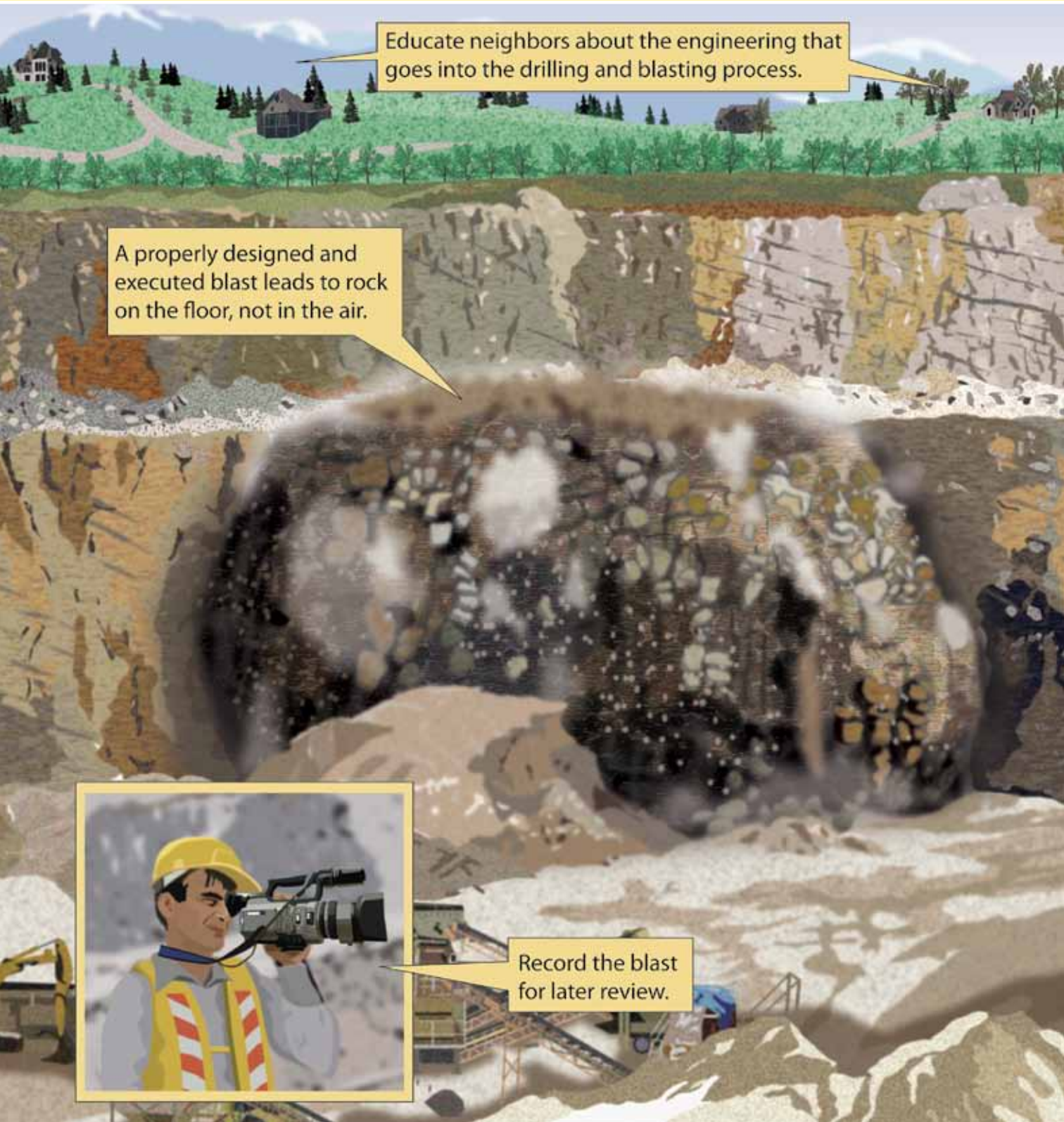
AGGREGATES MANAGER
PULL-OUT GUIDE
by Therese Dunphy, Editor-in-Chief

OPERATIONS ILLUSTRATED

Better Drilling and Blasting



AGGREGATES MANAGER

Communication is Key to Quality

For operations using contract drillers and blasters, effective communication is essential to ensuring a well-run drilling and blasting program. "There tend to be disconnects sometimes because of the fact that one shows up once or twice a week to do the blasting, while the other is here full time," says David Stewart, plant manager of Lafarge's Cumming Quarry, located in Cumming, Ga. "Communication is key between those groups, especially when you're trying to fine-tune your program."

Regular meetings between all three groups improve the quality and safety of the blast. "Meet on a frequency that correlates to the demands of the situation," recommends John Lee Turner, a Watkins, Colo.-based technical manager for Orica USA Inc. "You talk about what happened with recent blasts and future goals regarding development of the face."

An important tool in driller-blaster-operator communications is the drill log. While running the drill, the drilling contractor should note broken rock, voids, mud seams, and geological slips, as well as any other anomalies he encounters. An accurate, legible drilling record provides the blaster with important information for his job.

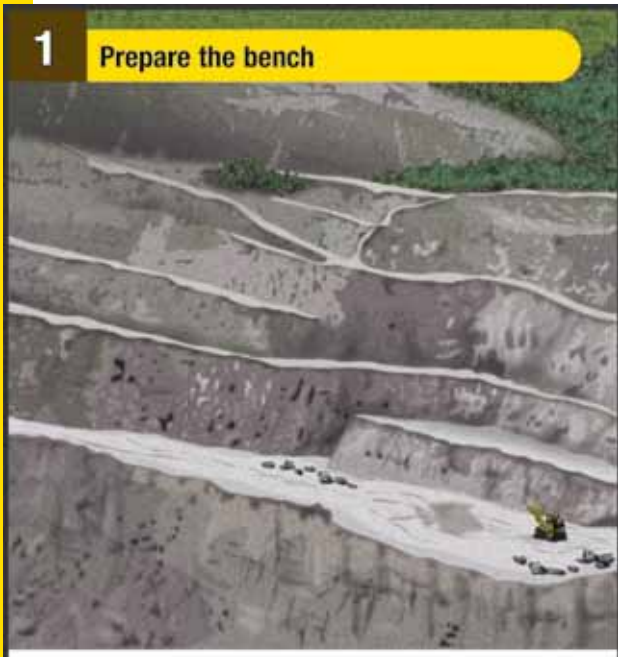
Geologic issues encountered during drilling impact loading of the hole. For example, how deep the subdrill was on an upper bench affects where stemming starts and stops for the blast of lower benches. An experienced driller also will notice a change in drill steel penetration rates. If the drill moves along at a steady rate and suddenly drops, it usually indicates that the drill hit a void. By noting seams, voids, and cracks, the driller can help the blaster better calculate the proper load for each hole, which, in turn, helps prevent the potential for fly rock or misfires.

Changes in the layout of the hole pattern or angles in the hole should also be clearly communicated from driller to blaster. In some cases, the location of a drill hole has to be moved for safety reasons or geology. Other times, a portion of the face may fall between the time the design was originally conceived and when drilling begins. Either of these circumstances can radically alter the blast and should be communicated to the blaster — if possible, before drilling commences.

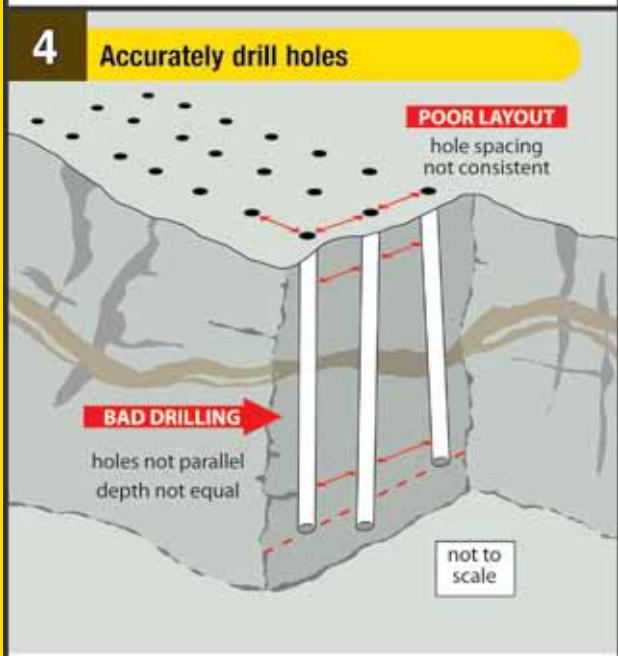
In terms of hole straightness, a slight angle in the drilling can increase or decrease the load between holes. In some cases, this can be remediated through how the explosives are loaded, while other times, the hole must be abandoned.

Before the blaster loads the holes, he should read the drill log and check each hole to ensure it is drilled to the proper depth. If the hole has been under-drilled, the driller should return to the site and increase its depth. More commonly, however, the hole may be slightly over-drilled to allow for material that may fall in and should be backfilled to the proper depth.

Once material is blasted, Turner recommends that the blaster talk with operations personnel to gauge how the material is loading and crushing. That feedback is shared during group meetings and the process can begin again.



Before setting up a shot, make sure the surface is smooth. Boulders should be removed and - if necessary - materials should be transported to the site to even out the surface. Establish good drainage and, if possible, divert storm water run-off away from the shot.



Drill holes need to be as straight as possible. This can be verified by shining a light into the hole or through the use of bore tracking, which measures straightness and degree of variation. If holes are not straight, the distance between each can vary from the plan.

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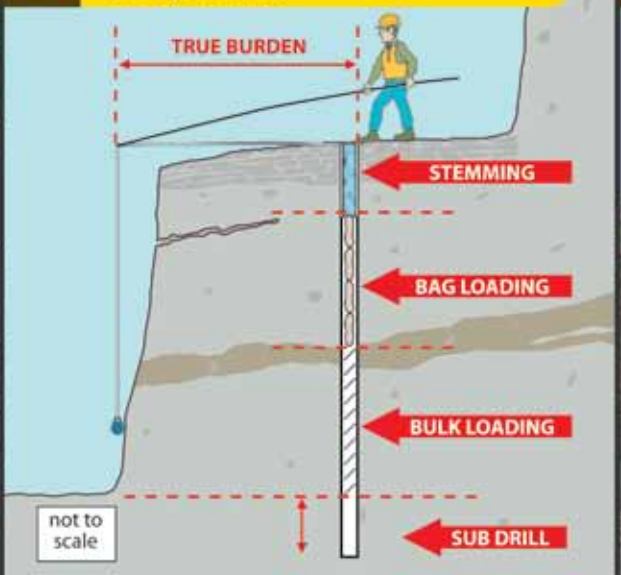
2 Survey the face

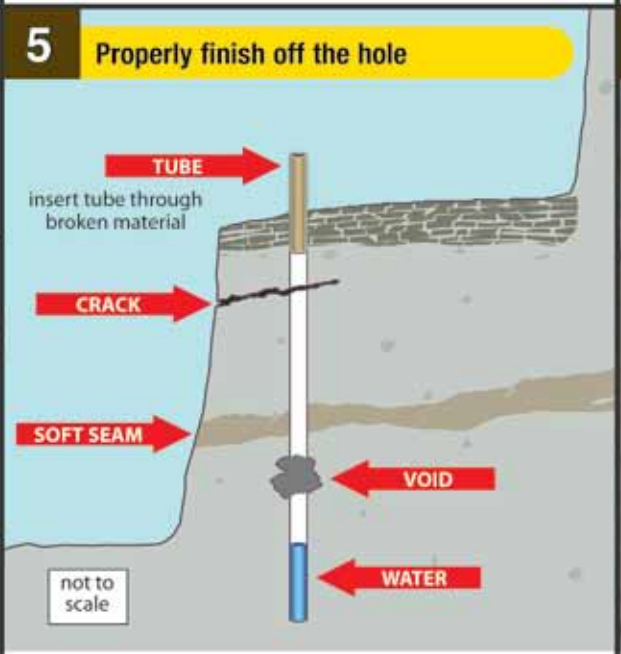


Perform a physical exam of the face before designing the shot. Note any cracks or seams. To calculate the actual burden, use a burden pole and measure the distance to the edge of the face.

3 Lay out and prepare to drill

Make sure measurements on burden and spacing are accurate. The drill should be set up and properly leveled before drilling begins. If site conditions change between marking and drilling, be sure to inform the blaster because deviations may affect the blast design.

5 Properly finish off the hole



Once the explosives have been loaded into the hole, use quality materials rather than site waste materials to stem the hole. Inexpensive cardboard blast tubes can be used at the top of the hole to prevent loose material from falling back into it or blocking it.

6 Film the blast

A video recording of the shot allows it to be analyzed later. By using a high-definition camera and viewing software that can be downloaded from the Internet, the shot can be recreated frame by frame. This can highlight cracks and seams that were not previously noted.

OUR EXPERTS

David Stewart is the plant manager of Lafarge's Cummings, Ga.-based Cummings Quarry. He has been at the operation for a year. Previously, he spent 10 years working for Hanson. Stewart has a bachelor's of science degree in mining from the University of Missouri at Rolla.

John Lee Turner is a Watkins, Colo.-based technical manager for Orica USA Inc. He has worked in the explosives arena since 1981, is a certified MSHA trainer, is a member of the International Society of Explosives Engineers, and actively participates with the Institute of Makers of Explosives. Turner has a bachelor's of science degree from the University of Tennessee.

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Voices of Experience

David Stewart

Working to mitigate blasting concerns from residential neighbors is common practice, running an operation in an affluent area can amplify those issues. "The neighbors are extremely sensitive to vibration and over pressure," says David Stewart, plant manager of Lafarge's Cumming, Ga.-based Cumming Quarry.

In response, he runs a blast optimization team. The team discusses ways to improve the drilling and blasting process. It typically meets once a quarter, but can meet more frequently. "I'm always working together with my blasters and drillers to minimize sound pressure and vibration," he says. "I try to keep the neighbors as happy as possible."

Through experience and regular communication, Stewart has learned that simple tweaks to the process can pay large dividends. For example, he uses quality stemming materials. While some operations will use scrap materials to stem the holes, Stewart always asks his blaster what stemming material they prefer. "My theory is that if I'm spending all this money on explosives, I want the best thing down there."

Similarly, Stewart says that a small investment per hole — for cardboard blast tubes inserted in the top of each hole — can provide an inexpensive insurance policy. The tubes, which look like thicker wrapping paper rolls, are wax coated and provide protection against loose material falling into the hole and blocking it during loading. "I do that to protect my investment. I have so many dollars in that hole," he says. "I put a $4 cardboard tube in the top of it to protect my investment. It won't guarantee it, but it will help protect it."

His favorite tip, however, is to buy a video camera and film the shot to review it afterward. "It's like instant replay for football. I thought he was in, but I guess he was not," he jokes. "The better quality camera you use, the better information you can get. I consider high-definition cameras cheap. You can get one for $599."

By using free software that can be found on the Internet, Stewart says he can view a shot as if it were in slow motion. "It will help you identify where a seam or crack was that wasn't seen on the survey. We note it for the next shot," he adds. "It offers so much information it's not even funny."

When reviewing the video during the blast optimization team meeting, Stewart says that he's had the driller remark that a frame of the shot explains something he felt when drilling. All parties come away from the process with a better understanding of the site's unique characteristics.

"It's a work in progress because the geology changes," Stewart notes. "Once you think you've got it, something is going to change."

John Lee Turner

Teamwork and good communications create a safe and effective blast, says John Lee Turner, a Watkins, Colo.-based technical manager for Orica USA Inc. "Safety is first," he emphasizes, "always."

Through communication, the drill-blast-operations team can identify not only geologic concerns that may create unsafe conditions, but also discuss opportunities that can improve production. "Over the ages, earth movement causes seams (or slips)," Turner says. "The seams shift and may be angled. If you hit an angled seam in the wrong direction, you can have a lot of rock slipping off into the pit. It may create a dangerous situation such as overhang or excessive toe that is difficult to drill."

To avoid these conditions, Turner says the team must work with the site's geology. While core drilling provides much insight into the deposit, seams don't always show up in those samples. "If you change the development of the pit, you can minimize problems," he says. "You're still going to have challenges, but they're going to be recognized challenges that can be managed."

At one site, Turner says he worked with a deposit that was like a jig saw puzzle based on seam movements. Mud seams also impacted development. "You work to slowly turn the face and try to improve the direction that you're shooting the blast so that it works with the rock," he says.

To create the best feed for loaders and crushers, the blaster may also be able to vary the type of explosive used. "It depends on the market," Turner notes. While some markets tend to use ANFO or ANFO blends, other options included sensitized blends or gassed emulsions. "If you've maxed out the type of products you're using, then drilling must be more accurate than in an area where you use blends where heavier loads can assist in taking care of excess burden," he adds.

Blaster training is critical to ensuring the best selection and use of materials. For example, if ANFO is used in a wet hole, the right percentage of blend must be achieved or it will not be water resistant. With gassed emulsions, the proper density must be achieved or the blast could be either ineffective or inefficient.

One exciting development in recent years, Turner says, is the availability of electronic detonators. "It has really changed the way that fragmentation can occur," he says. "They are basically a computer chip in a detonator. If you want to detonate a hole at 500 milliseconds and don't use an electronic detonator, it may detonate at 490 milliseconds or 510 milliseconds. If you use an electronic detonator, it detonates precisely when you tell it to detonate."

Turner says the technology has not only been helpful in remediating challenging geologic conditions, but also has helped operations reduce neighbor complaints.