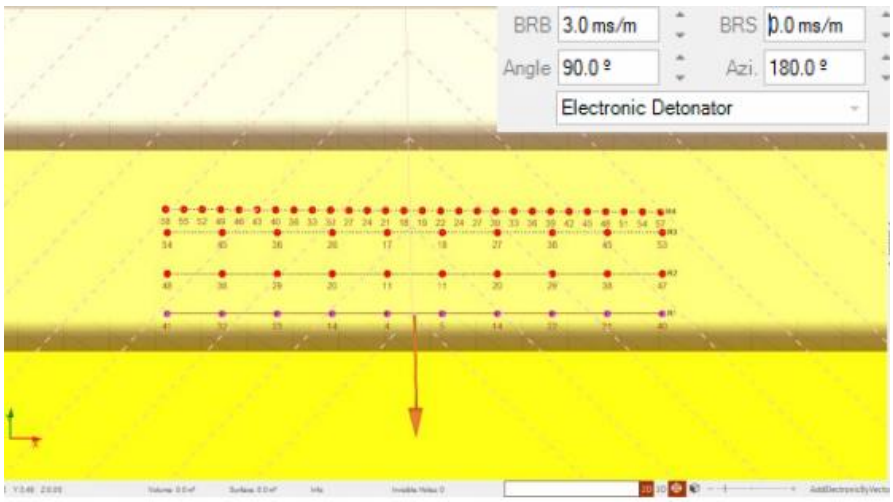

Fig. 303 – Direction Vector window

13.1.1. PolyLine Tool

Inside of this option, the user as "**Polyline tool**" (Fig. 304).

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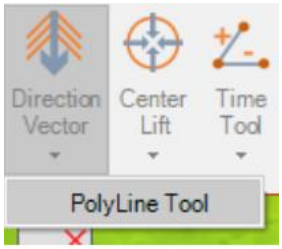

Fig. 304 - PolyLine tool

On this section, the user will be able to create a polyline in the position of the terrain here he wants to direct the blast (Fig. 305).

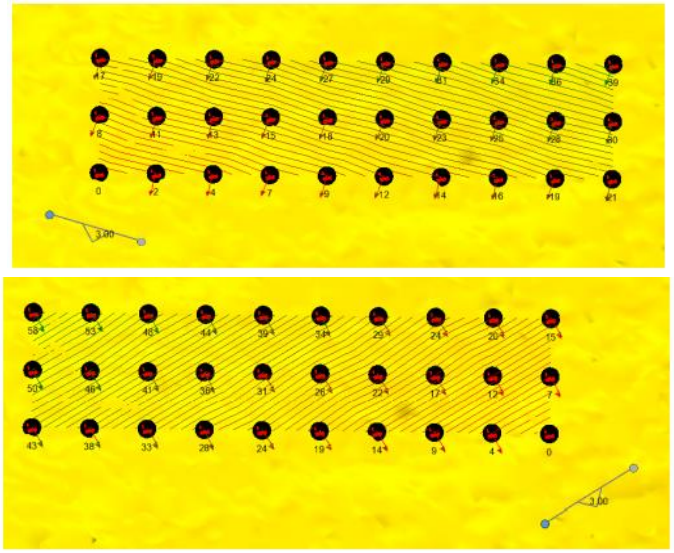

Fig. 305 - Two example of blast direction, depending on the polyline position

To change the BRB, the user must click CTRL plus left-click over the tool or scrolling the mouse over it, and then a pop-up window (Fig. 306) will appear with the possibility to change the BRB and to define the starting time, for the first borehole.

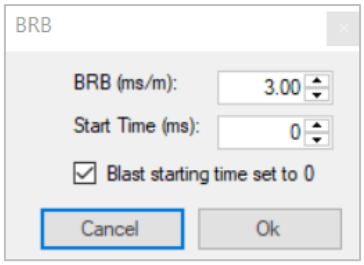

Fig. 306 - Window to change BRB and starting time

To move the tool, the user must click in CTRL + left click and drag for another position.
To delete the polyline the user must click in CRTL + right click (over the polyline).

13.2. Center Lift -

The user can simulate a center lift blasting by click on the **Center Lift** button. It will appear a blue circle that can be moved around the blasting area, to create the condition that the user wants.

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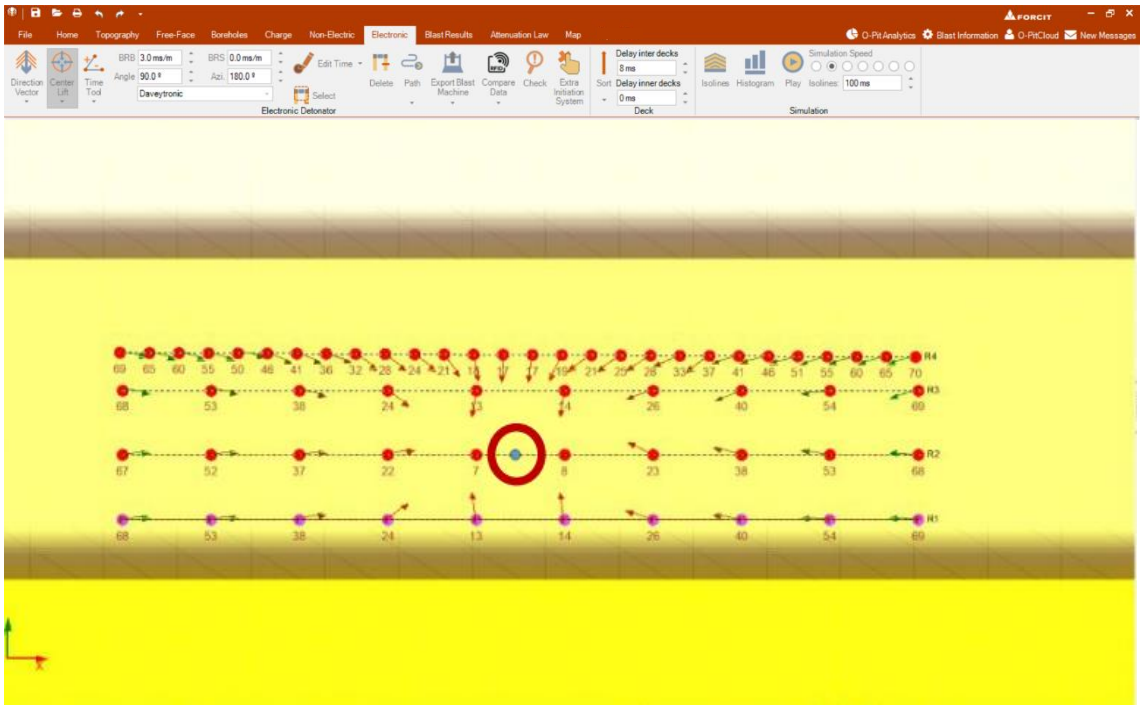

Fig. 307 – Center lift window

Inside of this option the user can use the tool **multiple directions.** The user draws the direction arrows from the center lift point and choose which BRB will be associate to that arrow (they are referenced by color). To **move** the center lift, the user must use **crtl** and with **left button of mouse** drag the point.

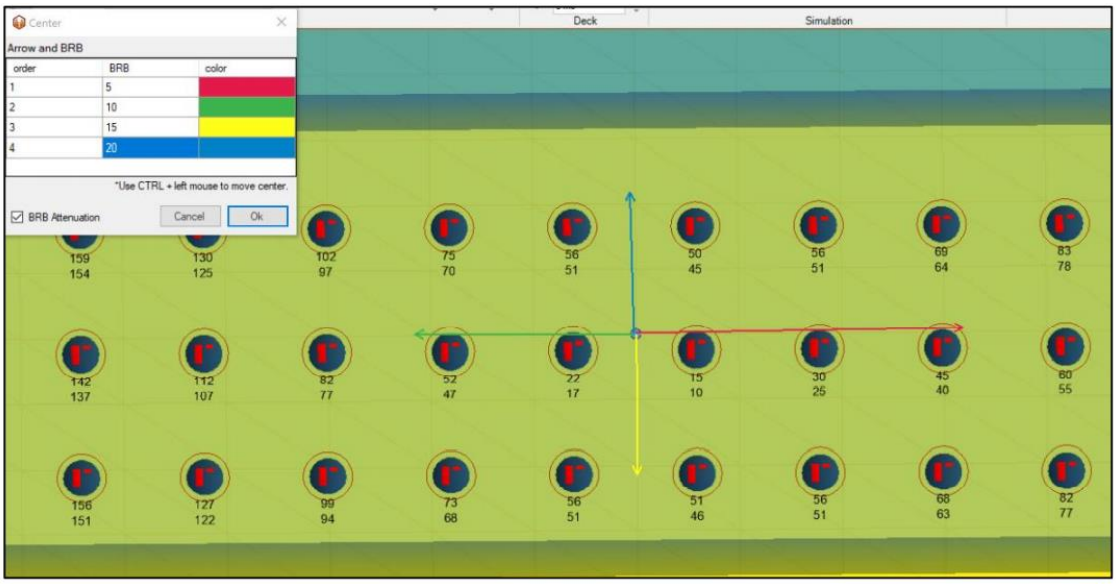

Fig. 308 - Multiple direction option

13.3. Time Tool -

With this tool the user can create different times between rows and holes. It will pop-up a window that allows the user to choose the time that he wants for each (**Inter-Rows** or **Inter-Holes**) and see which holes are not connected.

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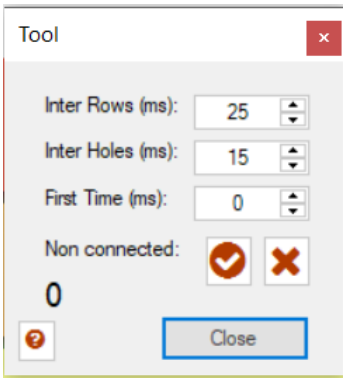

Fig. 309 - Time tool tab

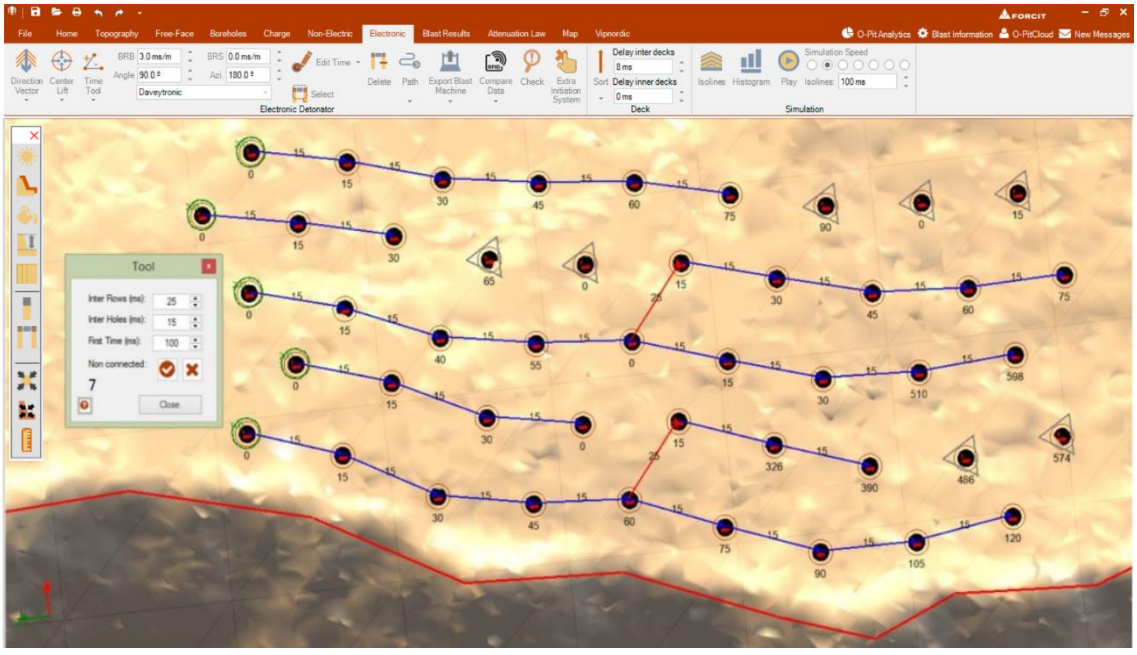

Fig. 310 - Timing between Rows and holes

To use it the user needs to define if he wants to connect first inter-rows or inter-holes, choose the time and start dragging the mouse to create the connection between rows/holes. Also, he can define the first time (of the first borehole).
To delete a connection the user must right click on the first borehole that he pretends to keep. The connections and all information's after that borehole will be deleted.

13.3.1. By click and Drag and Connect Tool

Below the Time Tool option, the user as two different tools: **By Click, Drag and Connect** and **Old Time Tool**.

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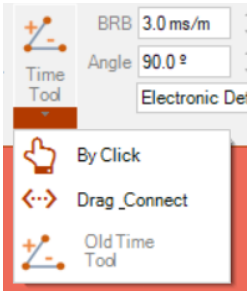


Fig. 311 - By click and Drag and Connect tool

On the first case, **By Click**, the user just needs to left click over the holes to apply a time to them. The user can choose the actual time (first click will have the actual time) and then a step. This step will be applied in every click. For example, if the user chooses 100ms for the actual time and 10ms for the step, the first hole where he clicks will have 100ms, the second will have 110ms, the third will have 120ms, etc.

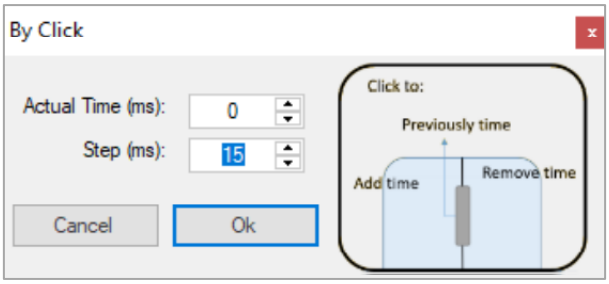
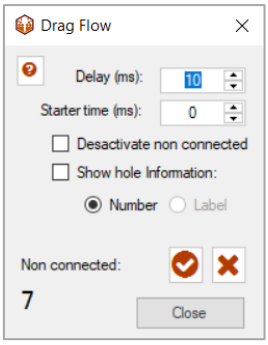


Fig. 312 - By click tool

To **remove** a time from a hole, the user needs to **right click** over the hole.
In relation to the tool **Drag and Connect**, the user needs necessarily to select a node (first hole to start the connection) or to choose the option automatically, where the software will recognize the timings that are already in the holes, so there's no need to have a starter time (because the starter time will be the one that it's already in the holes).



For example, the user chooses the delay and the starting time and starts to make the connections by dragging the mouse between holes.

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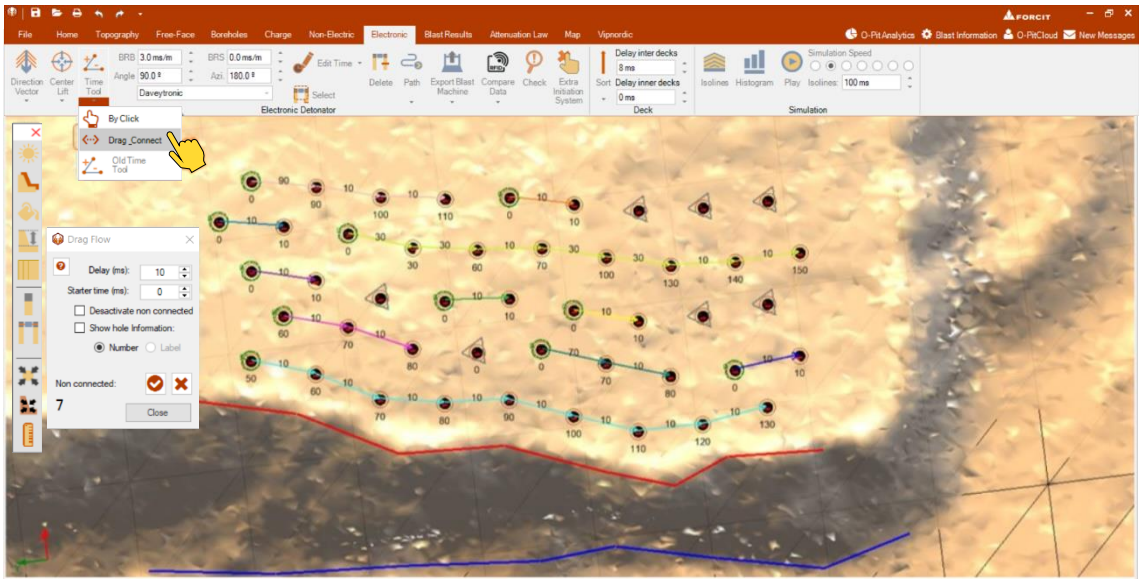

Fig. 313 - Select node option

When selecting show hole information, the numbers will appear in red.
To delete the connection the user just needs to right click over the hole where the connect that he wants to delete starts.

13.3.2.Old Time Tool

With this tool the user can create different times between rows and lines like section 13.3. It will pop-up a window that allows the user to choose the time that he wants and change the time Inter-Rows or Inter-Holes.

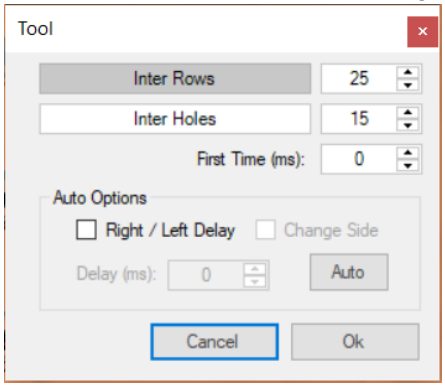

Fig. 314 – Old time tool tab

Clicking on Auto the connection will be made automatically in inter-holes.

13.4. Edit Time -

This tool allows the user to change timing individually (hole by hole). By clicking on Edit Time button a window will appear. In that window the user will be able to edit the in the desired hole.

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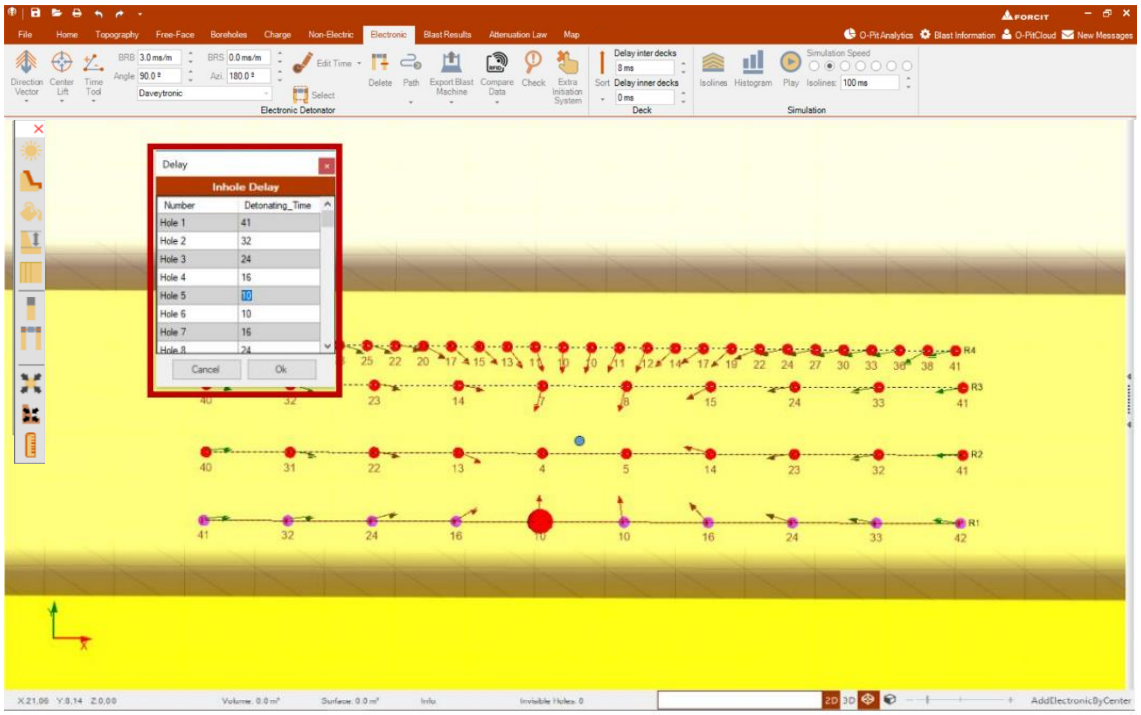

Fig. 315 – Edit Time window

13.4.1.Translate

Below the option Edit time the user has the option to add a delay to the global pattern. For example, if the user wants to start the blast at the second 1000ms, just needs to click on translate and define the translation time as 1000ms. It will be added a 1000ms delay to each hole.

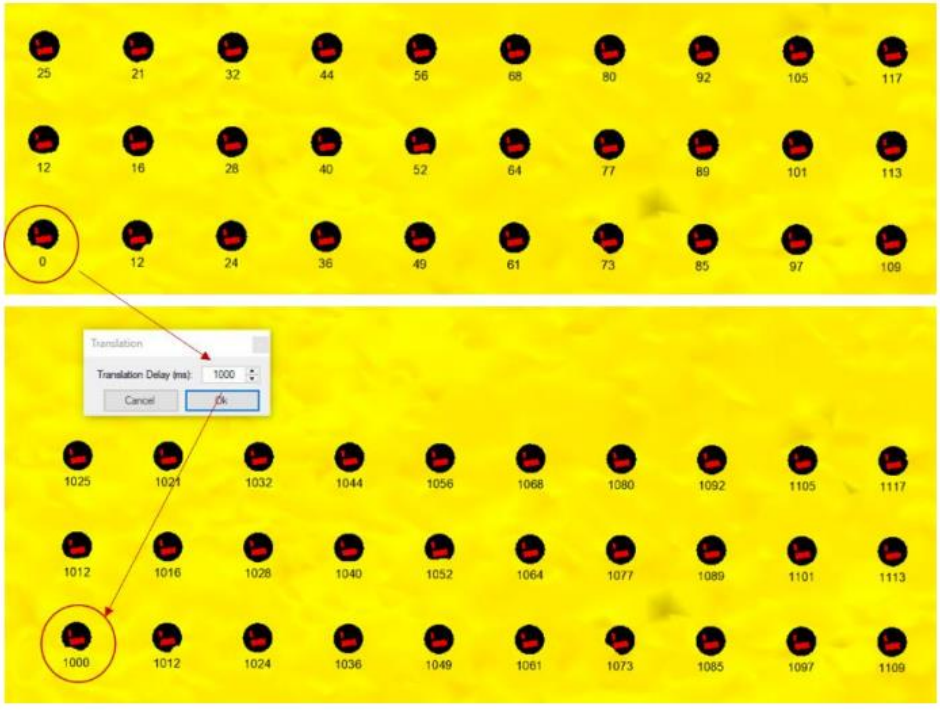

Fig. 316 - Translate (delay) option

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13.5. Delete Connections -

By clicking on the **Delete** button the user will delete all connections.
To delete a single connector, the user can right-click above the connector's cylinder.
To delete a conjunct of connections the user must create a selection area (Point: 12.1.7) and click on **Delete Connection** icon. Note: the detonator cylinder must be inside the selected area.

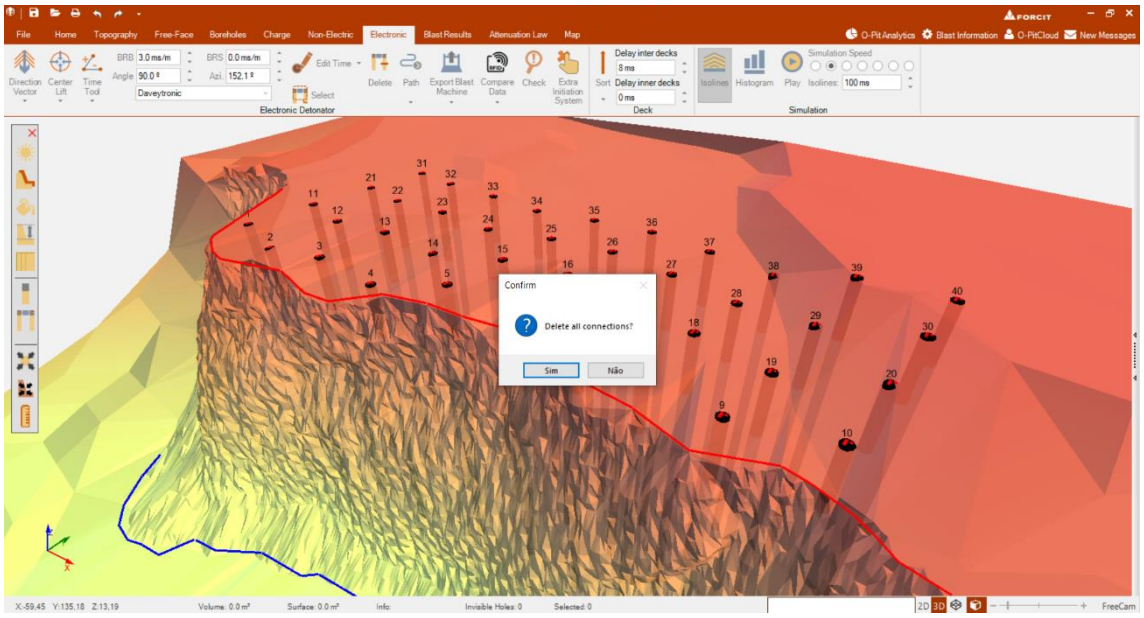

Fig. 317 – Delete all connections

13.6. Isolines, Histogram, Play and Pause

All this button works the same way as the Non-Electronic module. The user can check how this Simulation buttons works on Chapter 12.3. The only exception is that the user can **Fix** the blasting time automatically. Holes Blasting at the same time can be fixed on the option fix inside of the **Histogram**. The user chooses the interval in milliseconds that wants to work (by clicking on the plus sign).

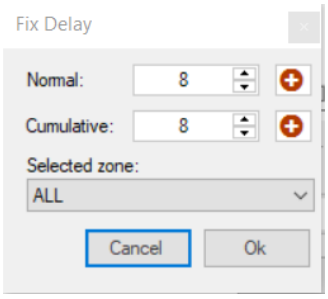

Fig. 318 - Fix delay option

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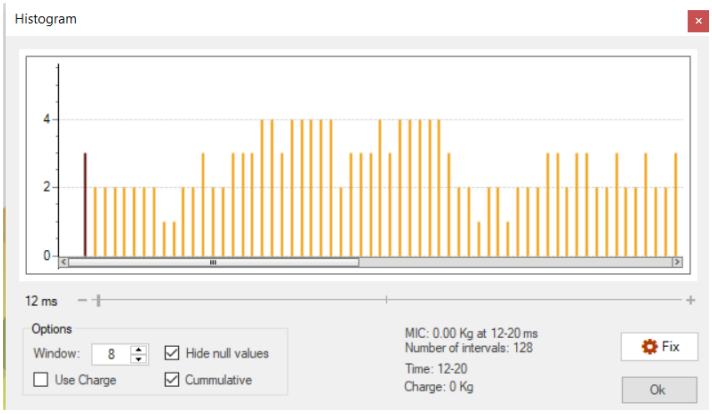

Fig. 319 - Holes blasting at the same time (before fix tool)

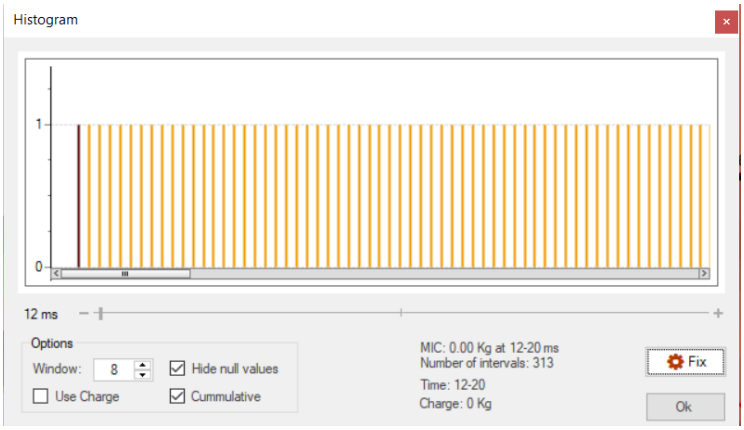

Fig. 320 - Holes not blasting at the same time (after fix tool)

13.7. Decks

In these options, the user needs to choose the delay inter decks, the delay inner decks and if it will start from bottom or top (Fig. 321).

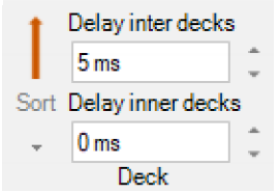

Fig. 321 - Decks options

13.8. Davey Bickford (Blast Machine)

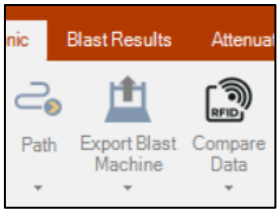

Fig. 322 - Blast Machine communication (Davey Bickford)

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13.8.1. Path

This option allows the user to prepare the path that it will be made by the PU. The pattern can have multiple paths or just one.
It's important to have in mind that **ALL** holes must have timing associated or it won't be possible to export to the blast machine.

To do the pattern the user clicks on button and start dragging the mouse between holes to start making the path. To a quick connection just need to click on the middle mouse button.

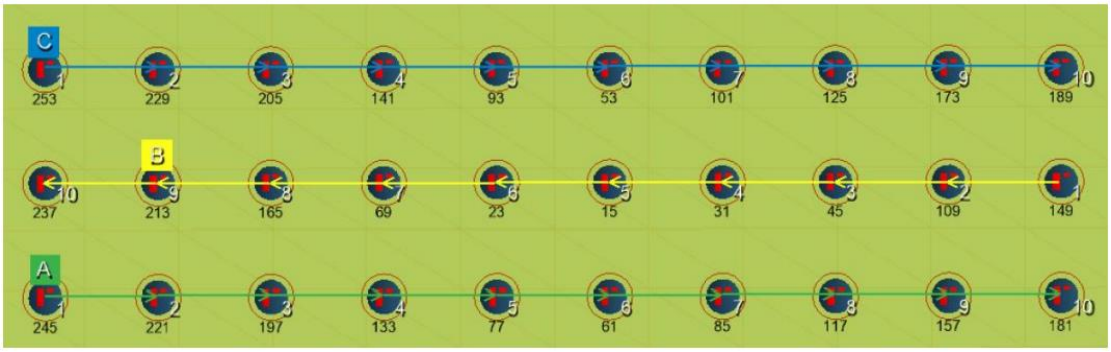

Fig. 323 - Multiple paths

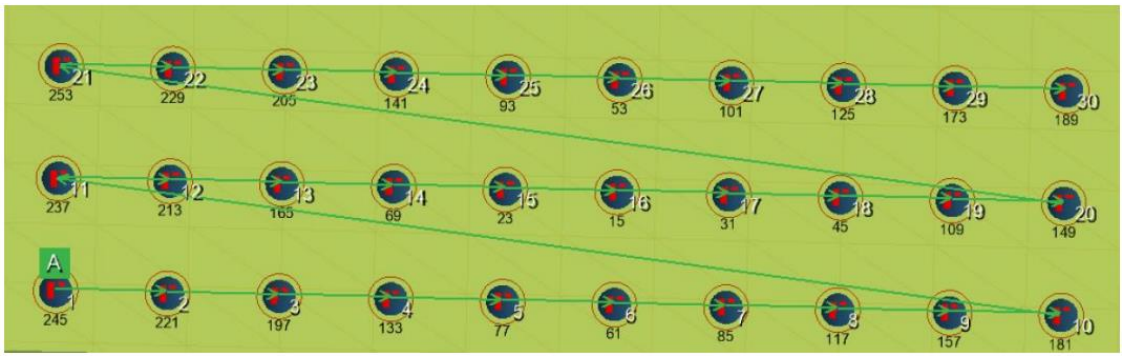

Fig. 324 - Path (quick way)

To delete a path the user must right click on the first borehole that he pretends to keep. The path and all information's after that borehole will be deleted.

13.8.2. Export to Blast Machine

This option will allow the user to export the paths to one or more PU's. Also, it can save .rhd files (blast plan with the path).
After open the **Export Blast Machine** window the user can change **display name**, **full name**, **site**, **location** and add **comments**.

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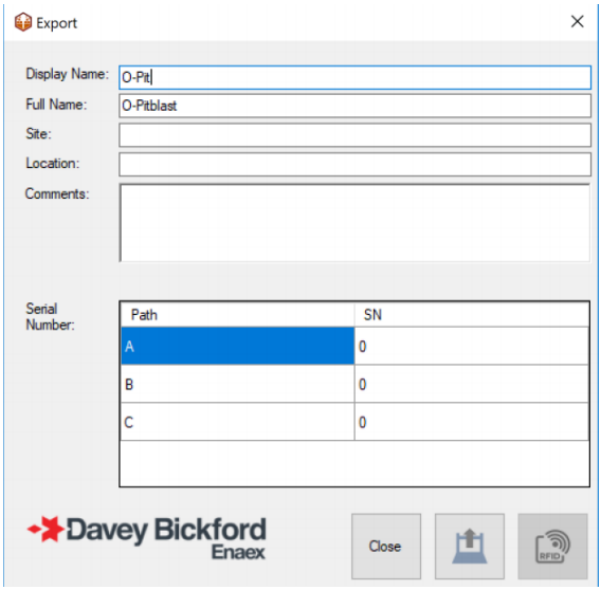

Fig. 325 - Export to blast machine window

Inside of this window the user can click on button and save a local file (.rhd).
To export to blast machine the user needs:

1. Connect the PU to computer;
2. The software will recognize the PU number and the user can associate to a path (Fig. 326);
3. Repeat the previous points if has more than one PU;
4. In the end the user will have every path associated to a PU (Fig. 327);
5. After that, clicks on RFID ( ) button and it will pop up a window asking if he wants to load the path to the PU (Fig. 328);
6. The exportation is complete (Fig. 329).

Fig. 326 - Connect path to PU

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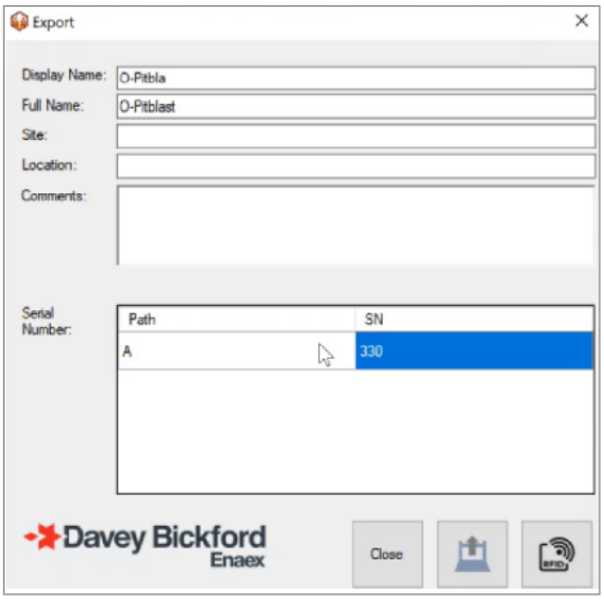

Fig. 327 - Confirmation Path-PU

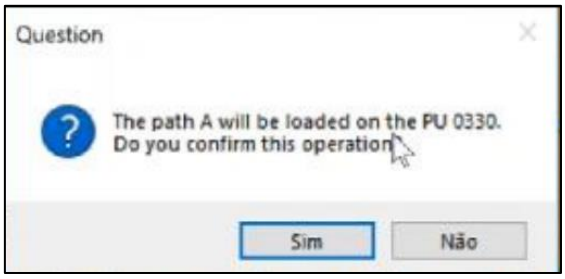

Fig. 328 - Confirmation message to exportation

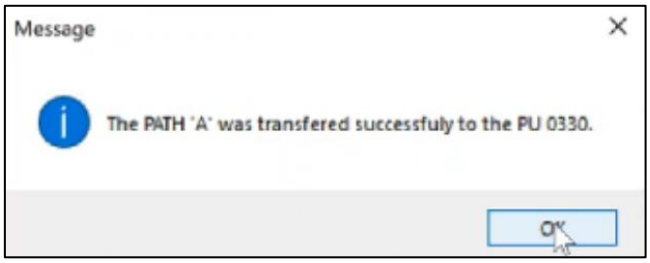

Fig. 329 - Message of successful exportation

13.8.3. Compare Data

This option allows the user to:

- Transfer the timing inside PU to the timing on O-Pitblast
- Transfer the timing on O-Pitblast and Update the timing in the PU
- Put to computer

1. Inside of the PU you have the previous information
2. Click on the button “PU to computer” to transfer the timing of the PU to O-Pitblast (Fig. 332).

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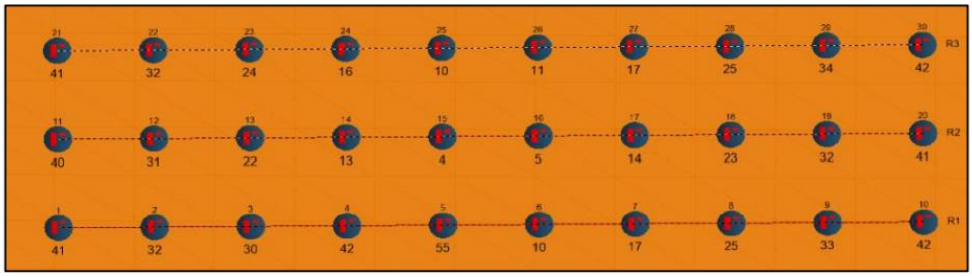

Fig. 330 - Time programed inside of the PU

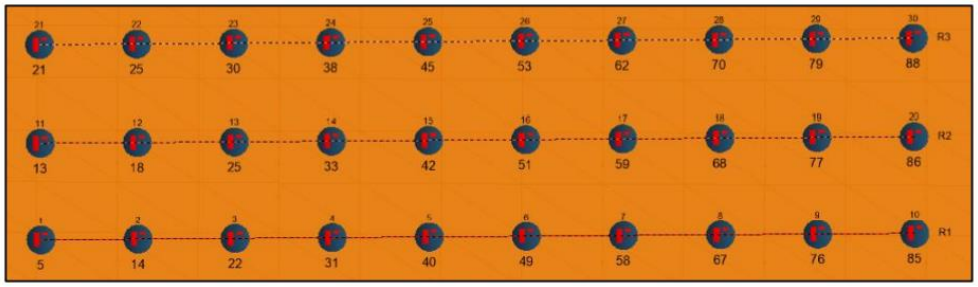

Fig. 331 - Timing on O-Pitblast that the user wants to transfer to the PU

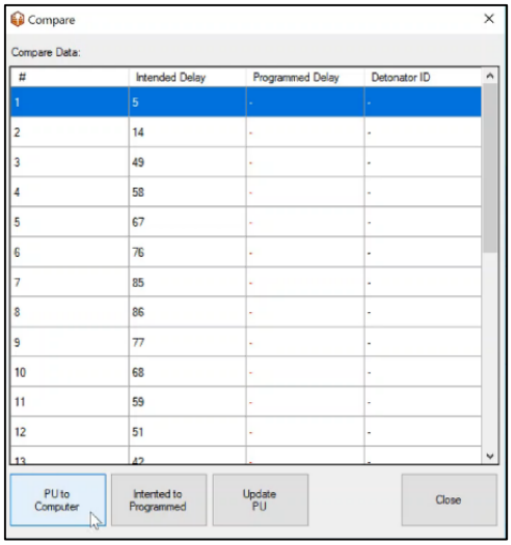

Fig. 332 - Option "PU to computer"

- Update timing in the PU after it's programmed

1. The user clicks on the button "Intended to be programmed" (Fig. 333).
2. Clicks on the button "Update PU" (Fig. 334).
3. Confirmation message (Fig. 334).

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Fig. 333 - Intended delay to being programmed

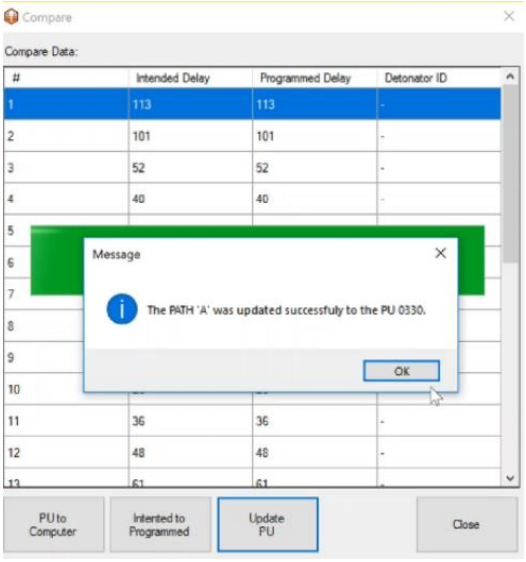

Fig. 334 - Update to PU option

13.9. Check

The user can “Check" your path to find boreholes not connected. To do that, just press Check option.

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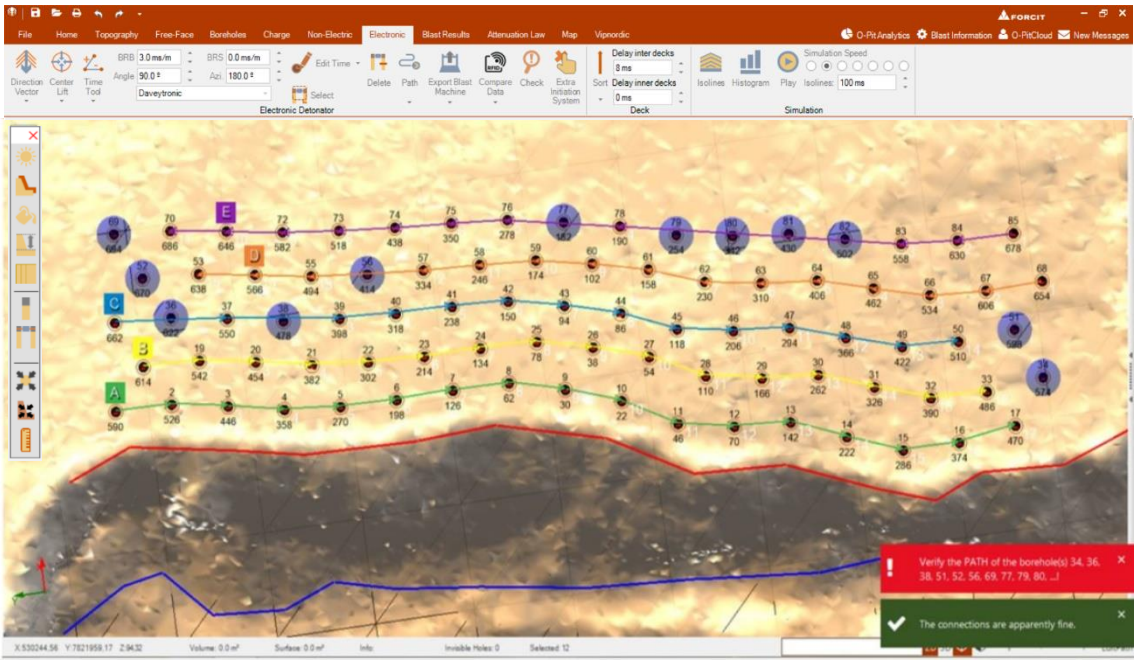

Fig. 335 – Geometry tool

13.10. Extra Initiation System

This option will allow the user to add an extra detonador to your initiation system. Once selected, the window to enter with this/these extra will appear (Fig. 366).

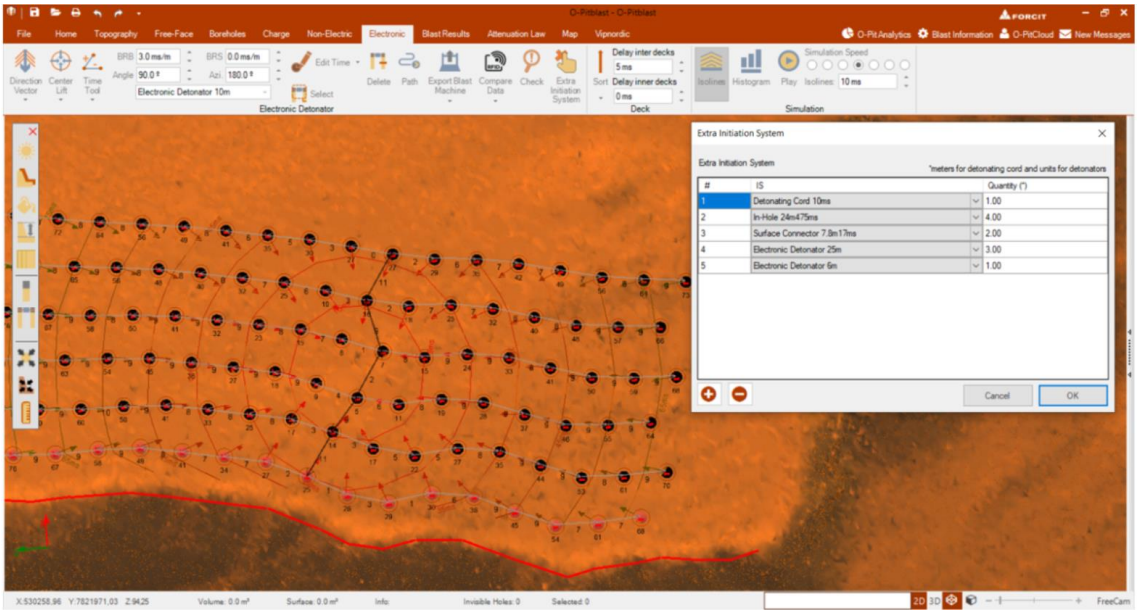

Fig. 336 – Extra initiation system

As showed in the previous item (12.1.11), all the information inserted will also be shown in the blast report.

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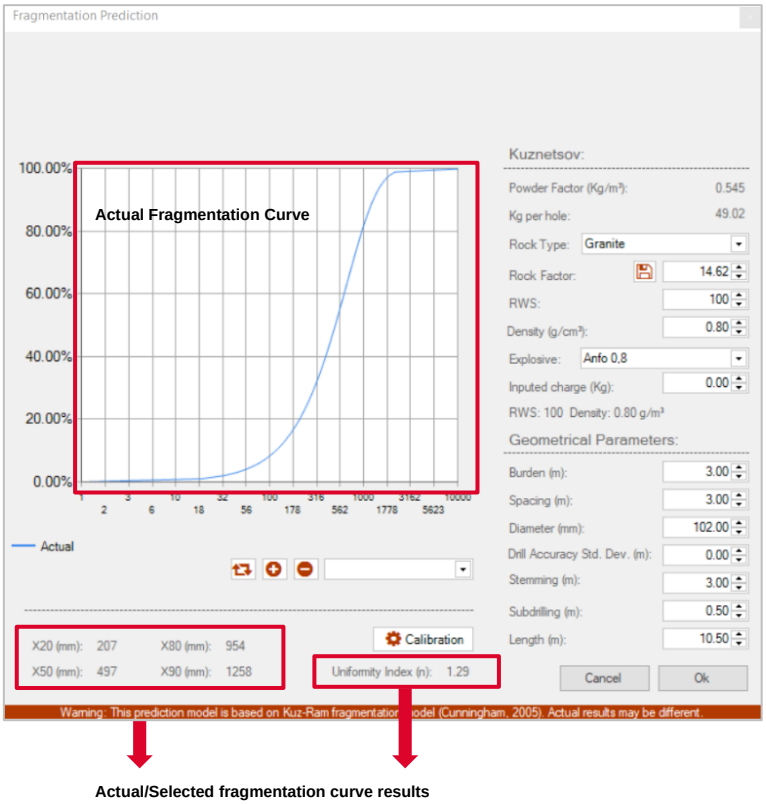
14. Blast Results

The Blast results Tab presents all the tools and applications for prediction and optimization of fragmentation. Also shows the costs of the selected blast.

Fig. 337 – Blast Results module.

14.1. Prediction

By clicking on the prediction button, it will pop out a window that shows every parameter that the user can adjust and all the actual fragmentation results of the selected curve. The user can also change de **Rock Type** (Chapter 6.3.5.5).



The user can adjust the **RWS, Density (g/cm^2), inputed charge (Kg), Burden (m), Spacing (m), Diameter (mm), Drill Accuracy Standard Deviation (m), Stemming, Subdrilling(m)** and **Length (m).**

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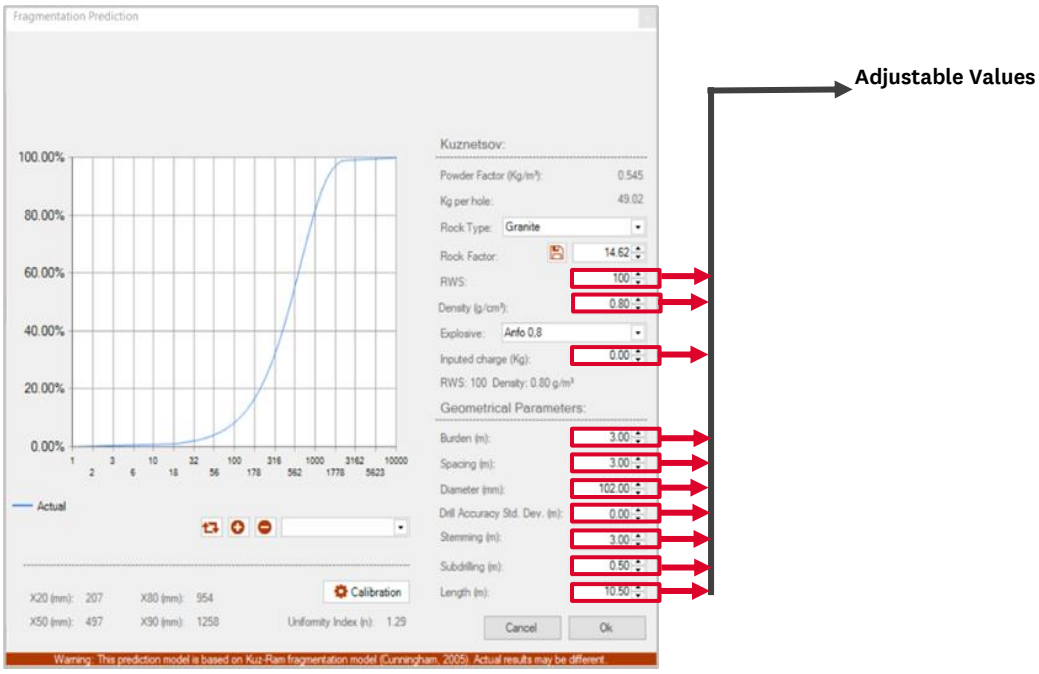

14.2. Add or Reset a Fragmentation Curve

The user can add a new fragmentation curve with new values by clicking on the button **Add** and writing a new name. To delete the user must click on the button **Delete**. The user can also clear all the curve by clicking on **Clear List** button.

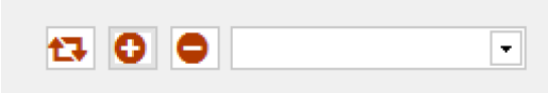

Fig. 338 – Tab to create or delete a new fragmentation curve

14.3. Calibration

By clicking in the calibration button, the user can input the real values (that were the result of the blasting). Then, the model used in O-Pitblast will update the rock factor and a window will appear asking if the user wants to confirm the changes (Fig. 339). If the user confirms the rock factor will be updated.

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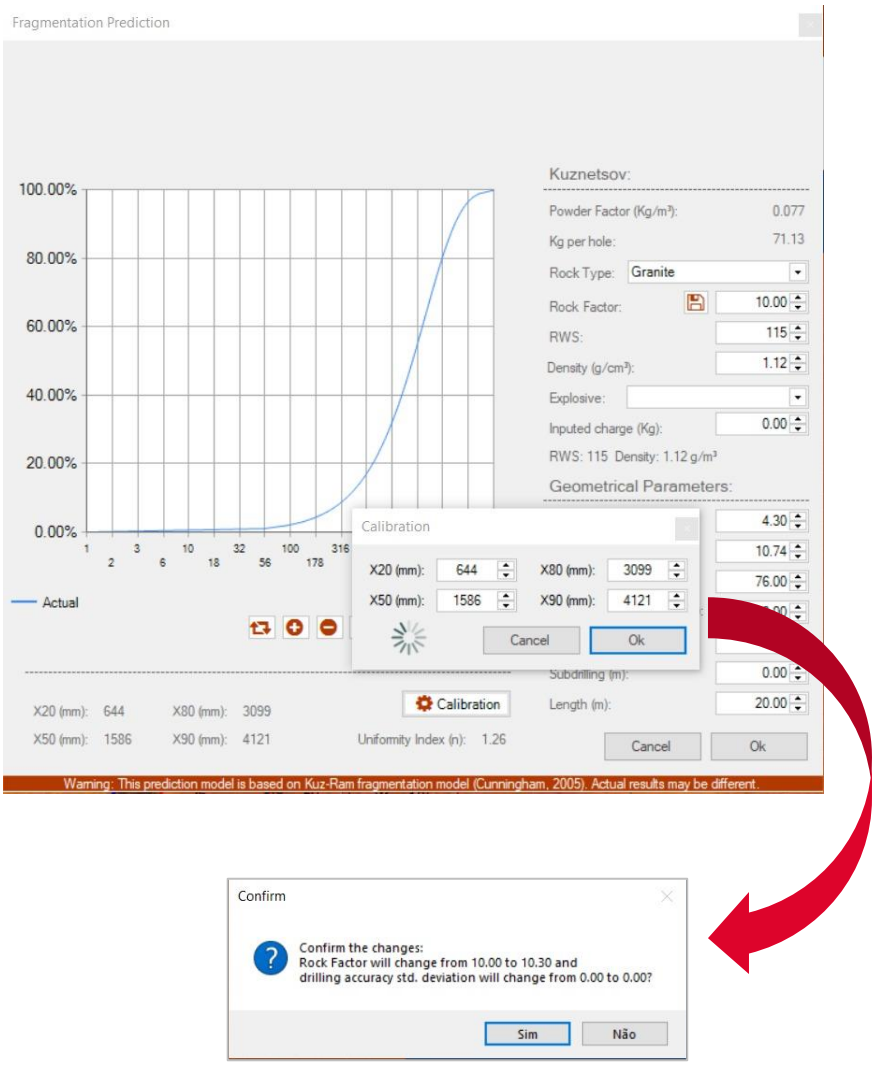

Fig. 339 – Calibration of the rock factor windows.

After this step, the user can save that rock factor by click on the **Update** button .

14.4. Optimization

At this point, the user can make, and optimization of the parameters present on the window bellow. The user can input some information like **Costs** of **Initiation (per hole), Explosive (per Kg), Drilling (per meter)** (Fig. 340-A)**.** The operator can also add the **Density (Kg/m²)** and **RWS** (Fig. 340 - A).
The user can see the data of the select project (values of the actual design) (Fig. 340-B), that includes the **Diameter (mm), Bench High (m), Burden (m), Spacing (m), Subdrilling (m), Stemming (m), Number of holes, Number os Rows, Volume (m²)** and **Rock Factor.**
Then the user can define the constraints. Both for Fragmentations or Geometry. The user can define the **Limit (%)** of fragmentation and the **Oversize (mm)** (Fig. 340-C). Can also define the constraints of the **Spacing by burden, Stemming by burden, Subdrilling by burden, Uniformity Index, Stiffness Ratio, Volume (m²)** and **Oversize (mm)** (Fig. 340-E)**.**
Finally, the user can see the Cost information in dollar (Fig. 340-F).

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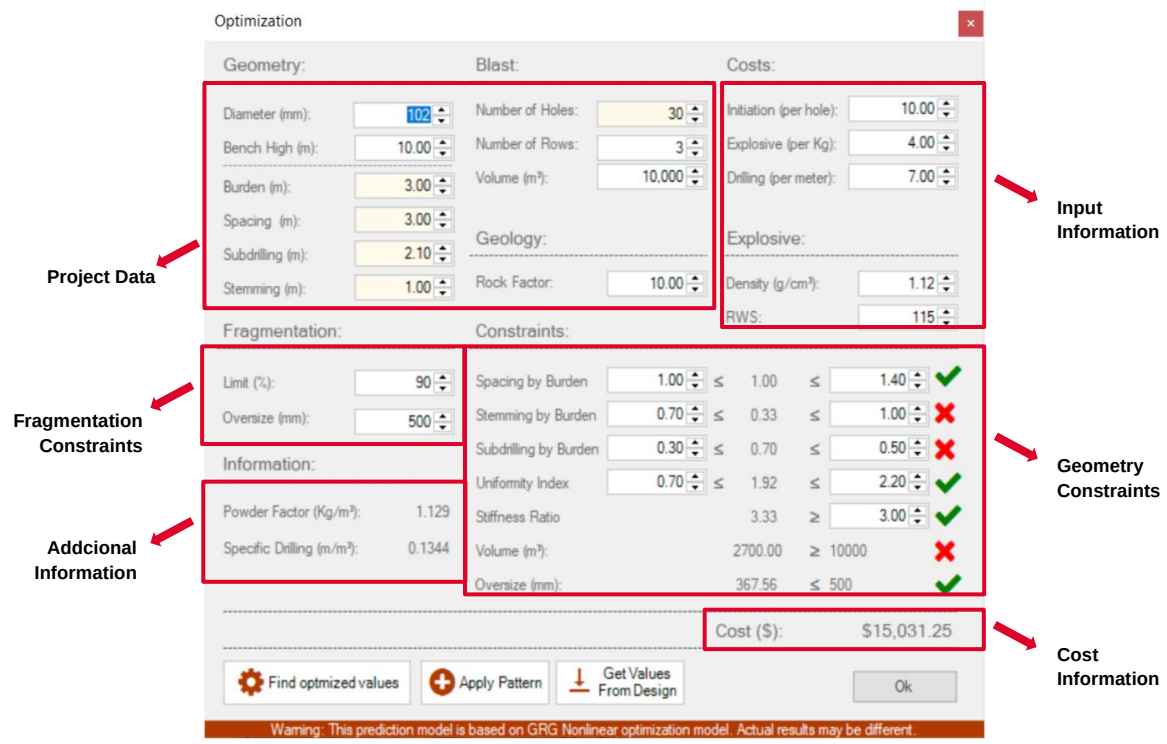

Fig. 340 – A: Input information; B: Project Data; C: Fragmentation Constraints; D: Addicional information; E: Geometry constraints; F: Cost information.

14.4.1.Find Optimized Values

By clicking in this button, the software will find the better values to fit in the Burden, Spacing, Subdrilling and Stemming.

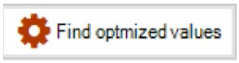

Fig. 341- Optimized value button

If everything is marked green, all the values are optimized and according to the constraints (Fig. 342).

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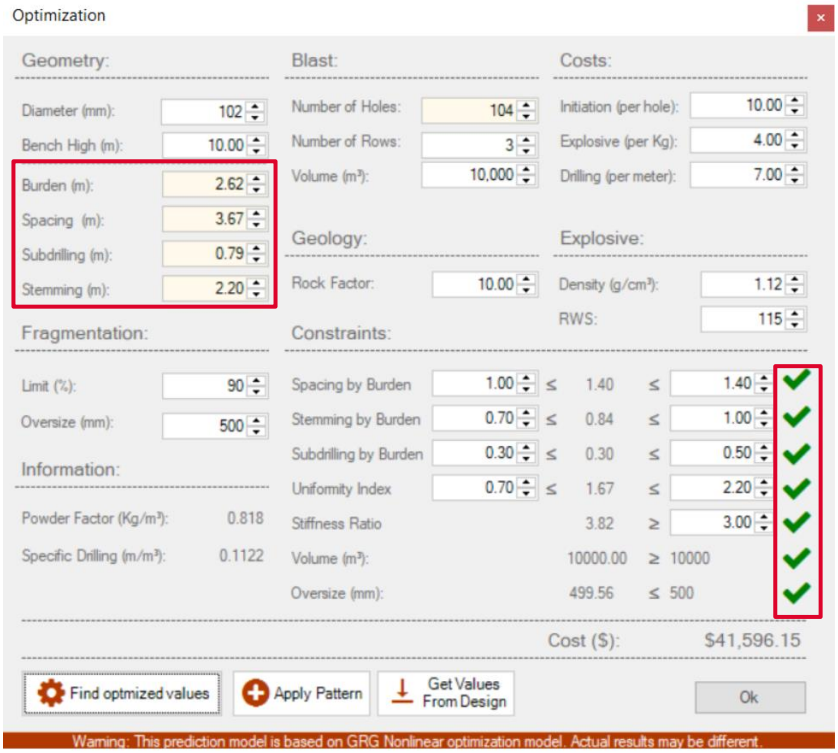

Fig. 342 – Optimized values

14.4.2.Apply Pattern

With this button the user can create a new pattern with the new optimized values.

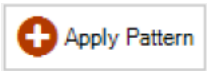

Fig. 343 – Apply pattern button

When finding the optimized values and clicking on apply pattern, the software will ask if the user wants to delete the previous boreholes and replace them with new ones (Fig. 344).

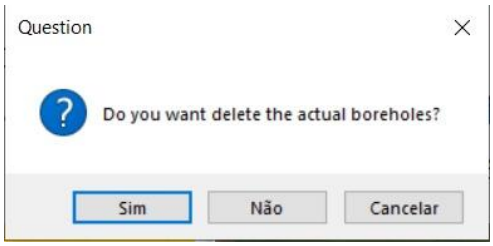

Fig. 344 – Apply pattern button

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14.4.3.Get Values from Design

By clicking on the button **Get Values from Design** the user makes a reset to all the optimized values and gets the values from the beginning.

Fig. 345 - Get Values from Design button

14.5. Search: Geometry, Structures, Connections and Verify all

The search button looks for abnormalities in some parameters like burden, spacing, subdrilling, stemming, length of the borehole (geometric parameters) and if the user as vibration data, this application also shows the critical structures that are going to be affected by the blast (structures parameters). Also, it gives problems with borehole connections, for example, too short detonator (connection parameters). You can see some examples of this messages in Fig. 346.

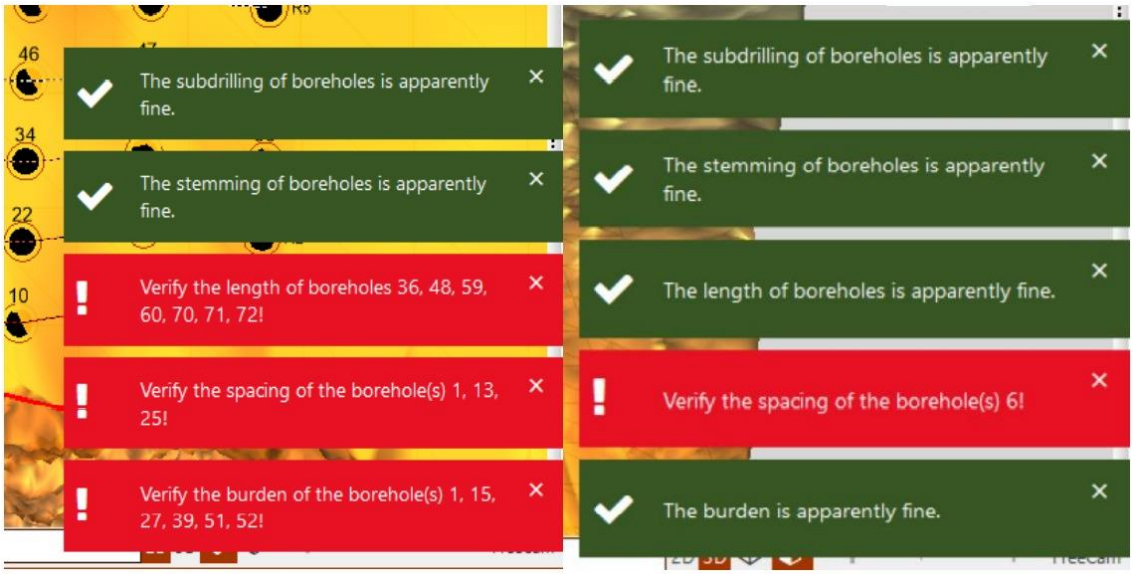

Fig. 346 – Search button results

14.5.1.Filter Holes by Geometry

The user can filter holes by geometry: length, subdrilling, stemming and diameter. And after assigning the hole´s angle definition inside options (Fig. 66), the user can also apply the inclination.
Then, when interval numbers are inserted, the holes that fall within assignment specifications it will appear highlighted (Fig. 347).

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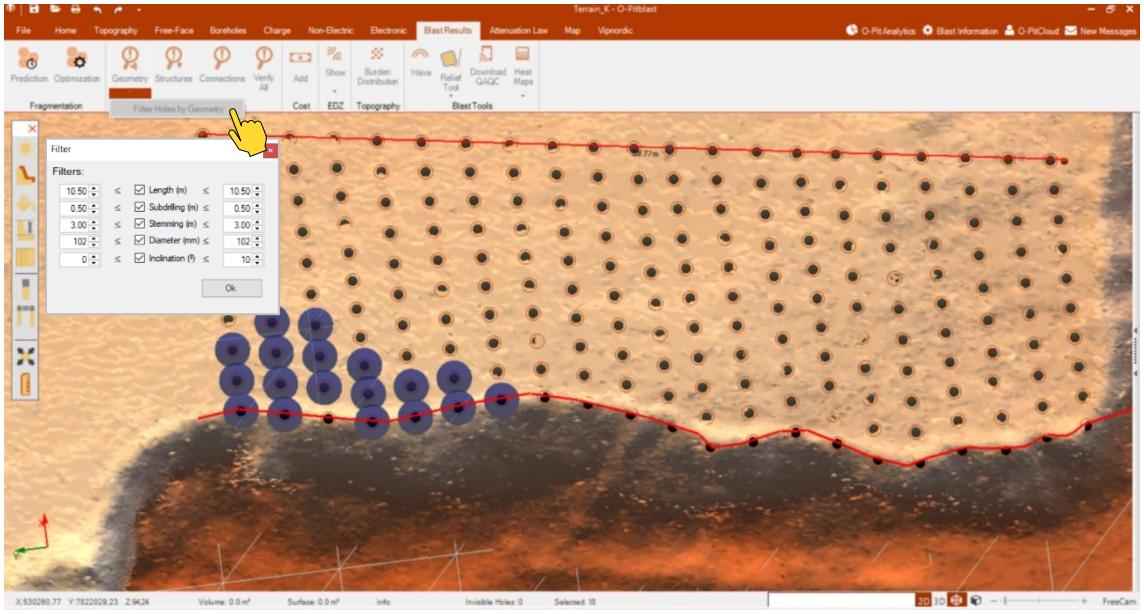

Fig. 347 – Filter holes by geometry

14.5.2.Check Different Inner Delays

Inside connections icon, the user can select “check different inner delays”. If there are different delays within the same deck of the same borehole, a warning message will appear (Fig. 348).

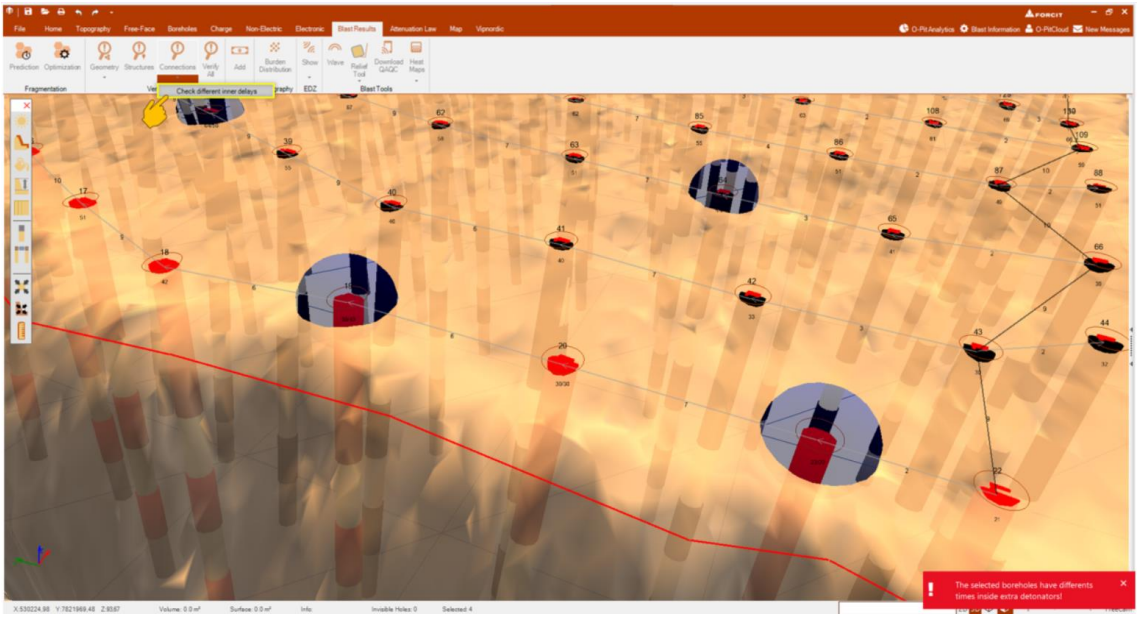

Fig. 348 – Check different inner delays

14.6. Add Costs

In this option the user can add extra costs to the blast.

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First chooses the costs that wants to add, then chooses the quantity that want to add and finally apply all changes.

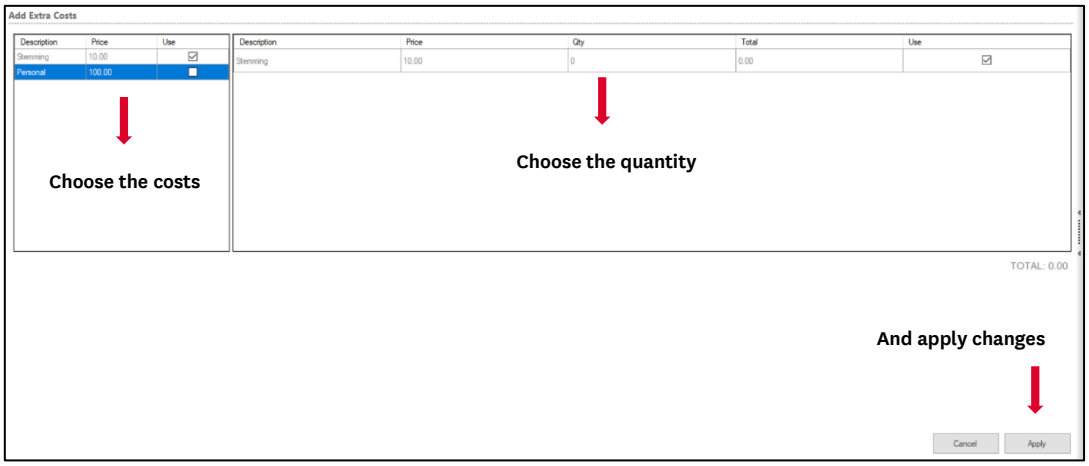

Fig. 349 - Add costs window

14.7. Burden Distribution

This option allows the user to see the pattern geometry distribution.
The red part tells us that you have a bad distribution (inclination of the holes, burden, stemming, etc.). The green part tells that it's well distributed (for example, inclination of the first row is well distance of the free face). In case it's blue, tells that is too far from the free face, for example.

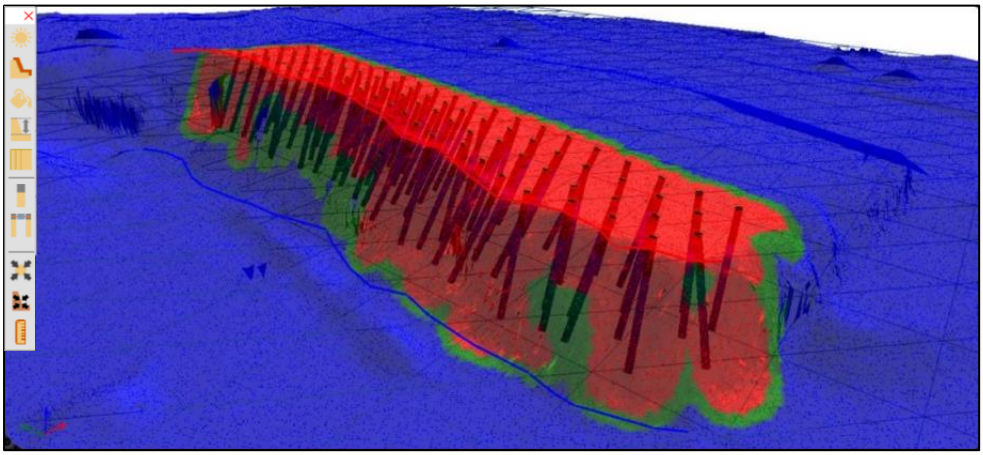

Fig. 350 - Distribution tool

14.8. Wave

This option will allow the user to compare the detonation time of holes with the signature hole wave.

Once the blast is load and with timing, it's possible for use to see the peaks of each hole blasting on the wave window (Fig. 351).

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Fig. 351 - Wave Analysis window

After that the user can import the seismographic information (time and vertical/transversal/longitudinal or SUM vector).
The user will be able to put an off-set (Fig. 352) to combine the first measurement from the seismograph with the first hole blasting (Fig. 353) and make the analyze based on those results.

Fig. 352 - Off-set

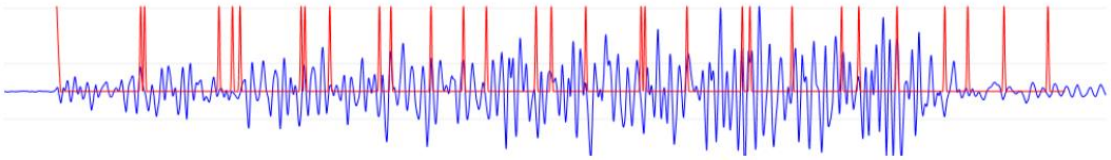

Fig. 353 - Seismographic information combined with the detonation time of holes

14.9. Download QAQC

In this option the user will be able to download the information obtained on OPITAPP and bring it to the O-Pitblast software, meaning change that he registers on the field (on the app) it can be download to the software.
The first step it's to choose the Project and Blast (on O-PitCloud) that he wants to download the new information and **download the select blast** .
After those clicks on the **Download QAQC** option and choose again the same blast. If there's any new information, it will pop-up a new window with the new information of each hole.

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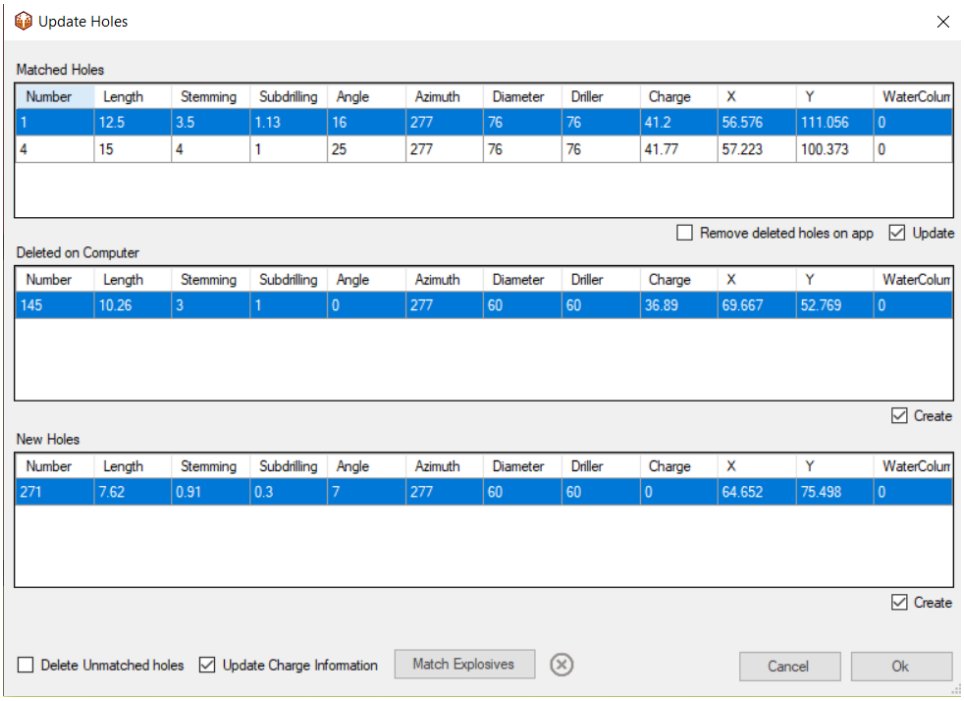

Fig. 354 - Download QAQC window

The user as the possibility to see the:

- Matched holes (that exist on the computer and in the app) and update this new information;
- Deleted on the computer (holes that here deleted on the software);
- New holes (holes that were created on the app) and create these holes on the software.

Also, on the bottom of the windows the user as the option to delete unmatched holes (holes that don't have any information in the app or computer) and update the charge information, for example to another type of explosive.

The match explosives button (Fig. 355) will enable to update the charge information making the match explosives according to the modifications made by the application. In other words, it will associate the server information with the explosive that the user has added in its database (Fig. 356). And the user can also select the right explosive from the dropdown list.

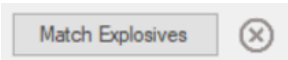

Fig. 355 – Match explosive

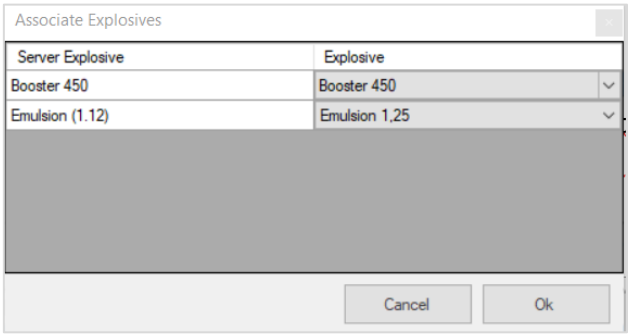

Fig. 356 – Associate explosive window

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Once done the match, a verified icon it will appear next to the match explosives (Fig. 357).

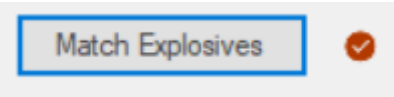

Fig. 357 – Match explosives was done

The same will occur with the diameter information. If some modifications were made to the application, when updating, the software will compare the driller information found on the server (actual values inserter in the application) with the information registered in the database.

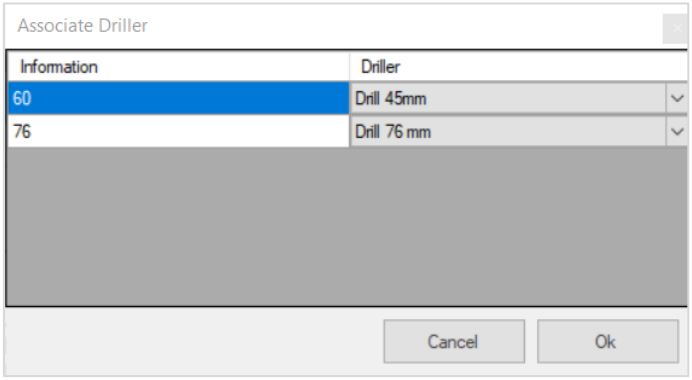

Fig. 358 – Match driller information

14.10. Relief Tool

The relief tool shows the relative difference of blasting time of each hole in one pattern.
Once selected the user will see a column with color and timing in (ms) and the gradient of colors on pattern.

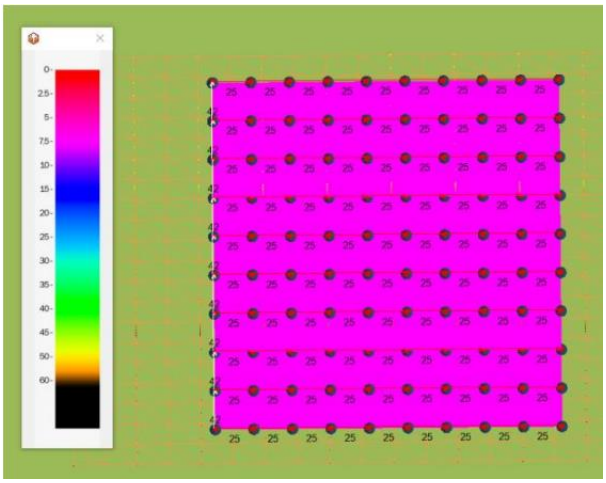

Fig. 359 – Relief tool

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14.11. Heat Maps

Through this tool, the user can analyse your blast parameters generating heat maps of the boreholes based on altitude, depth, subdrilling, water level, charge, stemming and powder factor.

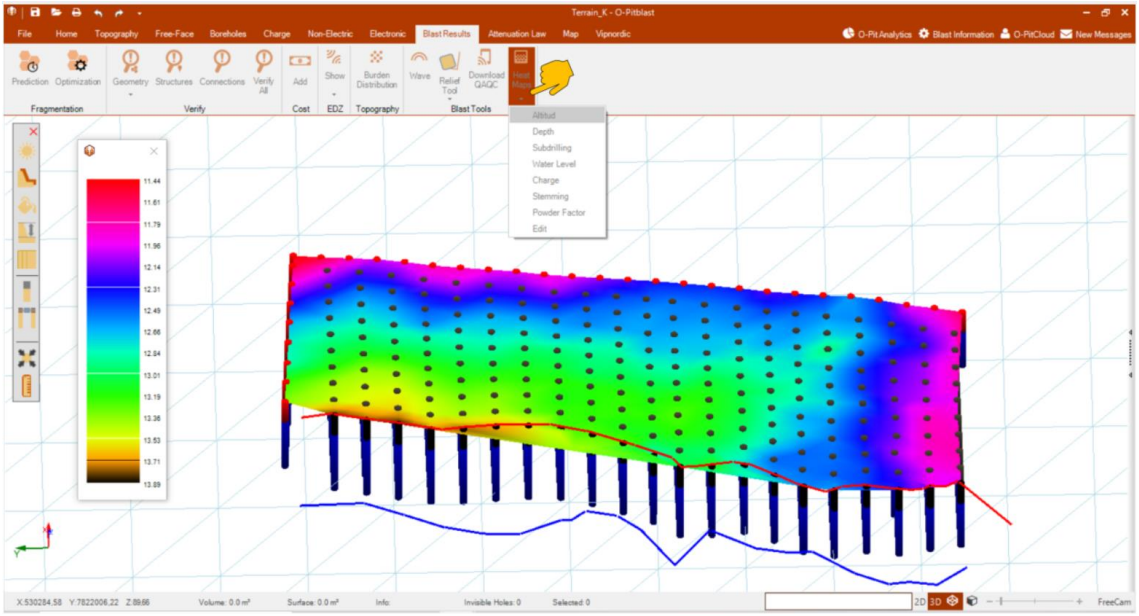

Fig. 360 – Heat maps

The user can also click on edit button to change the scale and color (Fig. 361 – Heat maps edit windowFig. 361).

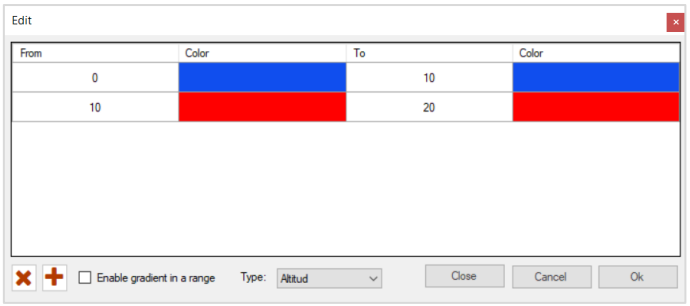

Fig. 361 – Heat maps edit window

15. Attenuation Law

The Attenuation Law tab presents all the tools and applications to predict and visualize different attenuation laws.

Fig. 362 – Attenuation Law module

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15.1. Import Data

To start the user can import their data by clicking in the button **Import Data.**

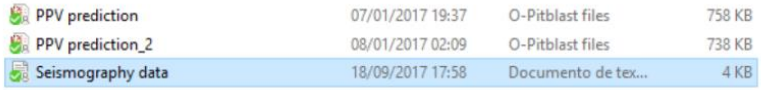

Fig. 363 - Import seismography data

Then for each column the user must put the correct parameter or open a XYZ coordinates file by clicking in the **Open file** button . When everything is ready the user must click on **Import the coordinates** button (Fig. 364)**.**

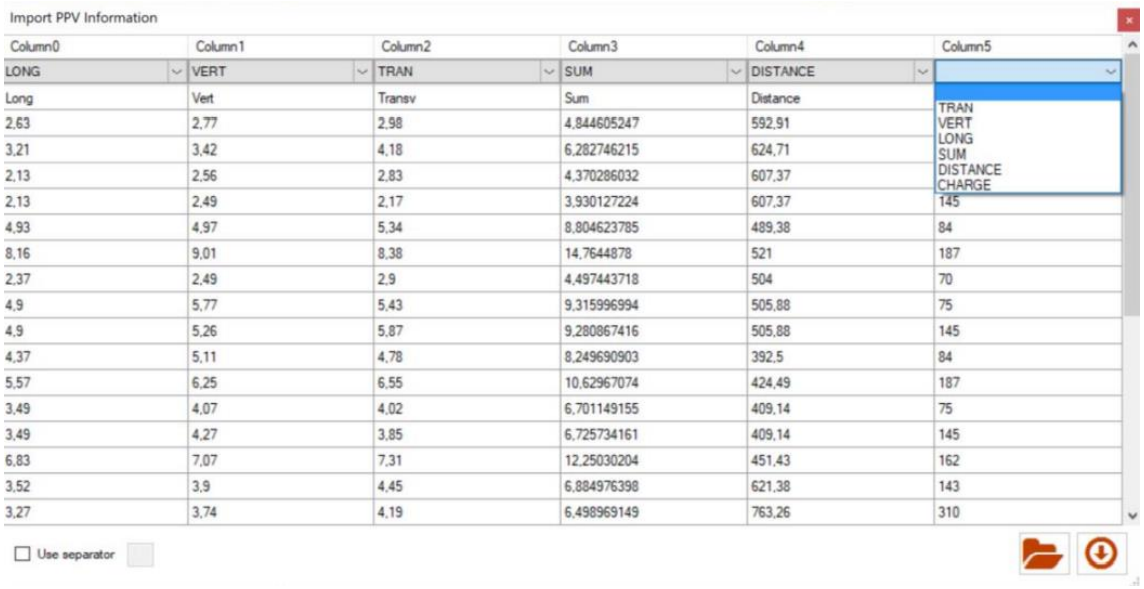

Fig. 364 – Import PPV data window

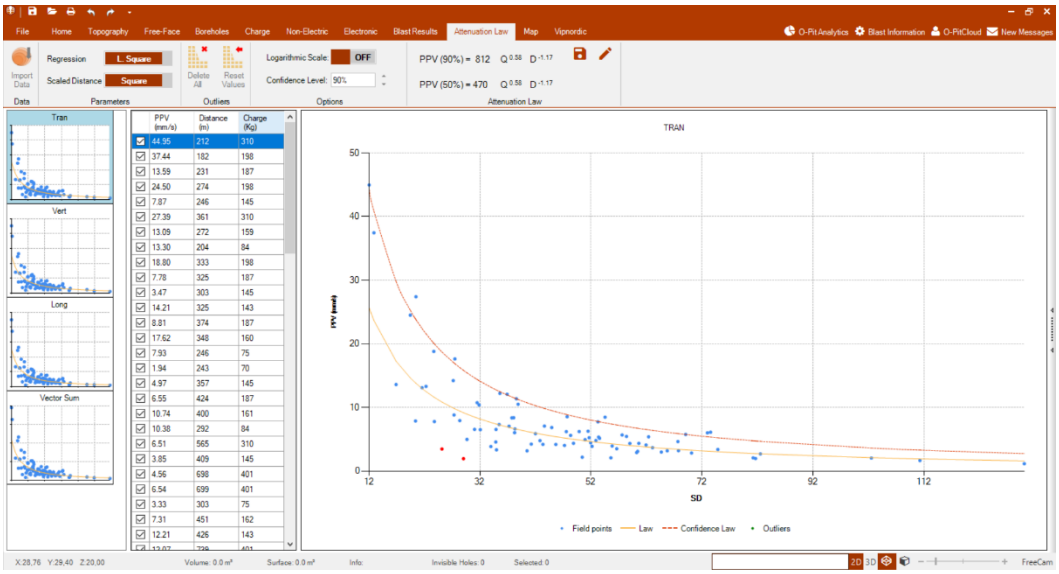

Fig. 365 – Final result of importing data

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15.1.1.Overview of the Imported Data

The window will show three important screens. The channel data (Fig. 366 – A): along of that channel the user can see multiple choices of graphics that are associated to the information that was imported. The raw data that was imported by the user (Fig. 366 – B) and the PPV/SD Graphic were the user can see the graphics and all the field points and the law and confidence level curve (Fig. 366 – C).

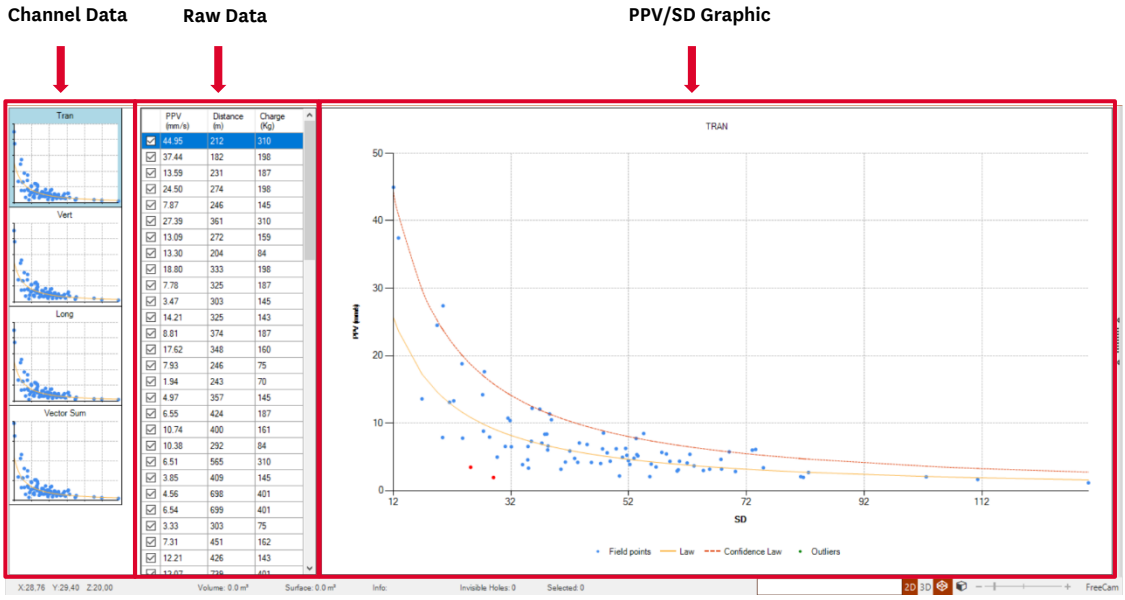

Fig. 366 – A: Channel data; B: Raw data; C: PPV/SD Graphic

15.1.2. Regression/Scaled Distance

At this point the user can define the best way to represent their field information. The operator has four options: using the Least Square or Least Residue; using the Square root to Scaled Distance or Cubic root.

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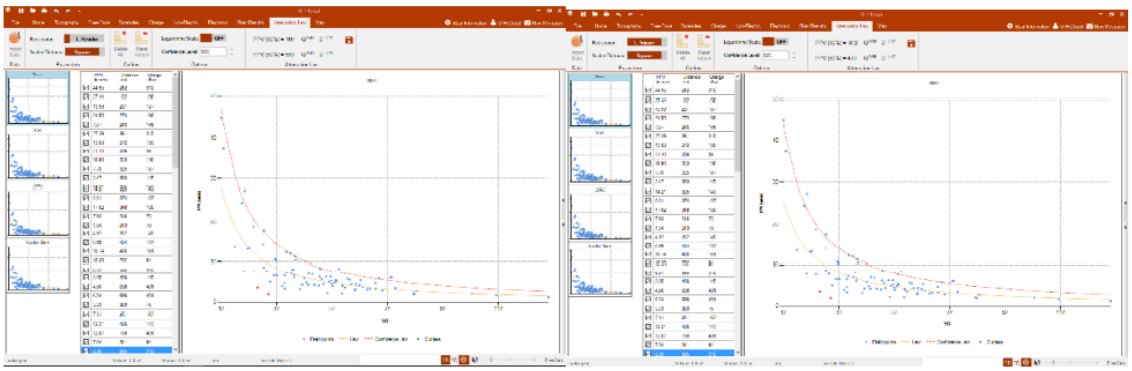

Fig. 367 – Left (A): Regression with L. Residue and Square Scaled Distance; Right (B): Regression with L. Square and Square Scaled Distance

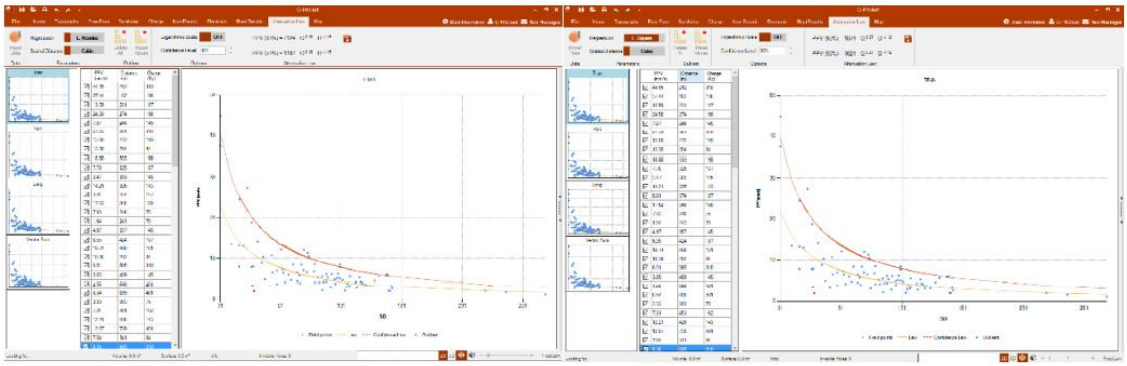

Fig. 368 – Left (A): Regression with L. Residue and Cube Scaled Distance; Right (B): Regression with L. Square and Cube Scaled Distance

15.1.3. Logarithmic Scale and Confidence Level

The user can press the button **Logarithmic Scale** to visualize the graphic at a logarithmic scale. The button will say ON when the logarithmic scale is appearing. The user can also change the confidence level up to 99% - this modification will change the confidence level and the attenuation law curve.

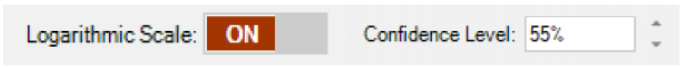

Fig. 369 – Logarithmic Scale and Confidence level tabs

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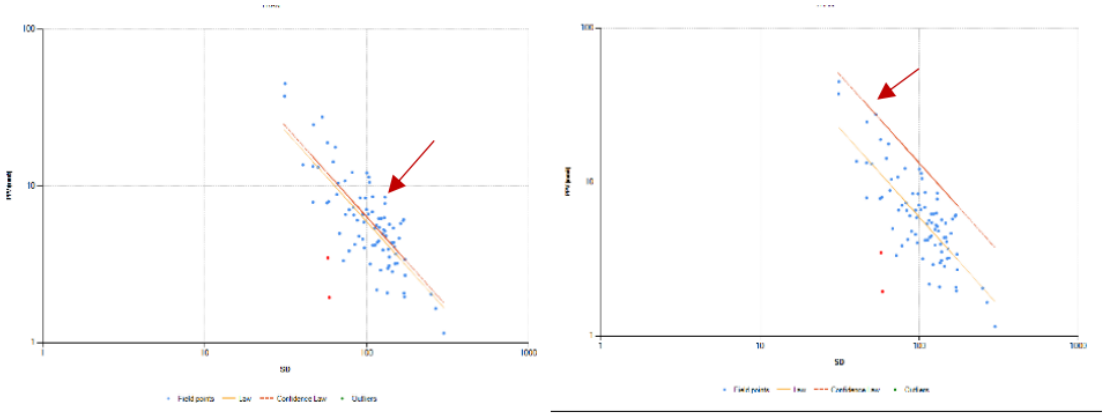

Fig. 370 – Left (A): Confidence level 55%; Right (B): Confidence level 99%

15.1.4.Outliers

Also, in Attenuation Law module exist outliers (9.1) and the user can delete them by clicking on the **Delete All** button . If the user wants to recover the outlier's information, he must click on the **Reset Values** button .

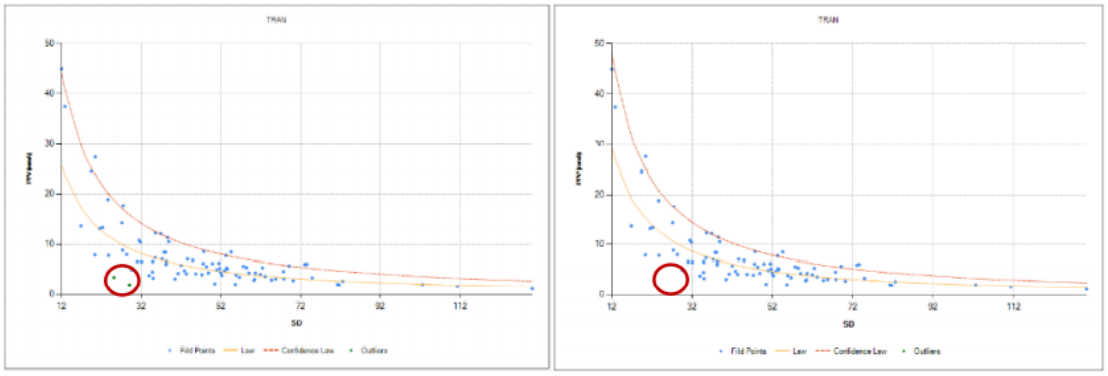

Fig. 371 – Left (A): PPV/SD Graphic with outliers; Right (B): PPV/SD Graphic without outliers

15.1.5. Attenuation Law

On this tab the user can see the attenuation law that he defined (confidence level: chapter 15.1.3) and if the user wants, he can save the attenuation law as a new one by clicking in the add button and put the Name/Description of that law Fig. 372. And the user can edit it using the edit attenuation law button (Fig. 373).

The yellow line corresponds to the attenuation law at 50% level of confidence, and it never changes; the red line corresponds to the level of confidence that the user chooses.

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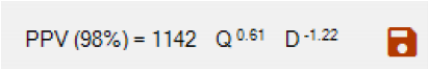

Fig. 372 – Attenuation law to the selected information

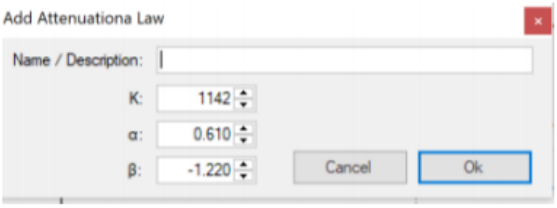

Fig. 373 – Add a new attenuation Law

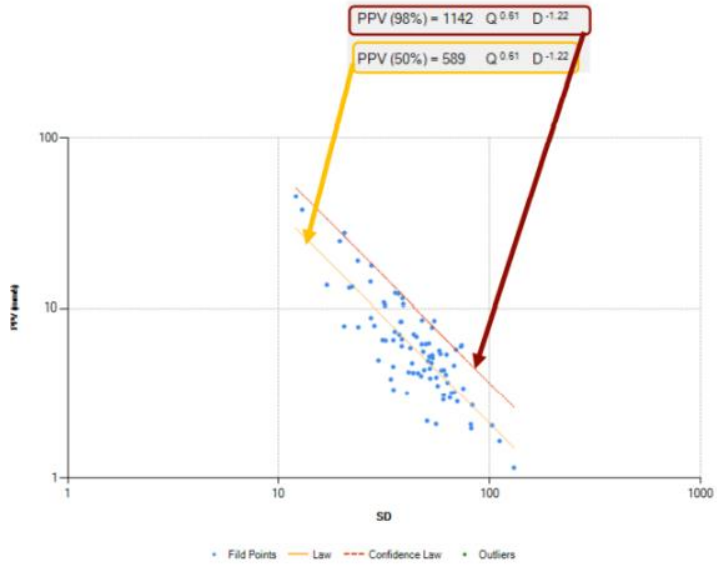

Fig. 374 – Curves/lines and their respective attenuation law

16. Map

The Map tab presents all the tools and applications to visualize your blast in Google Maps and register critical structures around your site.

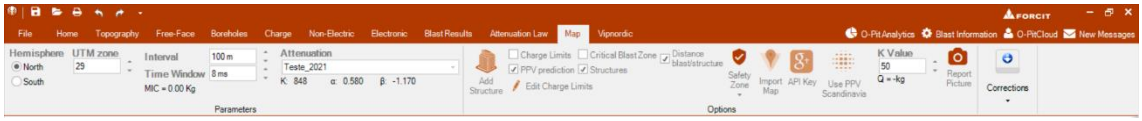

Fig. 375 – Map Module

16.1. Hemisphere and UTM Zone

To use this tool, the user must have coordinates information about the terrain in the data that was imported. Then he as to define the Hemisphere that he's working and the UTM Zone – as shown in Fig. 376 – Hemispheres and UTM zones.

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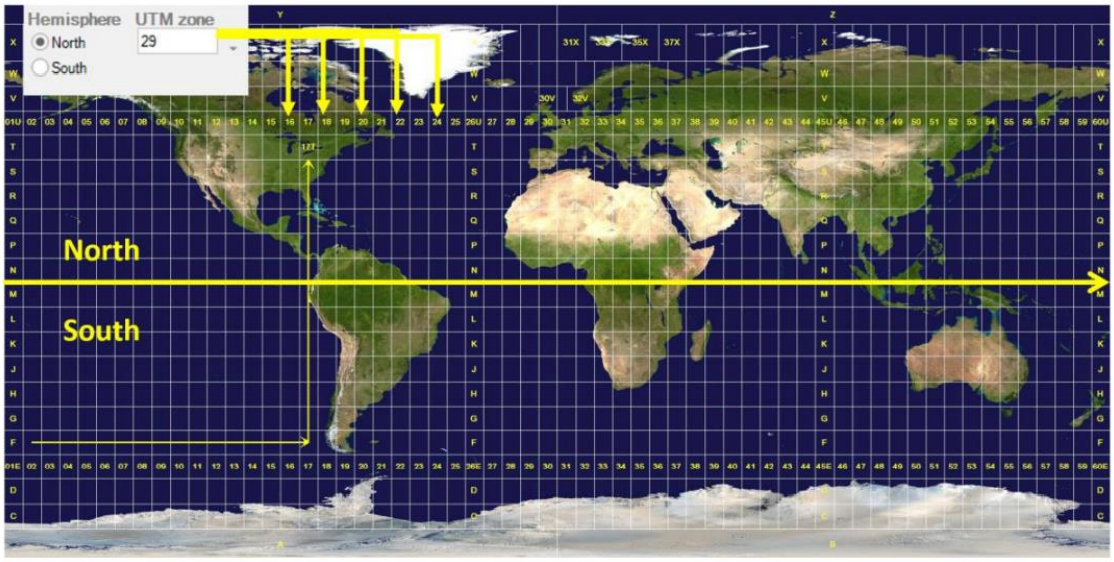

Fig. 376 – Hemispheres and UTM zones.

The user can also change the local coordinates to UTM coordinates by using the tools of **UTM correction** inside correction button. When it's on the user can change the X and Y of those coordinates.

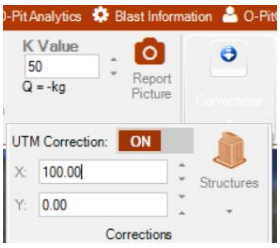

Fig. 377 – UTM Correction window

16.2. Views

There are three types of views: Map (Fig. 378 – Map view), Satellite (Fig. 379) and Open Street Map (Fig. 380).

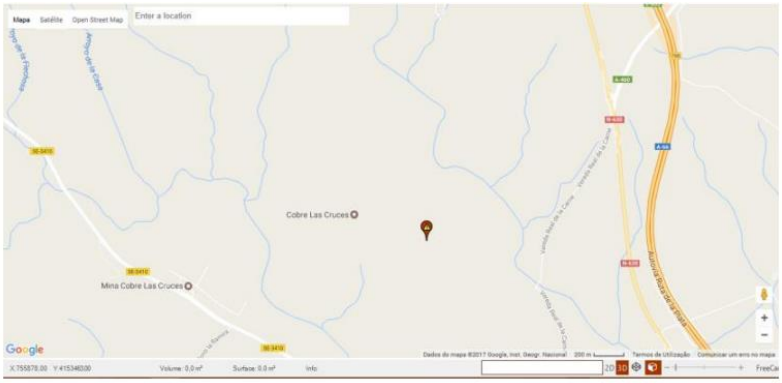

Fig. 378 – Map view

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Fig. 379 – Satellite view

Fig. 380 – Open Street Map view

16.3. PPV Contour Lines

If the box **PPV Prediction** is checked it will appear in the map some circular lines that defines the isolines to different distances and PPV (Fig. 382).

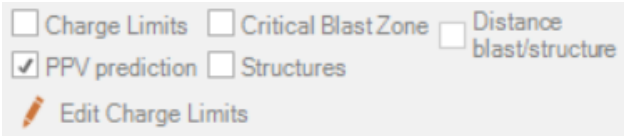

Fig. 381 – PPV prediction box

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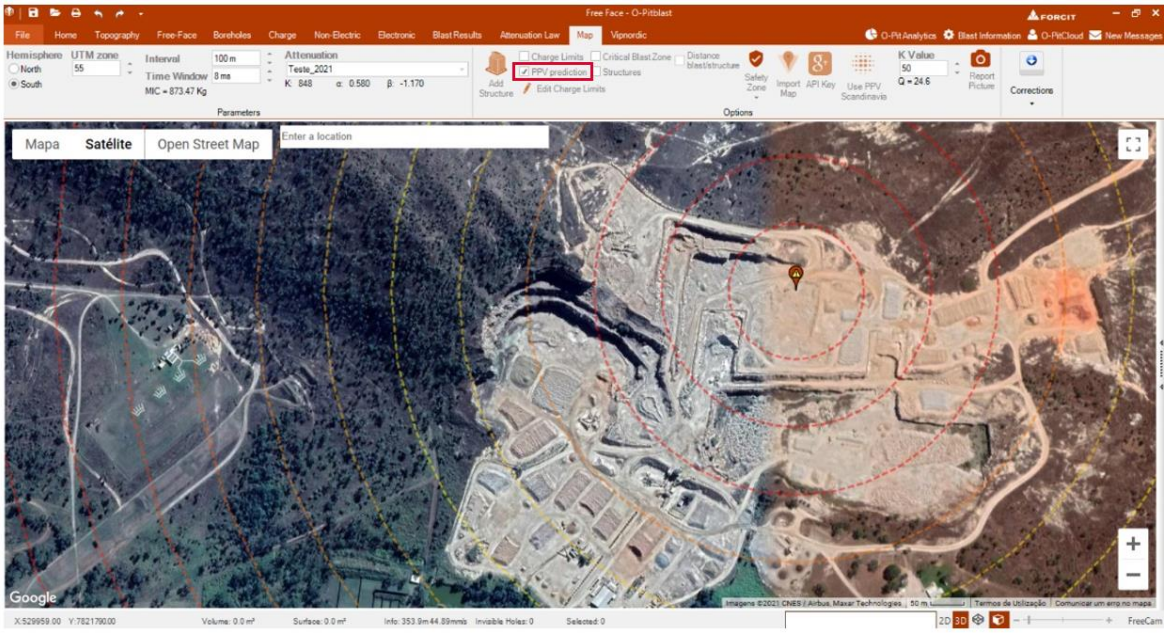

Fig. 382 - PPV isolines

If the user passes the mouse over one of the isolines it will show the PPV at that distance and the respective distance (Fig. 383).

Fig. 383 – Information of the isolines

To change the number of isolines the user must define how many meters they must be separated of each other in the tab **Interval** (Fig. 384).

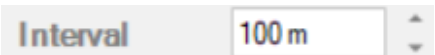

Fig. 384 – Interval tab

Finally, the user can choose one of their attenuation laws. In this case there's **Best Fit** law that comes as a default, but the user can add a new one at any moment (6.3.5.7).

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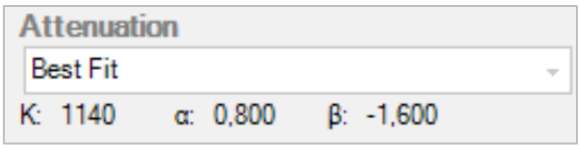

Fig. 385 – Attenuation Law: Best Fit

16.4. Time Window

On this tab the user can change the time window, in better words, this option allows you to define a time interval and calculate the number of holes blasting inside that range. This factor will change the MIC constantly.

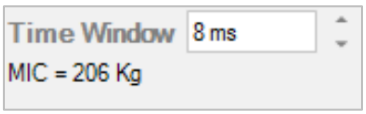

Fig. 386 – Time Window Tab

16.5. Structure

16.5.1. Add Structure

The user can add any structure he wants by clicking in **Add Structure** icon. There are some inputs that must be defined such as **PPV Limit, UTM X, UTM Y, Latitude, Longitude, Color, Acceleration, Freq, Correction X** and **Correction Y**.

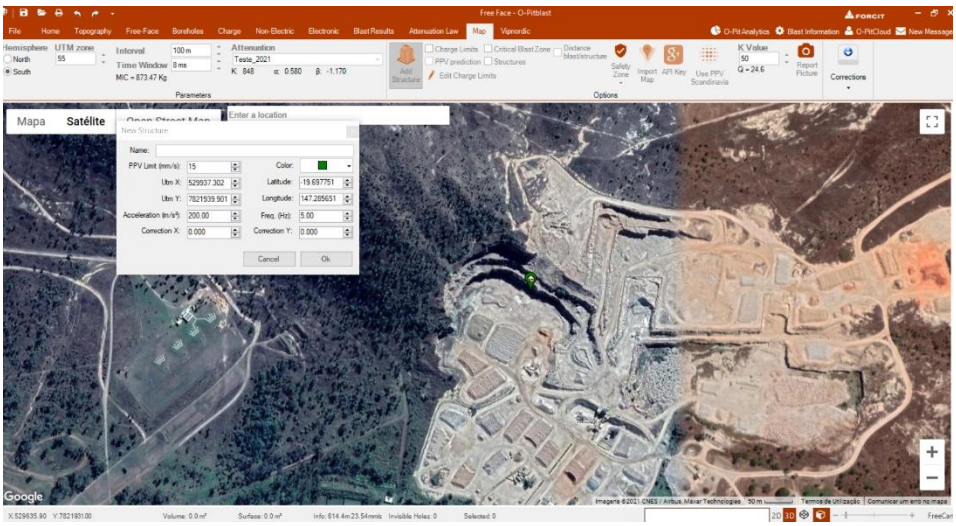

Fig. 387 – Add structure window

To see them, the user must check the Structures box. And select distance blast/structure to see the distance.

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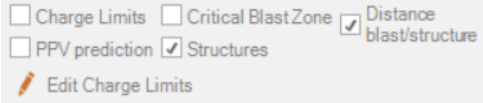

Fig. 388 – Structures box

16.5.2.Export Structure

The user can export your structure information to a .csv file. Once this tootl is selected, the export window will appear and then it is possible to select all or some of them to save (Fig. 390).

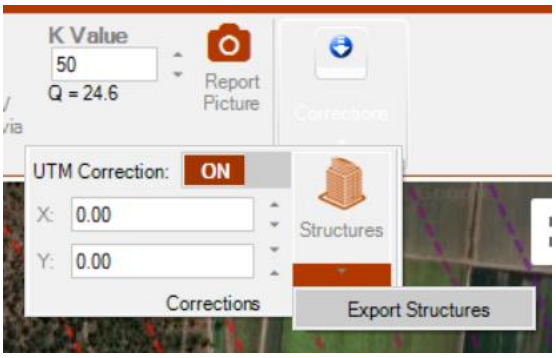

Fig. 389 – Export Structures option

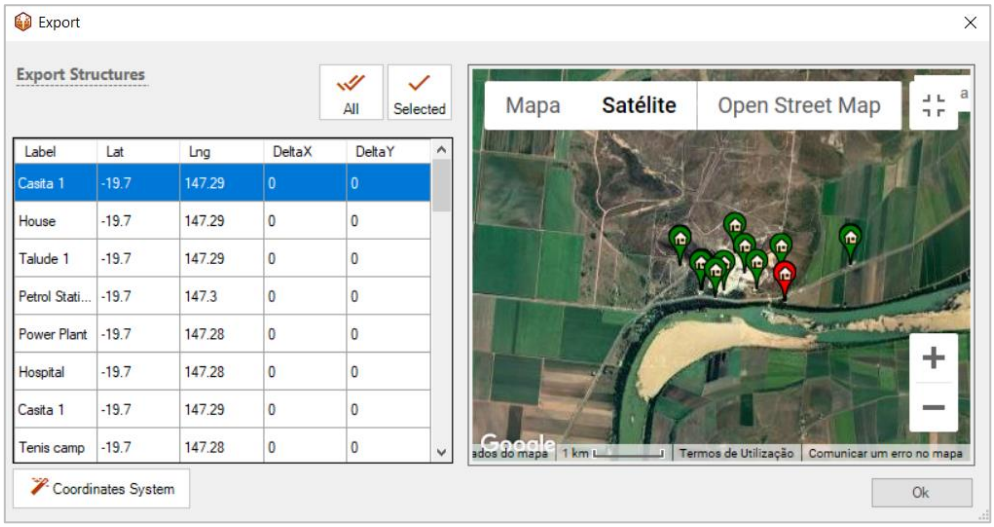

Fig. 390 – Export Structures window

16.5.3.Adjust Structure

The user can adjust your structures to the new position of your blast.

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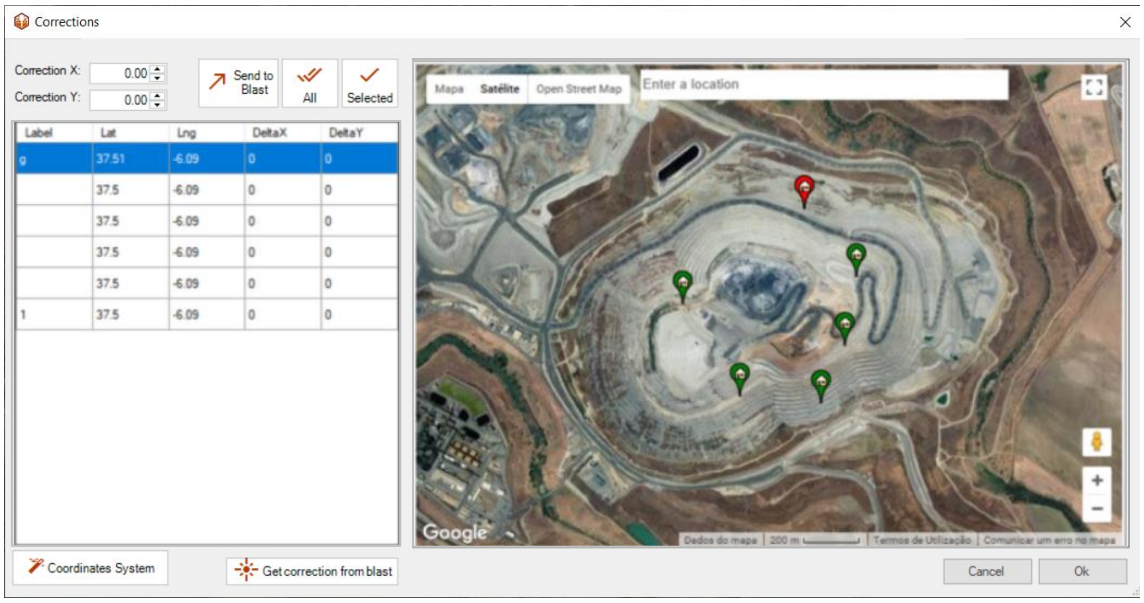

Fig. 391 – Structures corrections

16.5.3.1.Charge Limits

By checking the box **Charge Limits** the user can see the isoline that defines the charge limit of the structure selected. If the user passes the mouse over it will see the Kg of charge applied to a specific isoline.

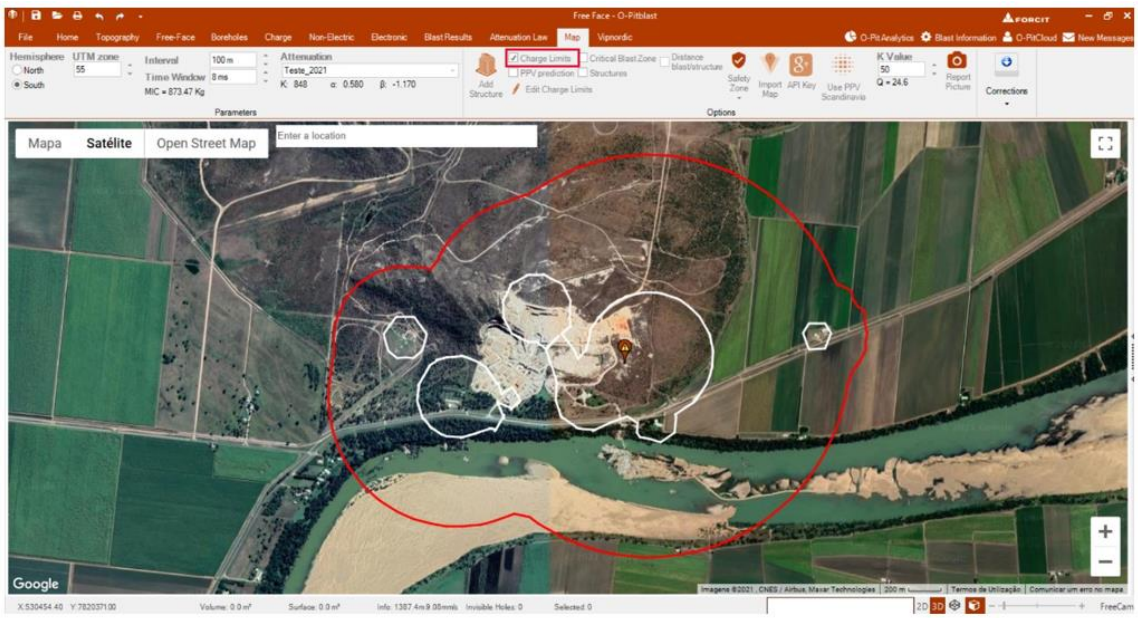

Fig. 392 – Charge limits area

16.5.3.1.1. Edit Charge Limits

The user has the possibility to change the Charge (Kg) of the isolines and the color associated to them. To validate their changes the user must click on Merge (Fig. 393).

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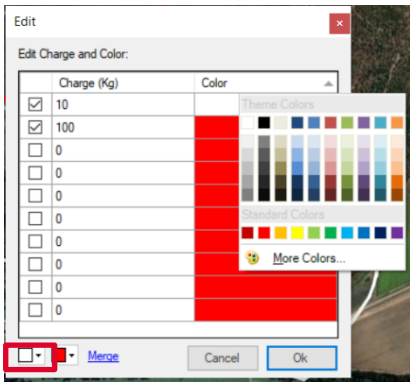

Fig. 393 – Edit Charge and Color window

16.5.4. Critical Blast Zone

If the user as the **Critical Blast Zone box** checked, it will appear a black contour that shows the critical zone. For example, the user can analyse if the blast will make some damage to the near structures.

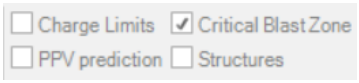

Fig. 394 – Critical Blast Zone box

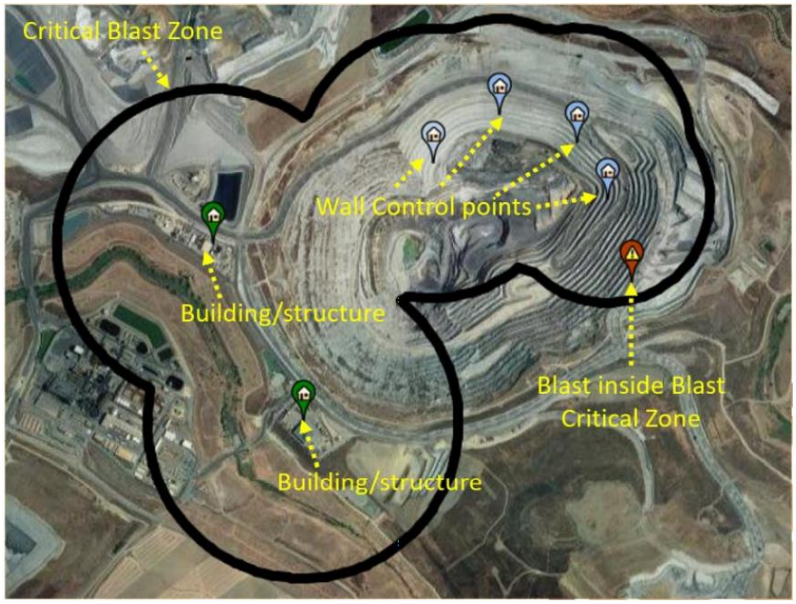

Fig. 395 – Critical Blast area

By clicking on the **Search (Chapter 14.5)** button the user can look for problems with the blast and with the structures.

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Fig. 396 – Detection of problems with the structures.

16.6. Safety Zone

This option allows the user to see the safety zone of the quarry or mine (see Chapter 6.3.7.2 to set the parameters for the clearance zone).

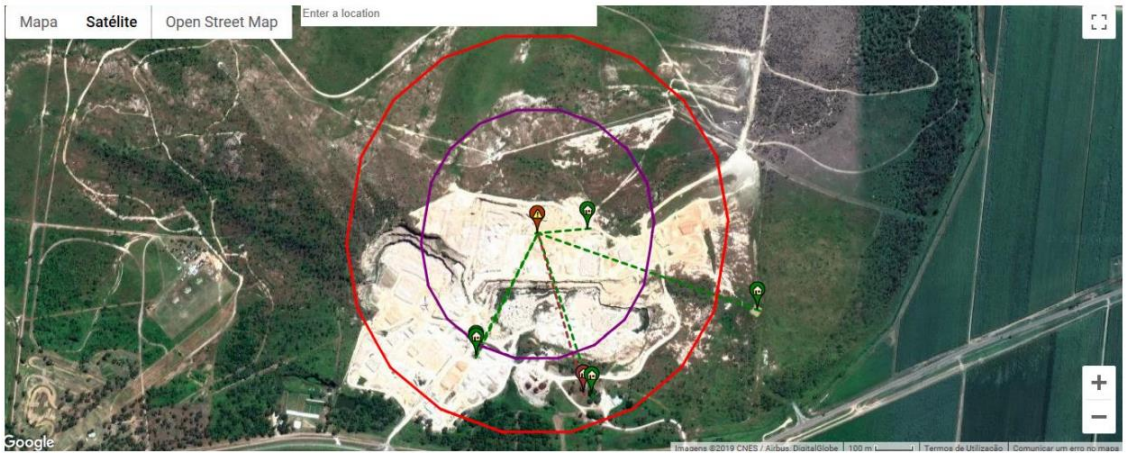

Fig. 397 - Example of safety zone for personnel and equipment

In the case shown above, the red line represents 500m to personnel and the purple line represents 300m for equipment.

16.6.1. Export Safety Zone (for Davey Bickford System)

In this case, the user can export two files to insert (by USB) on the Blast Machine. To do the exportation (Fig. 398) the user must follow the next steps:

1. Define the number of blast zones;
2. Define the safety distance of your blast (in meters);
3. Click “Calculate”;
4. Click on “Export”;
5. Define UTM Zone;

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6. Define the file name;
7. And finally, it will have the 2 files in the destination choose by the user.

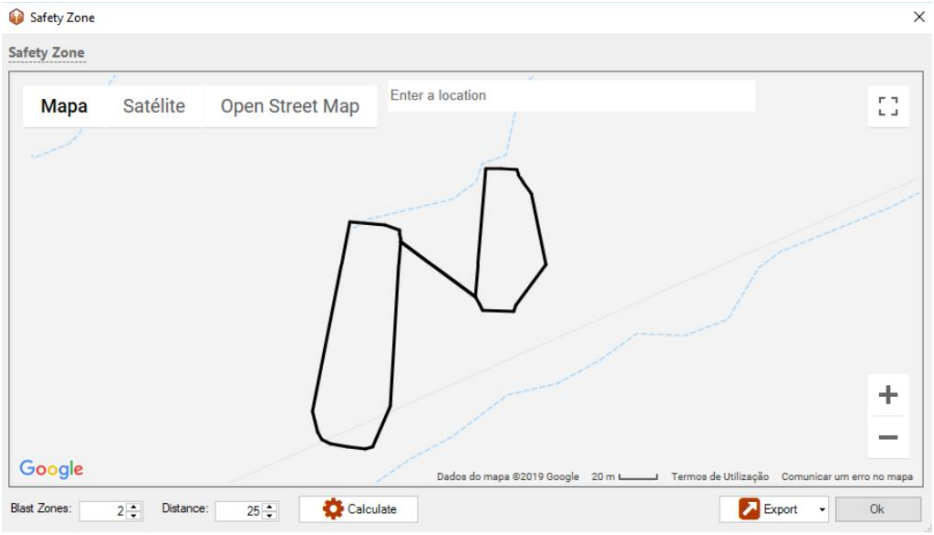

Fig. 398 – Safety Zone

16.7. Import Map

With this tool the user can import a map by selecting an area on the Map ( ) and then making the cut ( ).

Fig. 399 – Import Map window

After that, the loading will be done for make the preview terrain and the user can as a new terrain.

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16.8. Report Picture

The user can use this tool to take a picture for the report (consult Fig. 38).

17. Blast information

In this area the user can save information of the blast. It will appear lots of information to write in like **Site Name, Country, Location, Shotfirer, DB Responsible, Date, Type of rock**, **Comments** and **Geometry** (Burden, Spacing and Bench High). To save the information the user must click on the **Save** button .
The user can also reload previews information and put some pre-loaded comments by clicking on the button signalized in (Fig. 400).

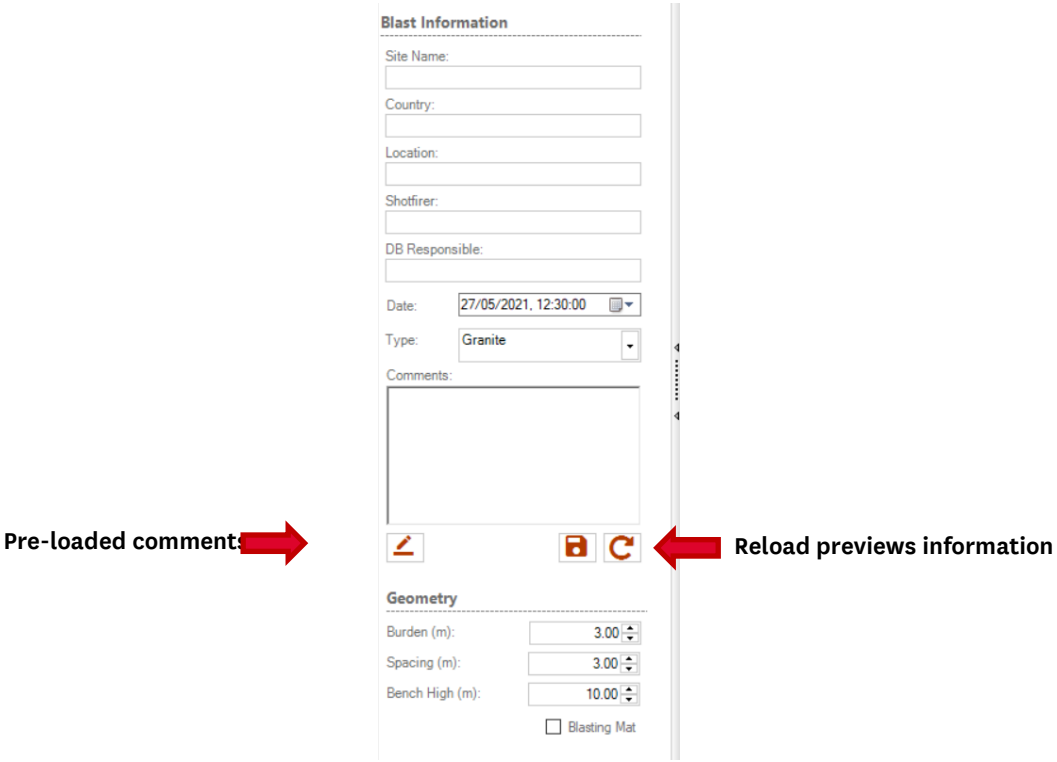

Fig. 400 – Blast information area

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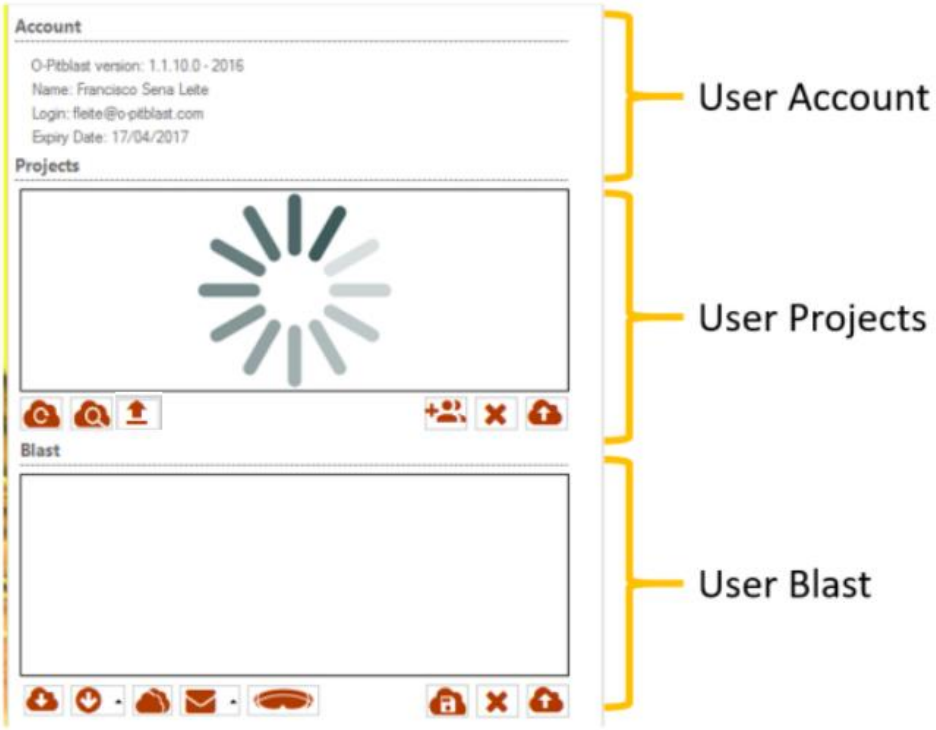
18. O-PitCloud

O-PitCloud is the area where the user can, for example, send blast reports to others users, upload new blasts and invite new people for a project.
The user as some information about their account and bellow he was the projects and blasts that their account is associated.



18.1. Projects Area

In this area the user can Reload Projects Lists, Check Details from some project, invite O-Pitblast users and create or delete a project, as shown on the picture bellow.

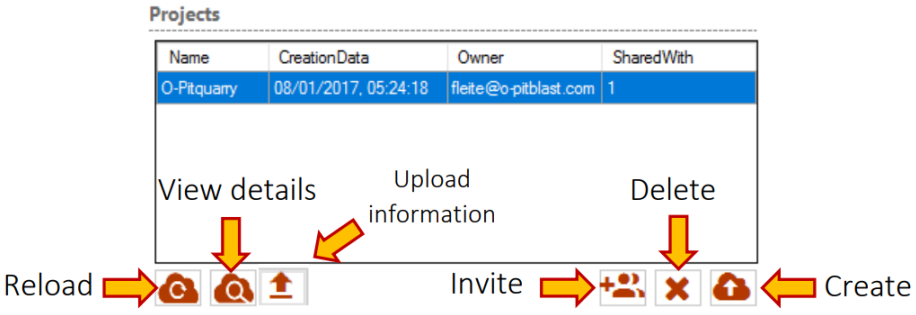


Fig. 401 – Projects menu

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18.1.1.Create a New Project

To create a new project the user must click on the button **Create** a new project and create a new name for the project.

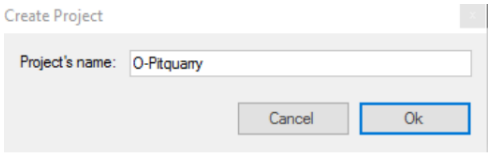

Fig. 402 – Create a new project window

18.1.2.Invite Users

The user can invite a new user by clicking in te button **Invite** **.** It will pop up a window that requires the e-mail of the new user.

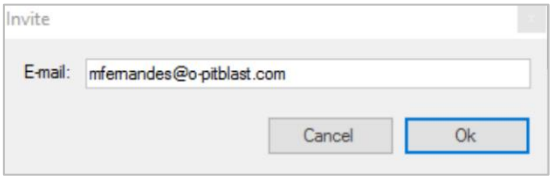

Fig. 403 – E-mail invitation window

The new user will receive a message saying, “You have new invitation”.

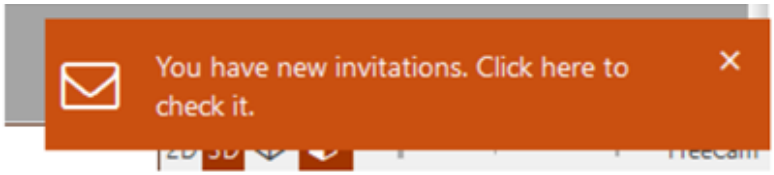

Fig. 404 – Message received by the new user

When the new user accepts the invitation, the user will receive a message saying “(…) accepted your invitation”.

Fig. 405 – Project to accept

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Fig. 406 – Message received when the new user accepts the invitation

18.1.3.Views Details

At this point the user can check for the details of any selected project, by clicking in **View Details** button.

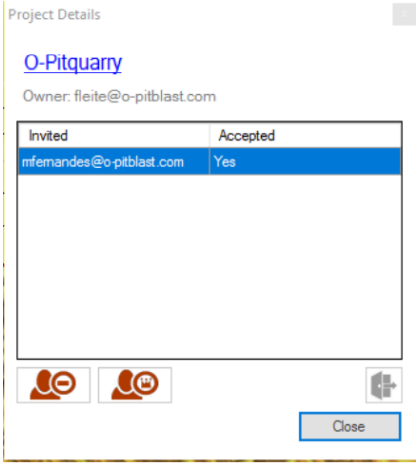

Fig. 407 – Project details window

18.1.4.Upload Information

In this bottom the user can upload different type of information to O-PitCloud.

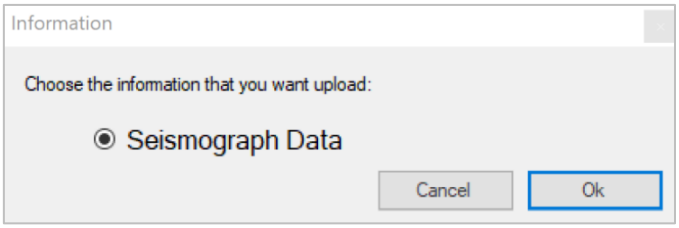

Fig. 408 – Upload information window

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18.1.4.1. Seismographic Data

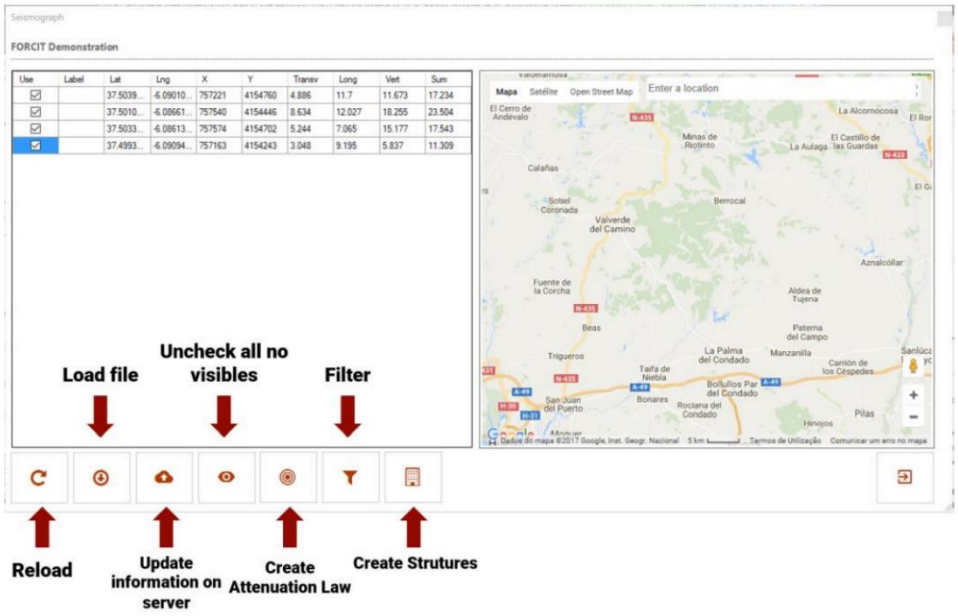

Fig. 409 – Seismograph (data) window

On this window - Fig. 409 –the user can **Load** a new file (it supports .xsl, CSV .txt) that contains seismographic data and **Update** that information to the server (O-PitCloud). Also, the user can **Create** a new attenuation law, **Filter** the data and **Create** Structures.

Load file

On this icon the user can import the file with all the seismographic data. It will pop up a window to fill with all the information per column (like shown on Fig. 410). The columns that belong to the coordinates (X, Y) and to the seismographic information (Transversal, Vertical, Longitudinal, Sum), Charge and Distance (shown in Fig. 410) must be rightly fill up to be possible to export.

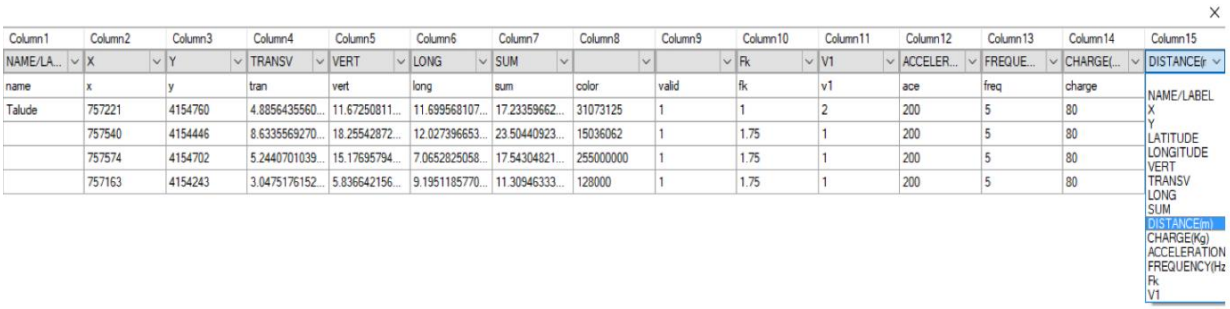

Fig. 410 - Export data window

Once the user exports the data, all the seismographs will be placed on the map. If the markers are yellow that means that the data is NOT on the server yet.

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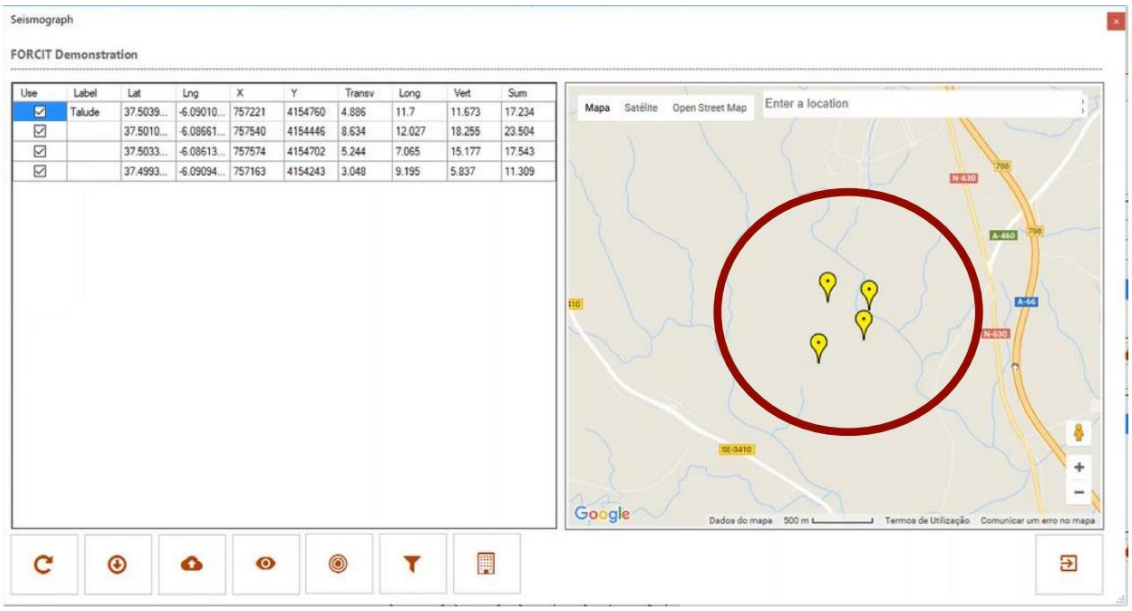

Fig. 411 - Seismographs placed on the map (yellow markers)

Upload to the server

After loading the information, the user can choose the data that we want and upload to the server.

When he unchecks the data, the yellow markers will pass to black (so the user can know what seismograph is not checked) like shown on Fig. 412.

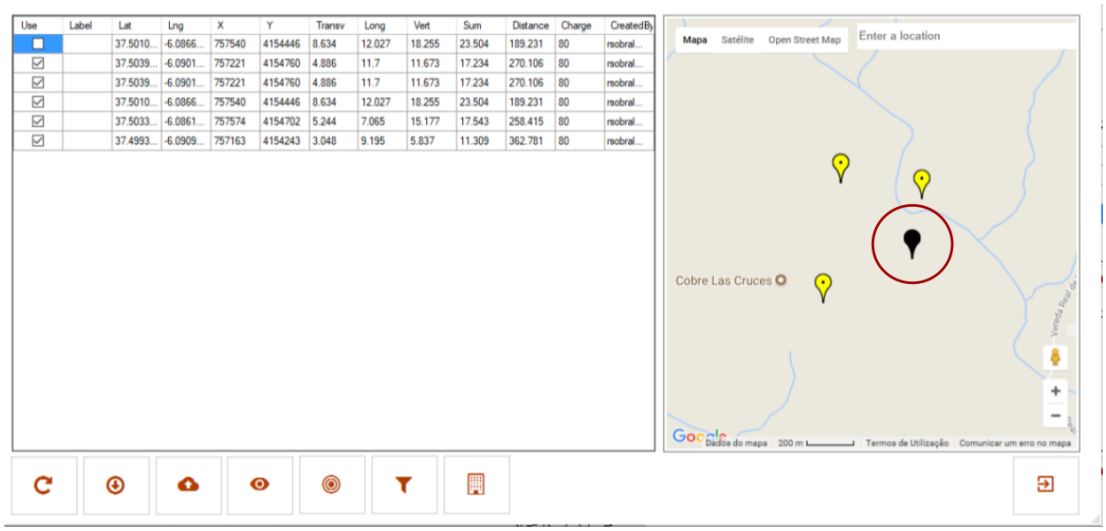

Fig. 412 – Check and uncheck the data to upload

After that selection the user clicks on the **Upload** bottom and all the markers will be pink. That means that the information is now on the server (Fig. 413).

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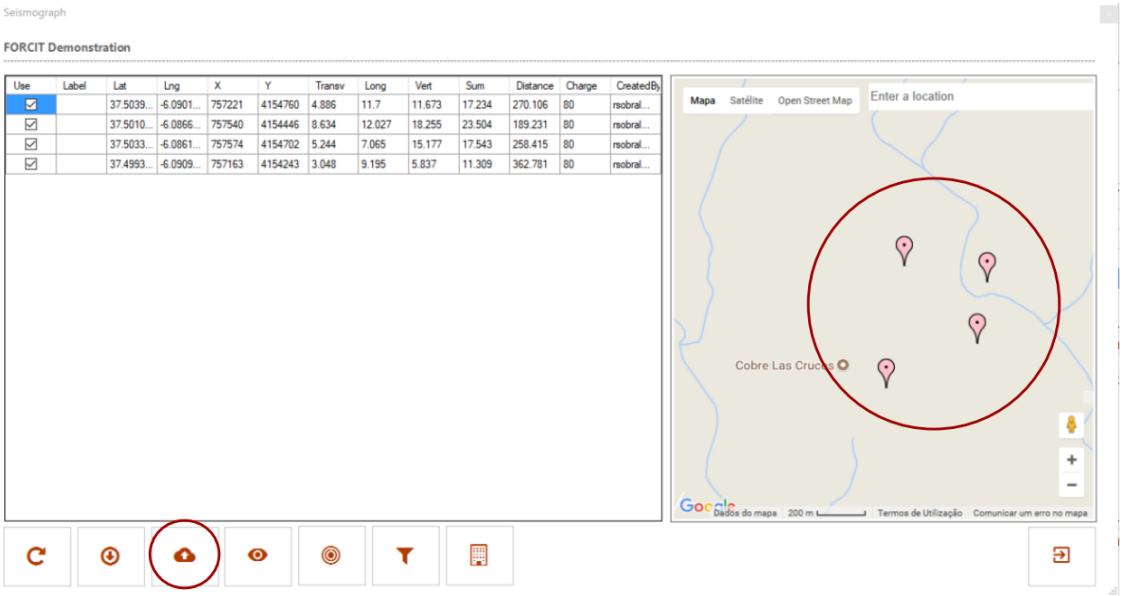

Fig. 413 - Seismograph data uploaded to the server (pink)

Uncheck all (no visible)

On this option the user can unselect all the data he wants by clicking on it. The only thing that is important to do is putting the data visible on the map. After that all the information that is no on sight will disappear (uncheck) – Fig. 414.

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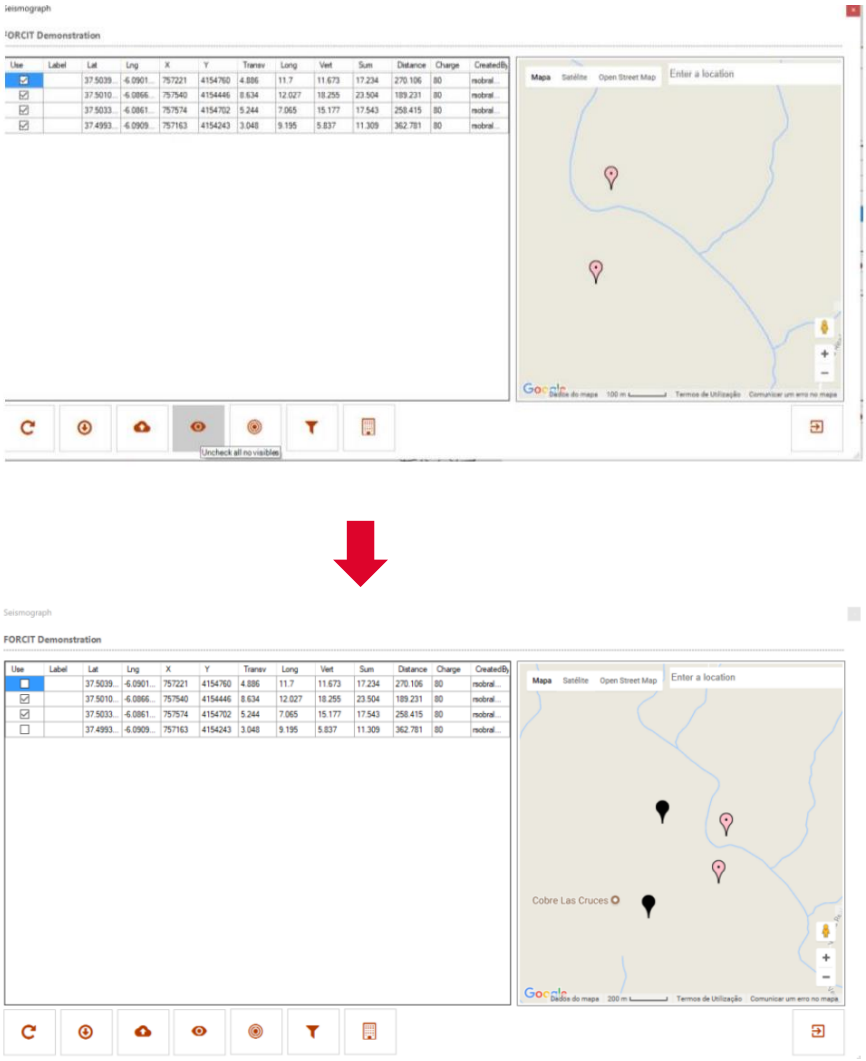

Fig. 414 – Uncheck all (no visible) seismographs

Create Attenuation Law

By clicking on this bottom, the user will create a new attenuation law with all the data that he selected.
In case of having some previous information, will pop-up a window asking if we want to attach the information, or delete all the information and create a new attenuation law with the new values (data) - Fig. 415.

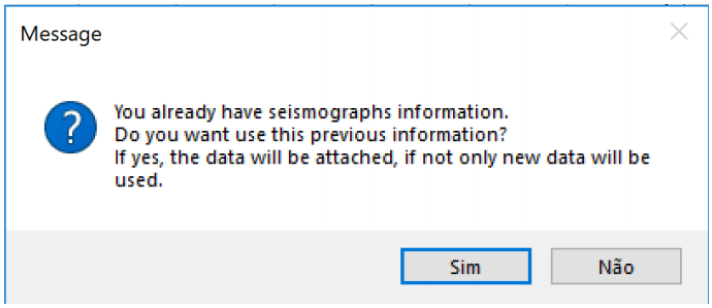

Fig. 415 – Overlap data tab

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In the case of choosing “Sim” (yes), the data will be attached. In case on “No” (não), a new data will be used.

Filter Data

In this option the user can filter the data that he wants by countless parameters like: Name, Latitude, Longitude, X, Y, Transversal, Longitudinal, Vertical and Sum. The user chooses the range of any parameter (or more than one) that he wants, and the filter will be applied, by clicking on the bottom “Apply” - Fig. 416.

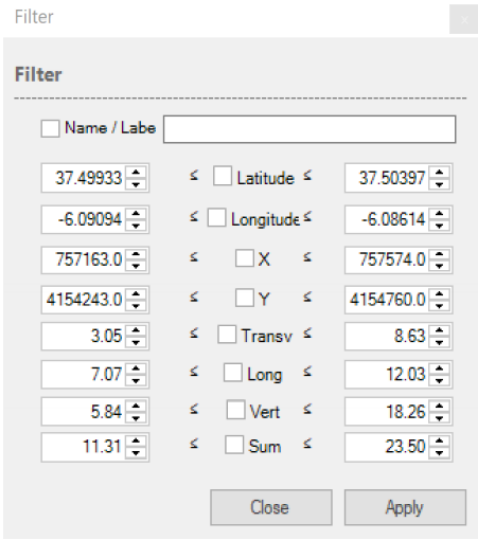

Fig. 416 - Filter window

Create Structure

Before you use this option is important to know that the PPV information is mandatory to fill (Fig. 417): Fk, V1, Acceleration and Frequency, to become possible to create the structures. If you start filling up the first column, you must fill out the four of them.

Column10	Column11	Column12	Column13
fk	v1	ace	freq
1	2	200	5
1.75	1	200	5
1.75	1	200	5
1.75	1	200	5

Fig. 417 – PPV information columns

After that if you have the PPV information, you can create structures by clicking on Create Structures bottom . This means that, in the place where the seismographs are placed, it will be added new structures on the map - Fig. 418.

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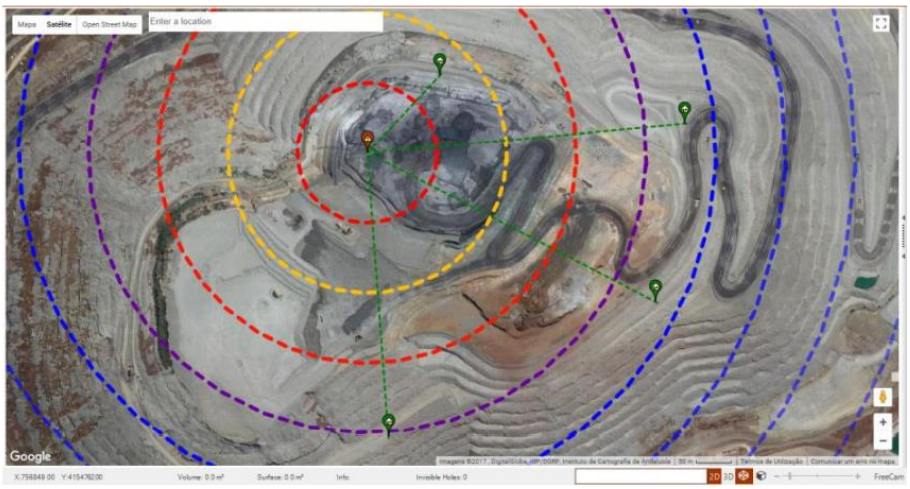

Fig. 418 – Creating new structures on the map

In case of overlap information, it will pop-up a window that allows the user to choose 3 options (Fig. 419):

- Replace the structure: will make a new structure on that exact place;
- Change the position (by 10 meters): will create a new structure 10 meters aside of the other one - Fig. 420;
- Don't create will not be add the new structure.

Also, the user as the option to "Repeat this option" that allows him to apply the decision to every "overlap" structure.

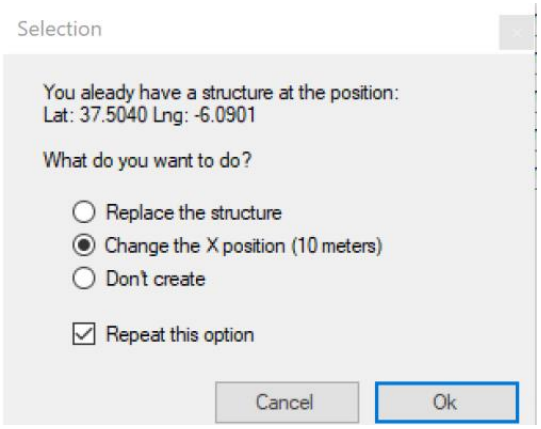

Fig. 419 – "Overlap" structures window

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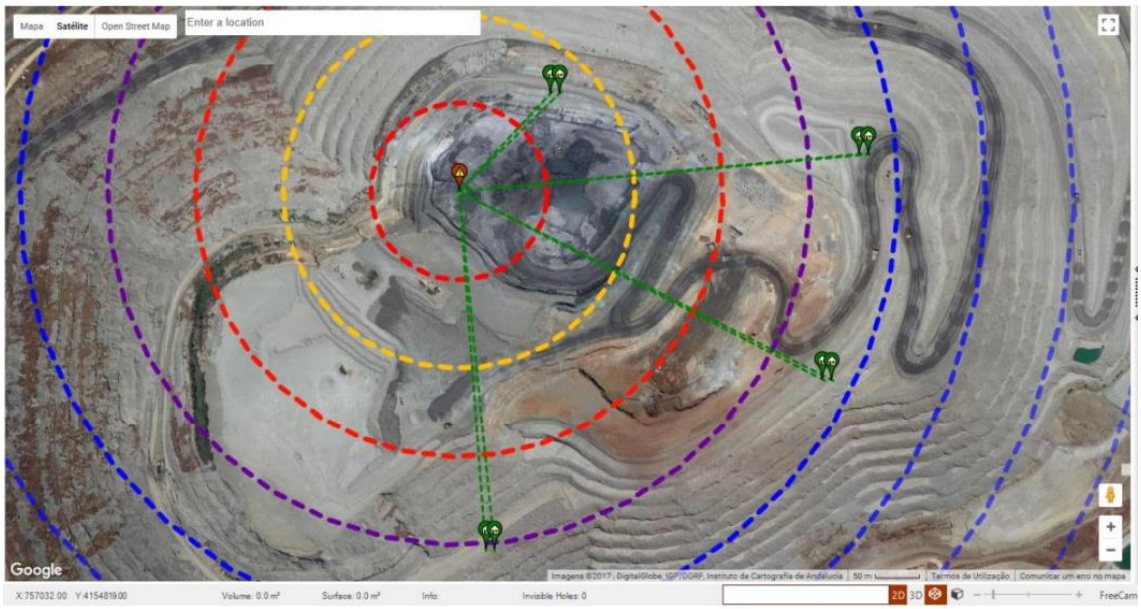

Fig. 420 – Creating new structures (10 meters aside)

18.2. Blast Area

In the blast area the user can Download the selected blast, download the QAQC information, copy the selected blast to another project, plan and report by e-mail, update, delete or upload the selected blast.

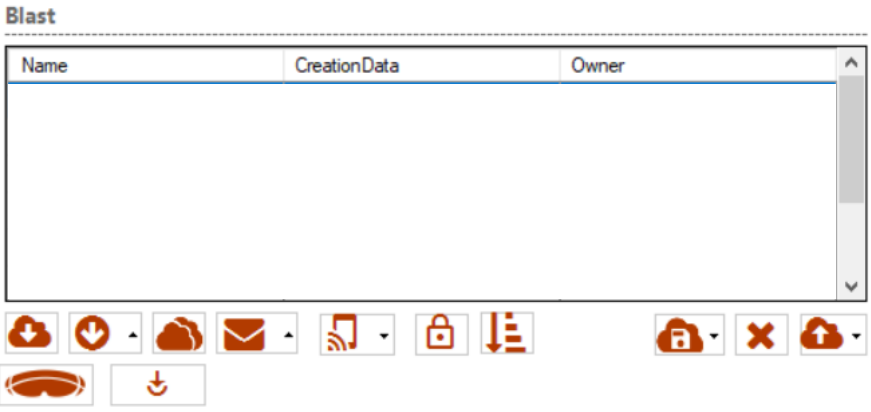

Fig. 421 – Blast area

18.2.1. Update, Delete and Upload Blasts

To update or delete your blast just click on the button **Update/Delete** and the blast, that must be selected, will be updated/deleted.
To upload a blast the user just has to press the blast button and write the new blast name.

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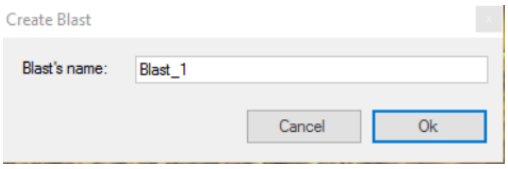

Fig. 422 – Create a new blast window

If you have a shared project with blasts, when you upload a new blast, the other users will receive an alert message (e-mail) saying that the blast was uploaded and with an attachment of the new blast.

Fig. 423 – E-mail received by the other users

18.2.2.Download a Blast

To download a blast the user must press the **Download** button after selected a blast. After the loading is completed, the blast will appear in the software.

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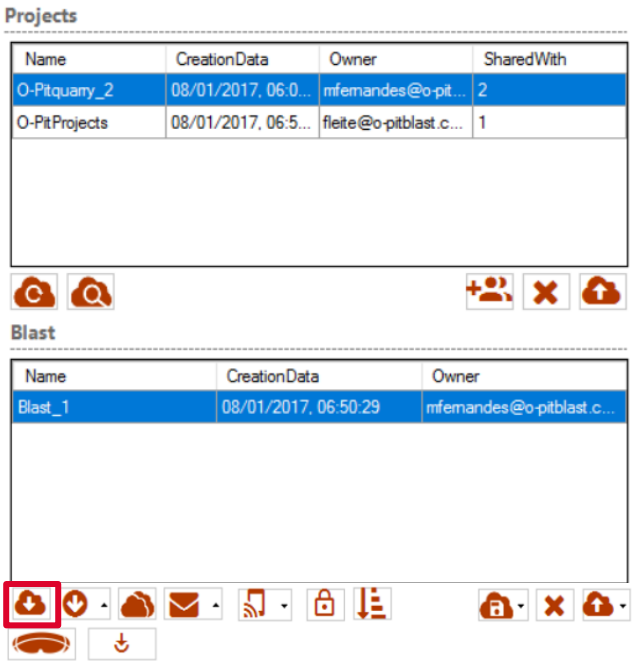

Fig. 424 – Download a select blast window

18.2.3. Download a QAQC Information

By clicking in this button, the user can download the QAQC information to compare the theorical values with the real values. The user can upload excel and CSV files.
The user can also download the Blast report (the one that it's sends directly from the app).

18.2.4. Copy to Another Project

By clicking in this button, the user can make a copy of a blast to another existing project. It will appear a window with all the projects that that account is connected, and the user must choose where he wants to copy the file.

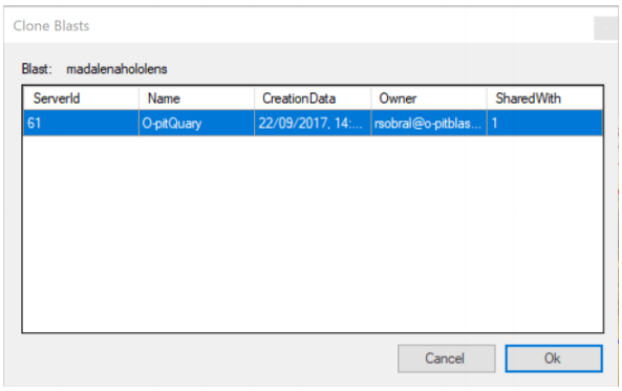

Fig. 425 – Copy the selected blast to another project window

18.2.5.Plan and Report by e-mail

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The user must click on report symbol. At this point the user as two choices: send a blast report or send a blast plan. After making that choose it will pop up a window to confirm the decision and the e-mail will be sent.

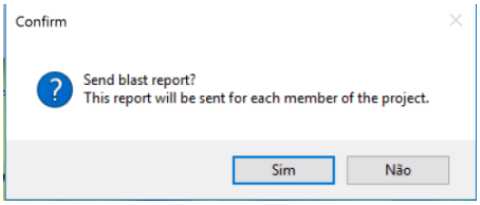

Fig. 426 – Send a report window

18.2.6.Update Holes

This button is used to update the information as mentioned previously in 14.2.

18.2.7. Close or Open the Selected Blast

This button allows to block/close the blast and then no other user can make changes again. If the admin wants to open again the blast, it is only necessary click the icon again .

18.2.8.Import Layer

With this icon is possible to import layer from Cloud through drill log information which was entered into the application.

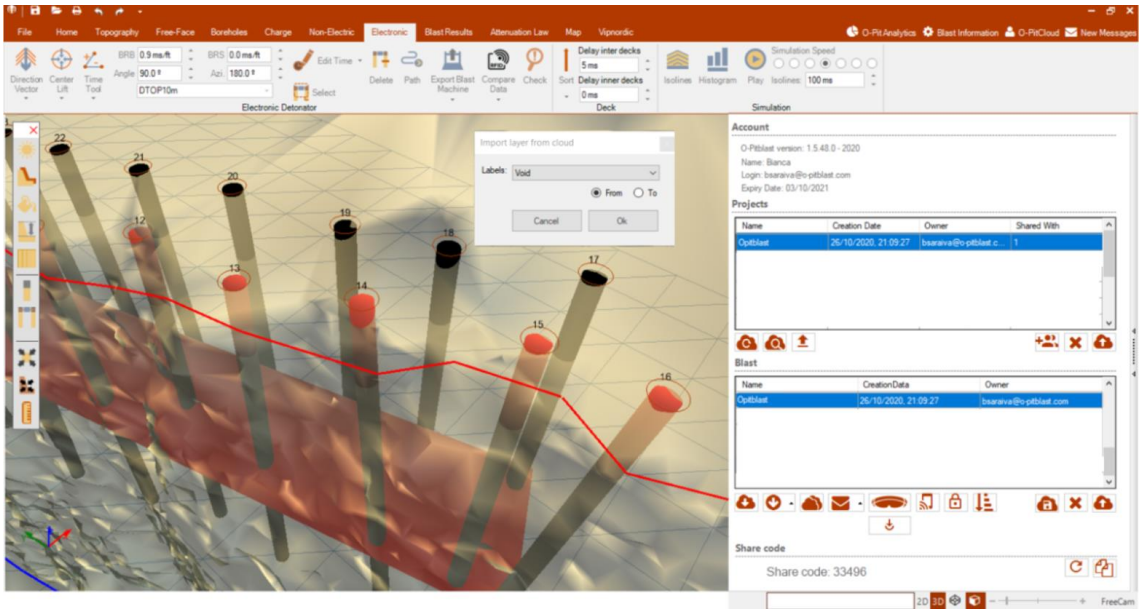

Fig. 427 – Import layer from the Cloud

18.2.9.Share Code with Co-Workers (Share Database Information)

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This option (Fig. 428) allows the user to generate a code, that he can share with another O-Pitblast users (see chapter 6.3.5.9.2 to find where to paste this code).

The user can copy the code or generate a new one (if the old code it's not updated with all the information present on the database).

Fig. 428 - Share code option

19. Short Cuts

The following table presents the short cuts keys for each action mentioned in this Manual.

Icon	*Function*	*Shortcut*
	Save	Ctrl+S
	Open	Ctrl+O
	Print	Ctrl+P
	Undo	Ctrl+Z
	Redo	Ctrl+Shift+Z
	Toolbox	Ctrl+W
	Lighting Control	L
	Terrain Control	C
	Change Transparency	Right-Click
	Background Color	S
	Bench Bottom Control	B
	Show/Hide Bench Bottom	Right-Click
	Hole Control	H
	Timing Control	T
	Centralize	Ctrl+1
	Import Terrain	Ctrl+T
	Import Layer	Ctrl+L
	Geo-Reference	Ctrl+G
	Cut Terrain	Ctrl+X
	Add Holes	Ctrl+H
	Edit Holes	Ctrl+E

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	Delete Holes	Ctrl+Del
	Move Holes	Ctrl+M
	Edit Toe	Ctrl+Shift+T
	Select Holes	Ctrl+Q
	*Pattern Creation*	Ctrl+Shift+P
	Import Pattern	Ctrl+P
	Import Polygon	Ctrl+L
	Add Connection	Ctrl+Shift+A
	Line Connection	Ctrl+Shift+L
	Edit Timing	Ctrl+Shift+E
	Initiation Hole	Ctrl+Shift+I
	Delete	Ctrl+Shift+D
	Select	Ctrl+Shift+Q
	Play	Space
	Quick Zoom	Scroll + A

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