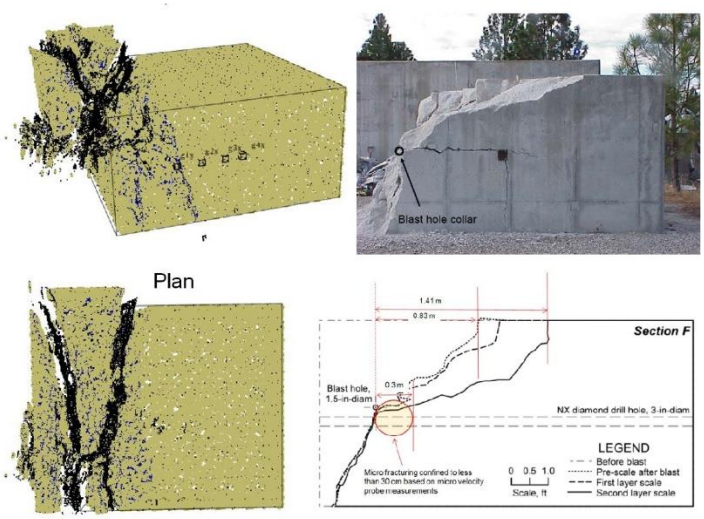
Methodologies for initial blast plan design (Part 03 of 03)

by Bruno Pimentel.



Hello my friends, I hope you are all well and once again we apologize for the delay in our publication today, because this week I was travelling, now moving from Goiás to Pará, so it was two days driving, plus all the preparation before and now unload things. We're going to stay in a hotel, with wife, boy and dog, we're even fixing a house, so you already know that the next few days are going to be tumultuous, but let's put that aside, because now we're here on a Saturday morning writing to finish our comments on the creating an initial blast plan.

As always, we leave here the links to our Newsletter so you can check our previous articles, as well as register, so that you are automatically notified of each new article we publish:

Português

https://www.linkedin.com/newsletters/blast-de-rocha-c-explosivo-6941709482355748864/

English

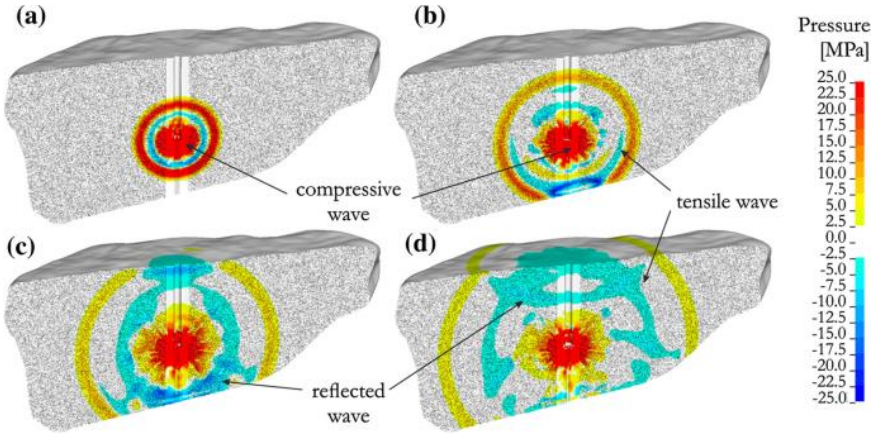
https://www.linkedin.com/newsletters/rock-blasting-6959820770344595456/

In today's article we will continue the previous article, making a series of comments on the choice of a methodology for the preparation of an initial blast plan, and in the last article we commented on the 3 main methodologies, which are the most used, although they are often merge or that in some situations the division between them is not completely clear.

1. Theoretical formulas = use of formulas and estimates to determine the controllable parameters of the blast plan starting from the uncontrollable variables or key parameters.

2. Benchmarking evaluation or previous experience = using references of similar operations or conditions to carry out a similar design adapted to the specific characteristics of the blast to be carried out.

3. Specific objective = use of a main objective as a reference for determining the blast plan parameters, where simulations are often carried out with software or approximation equations.



In a very brief way, just to refresh the memory of the comments of the last article, we have some assumptions of example situations where we can see the use of each of these methodologies:

1. Theoretical formulas = A classic example is the exercises presented in training, when we use the formulas recommended in the handout or book and calculate initial parameters for our blast plan, or a more practical example, when we use approximate formulas to calculate blast plan parameters , for example, the approximation that the stemming should equal 0.8 or 1.2 times burden (S = 0.8 to 1.2 x B) or the Spacing equal to 1 or even 2 times burden (S = 1 to 2 x B). So what we do is take parameters that have already been stipulated (uncontrollable or mandatory) and we determine the others by formulas recommended in books or by empirically determined in the operation.

2. Benchmarking evaluation or previous experience = Here we can look at what the neighbor is doing and copy, when we evaluate operations that normally have the same rock and we evaluate their blast plan and copy it completely or adapt it to our operation, or when a professional expert uses all knowledge of previous detonations performed to draw a blast plan similar to one he has done before. Another example would be when we take the typical tables indicating the reference charge ratio for a certain type of rock and draw a blast plan so that it has the same charge ratio.

3. Specific objective = Although there are some theoretical formulas that could be used, the most typical example of this methodology today is when we use modeling and simulation software, which will help us in designing a blast plan to achieve a specific objective, such as example a desired fragmentation or even vibration controls and release of the material. It is common for some software to allow us to design several scenarios and compare the results until we find one that resembles our needs, or more robust software can model a plan based on the imposed conditions and determined objectives.

We need to bear in mind that the choice of methodology to use will be closely related to the scenario, information and resources available, as well as according to the experience of the person carrying out the blast plan, but we can say that the points below must be taken into account in choosing the methodology:

- Characteristics of the blast to be carried out = normally the characteristics and criticality of the blast, either with regard to safety or its importance, will determine the level of resources available for its design and realization.

• Continuity of the operation = normally operations that will have continuity will invest more resources in the elaboration of a more adequate blast plan, while specific operations will depend much more on the characteristics of the blast itself.

• Availability of information and resources = some methodologies will require a minimum level of information or resources to be correctly applied.

• Necessary objectives = objectives can be imperative in choosing the methodology, as well as in defining the blast parameters, which is why they are always one of the initial references for starting any operation.

For example, it is very common in civil works to use a mixture of methodologies 1 and 2, which is based on past experiences of detonations in similar rocks and some theoretical formulas are used to adjust the parameters.

Another situation is a new large mining operation, which will normally assemble a team of specialists or hire a consultancy that will normally use software to carry out simulations and models, while benchmarking research can be carried out to assess what other operations are doing.

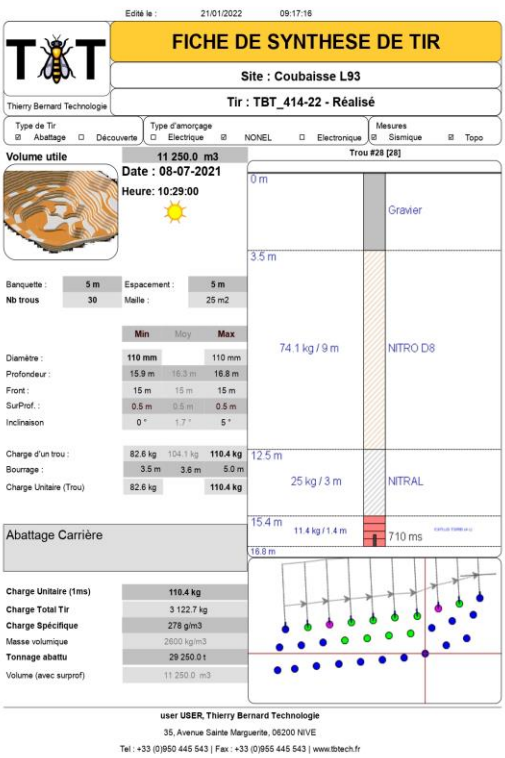
We may also have an operation that is already underway, and you need to create a plan for a new area, with rocks that have very different characteristics from those that normally detonate, and may have different objectives and levels of security, so you will have to do a detailed analysis of the scenario and assess whether the best way is to use the plans already used as a reference, make a new design using some formulas and adjustments, or even prefer to use software or hire a consultancy to support the first detonations.

So, as simple as the options seem, the choice of which path to follow can change in each situation, and we can even use more than one methodology to buy the plans generated by them and make an adjustment looking for an intermediate plan or even use the one that provide a greater margin of safety.

Once the methodology that we are going to use is determined, we need to define the starting point, which, as we said, will be defined basically by the information we have, by the objectives and by the uncontrollable variables already established by the operation.

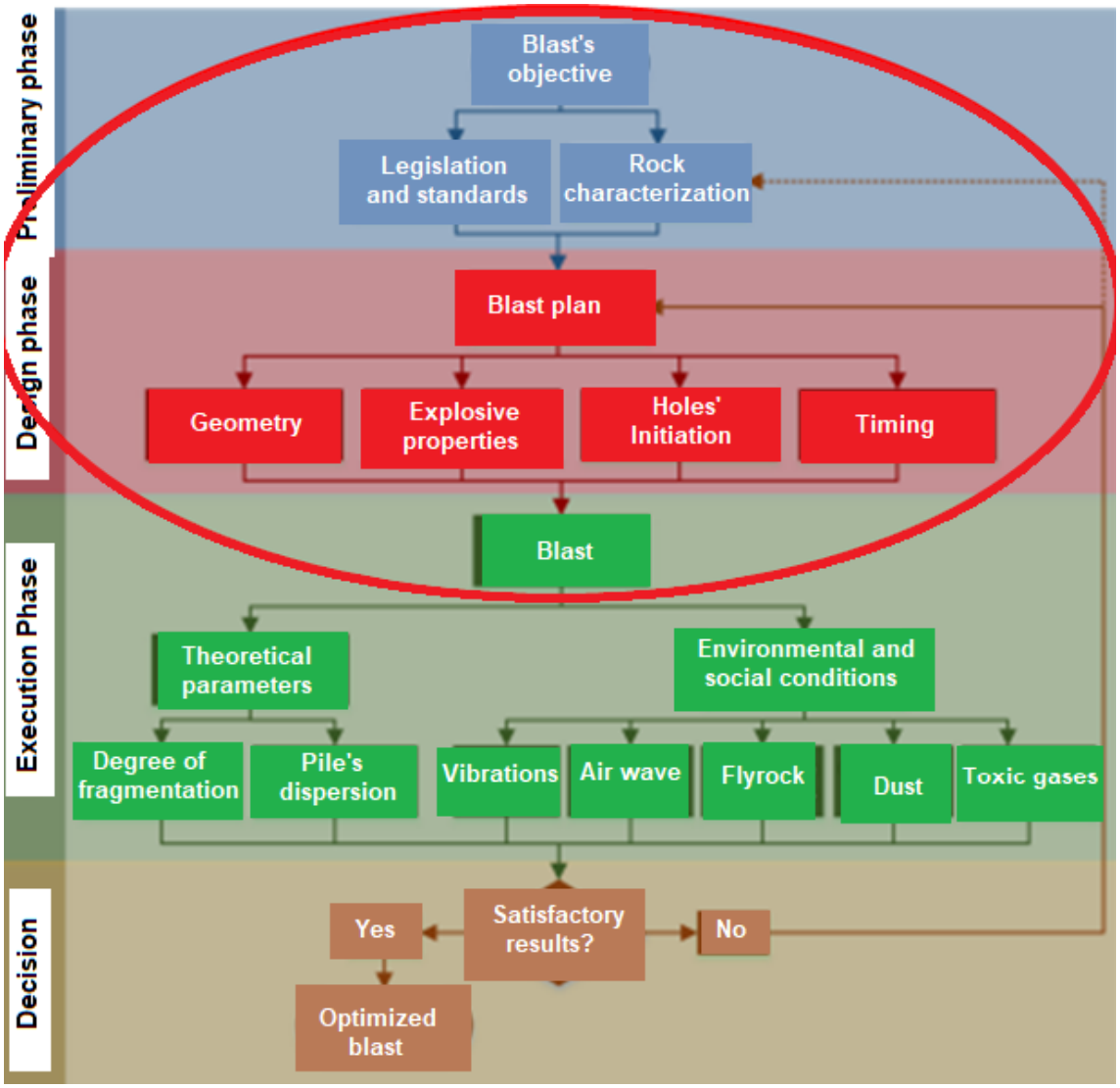
Some of the uncontrollable variables can be intermittent or have small changes, and can sometimes be determined in the blast plan elaboration stage, but they are tied to the general characteristics of the operation, in which case a broader weighting needs to be done. For example, we may have some equipment that allows diameter variation, but we need to analyze in addition to the blast plan, cost parameters, tools and efficiency of the drilling operation, and thus it is not just the result of the blast that matters, but the set of the entire process or directly interconnected processes.

This almost infinite variability of possibilities is what will make the design of each blast plan unique, and even using the same methodology we can follow completely different paths, and that's why we always say that we don't have a magic guide, but that each case should be evaluated separately and assess what is the best way forward.



Another point that we need to keep in mind is that although the initial blast plan aims to meet the specific needs of the blast that will be carried out, in cases where the operation continues, it is important to have in mind the future needs and, above all, the key objectives. that we will use as a reference to evaluate your results.

In the diagram below we see an example of the process of implementing a blast plan, and we can see that we have 4 main phases, where the first two are fundamental for the design of the initial blast plan, and the last two are part of the testing process and refinement to turn an initial blast plan into a default plan.



So even if our initial design focuses on the blast to be carried out, in operations that will have continuity it is important to take the next steps into account. For example, to carry out our blast we can adapt to an available diameter, but for the continuity of the operation, there may be a diameter that brings the best cost-benefit ratio, and knowing that, we can evaluate this possibility already in the initial stages, so as not to need change equipment in the blast plan optimization process.

As we mentioned, these days are very busy, so I will just leave a series of general comments here and at another time we will return to these points throughout our articles.

GENERAL OBSERVATIONS

- We always have to keep in mind that no methodology used for designing an initial blast plan is 100% accurate or precise, and that they only provide us with an initial reference estimate, which can also be judged according to the experience of each professional and the scenario in which the blast will be performed.
- Carrying out the first blast always has a higher potential risk, as we have no previous location references to guide us.
- Regardless of the methodology used, it is important to always establish a safety margin according to the scenario, it is always better to stick to safety, even if it is necessary to

carry out more than one blast, due to the level of criticality and dangerousness of the activity.

- It is important to understand that a high standard of quality and precision is required for the implementation of any initial blast plan, as any additional error can increase the risk potential in such a way that we cannot have the slightest prediction or confidence in the results.
- We cannot forget that in specific plans we must focus much more on the scenario, on the security measures and on the blast that will be carried out, while in continuous operations, in addition, it is often necessary to design broader plans that cover long-term objectives and that can be extensively tested and improved.
- Continuous operations usually prepare, in addition to the initial plan, versions of operational and safety procedures, risk maps, check-lists, etc., which makes the process start much more robustly, while for punctual detonations usually only the blast plan, but we believe it is of fundamental importance that service providers or professionals that carry out specific blasting in various operations, that have procedures and base risk analysis, that serve as a guide for any scenario, so it is possible to maintain the operational quality of the execution even not being a continuous operation.
- It is important that we keep records of all the specific detonations that we carry out, so that they can serve as a reference for new detonations, mainly to analyze the effect of present anomalies and the result in view of the adjustments made.
- In higher risk scenarios, it is always important to have more precise measurements, using equipment to determine the actual measurements, such as performing a profilometry of the free face or equipment to measure the deviation of the holes, so that we can carry out a blast plan much more reliable starter.
- As a safety measure, we should avoid approaching, especially in critical areas or in regions where the rock does not have such clear characteristics.
- We must always evaluate the area and the rock block to be detonated personally, evaluating in detail the scenario, the information provided and if there are any specific situations that could influence our design.
- It is also important that we monitor the execution of the plan, evaluating drilling and loading, and in the presence of any anomaly, we assess the need to revise the initial design.
- Sharing points of doubt, such as rock characteristics with geologists or polygon geometry with planning, can be useful to better assess the scenario and adjustment possibilities.

Finally, regardless of the method used to prepare the blast plan, there are a series of criteria and principles that we need to take into account:

• Firstly, we need to know the legislation, limits and safety rules well, so always keep in mind that an adequate risk assessment should never be neglected before designing and carrying out any blast.

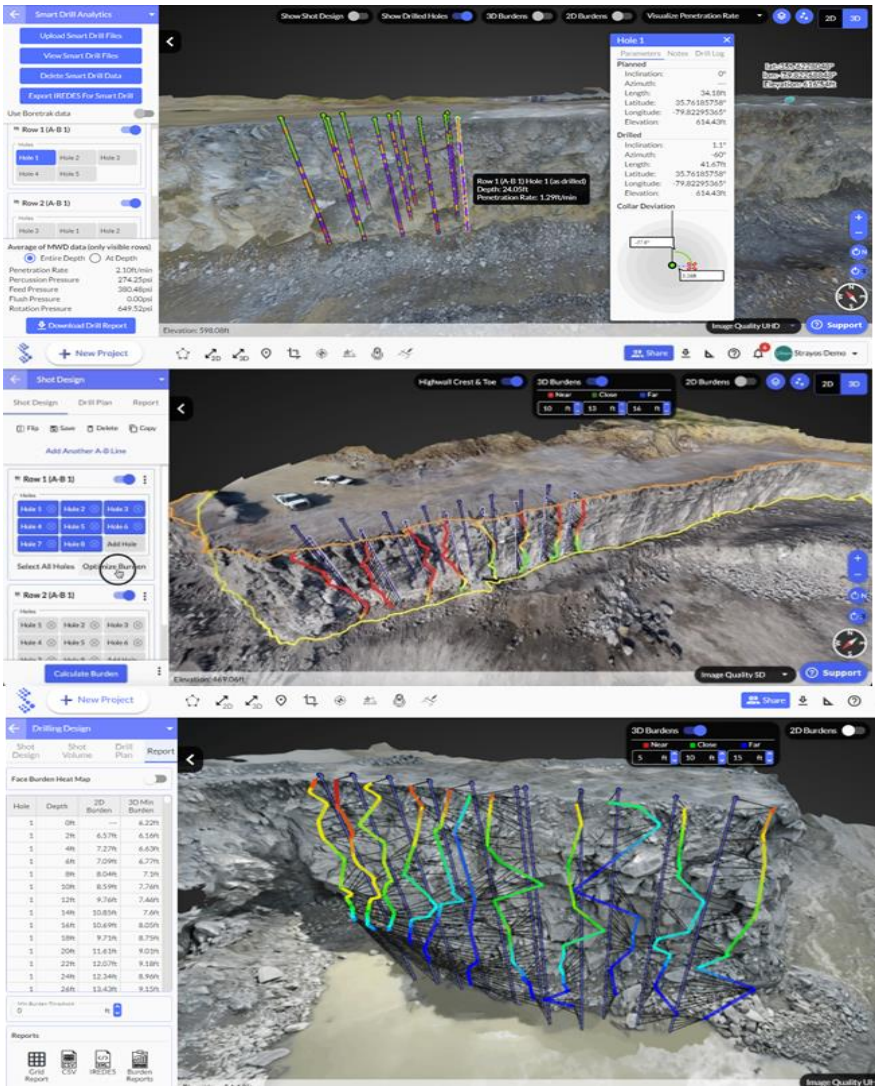
• It is important to know well the explosives we are using, their characteristics and particularities, as well as their behavior during the blast.

• It is essential that we know the blast process, the behavior of the rock and the fragmentation process, its phases and effects, as they are a basic knowledge for the elaboration of any blast plan.

• We need to consider the effect of drilling quality and accuracy on the performance of any given blast.

• We need to understand the loading and blasting process, and the effects of operational quality on the blasting process and results.

• Finally, we need to know and analyze the possible impacts (vibrations, ultra launches, etc) that can be generated by a blast and its effects on the scenario in which the blast will be carried out.



Something we always comment on in our trainings is that most people can easily follow a methodology and create an initial blast plan, as it is just using formulas, making adjustments or using a computer program, but to be able to carry out a plan that gives us a A “predictable and controlled” result requires much more than doing calculations or handling a computer program, as the considerations necessary to effectively evaluate any scenario is the key point for carrying out a successful blast.

That's it guys, let's stop here, the idea was just to make some general comments to finish our last article. As we said, the elaboration of a blast plan is still an art, which depends a lot on

uncontrollable factors and leaves a lot of responsibility on the person who is carrying out its elaboration. It is possible to count on the evaluation and support of other people, who can help us to evaluate points that we do not perceive.

As we always ask, please comment and share, so that we have increasingly safe and quality detonations!!!

Blasting Trainings wants to help you shape the world with safety and quality.

Rock Blast Courses:

Português -> https://lnkd.in/d5eivncS
English -> https://lnkd.in/dsrq7PGm

www.blastingtreinamentos.com

blastingtreinamentos@gmail.com