STEMTEK -NEWS-

DECEMBER 2008

Welcome to this edition of Stemtek News.

Those with long memories (or a good filing system) may recall we haven't produced one for some time. Whilst our message hasn't changed, times certainly have. The price of bulk ammonium nitrate has rocketed in the last few months from around £235/tonne last January to nearer £400/tonne. There also appears to be somewhat of a world shortage. The other new kid on the block since we last went to press is generally saving the planet by reducing your carbon footprint. We are all being urged to recycle, switch off, sign up to a green tariff, catch the bus more and knit your own muesli. Face heights and face stability have also hit the headlines with the HSE making a big issue of it.

For those who already employ air/water deck techniques or dewater/sleeve holes, you can congratulate yourself that on all counts you are doing your bit. For those who have either not come across our ideas or think that it's not worth the effort, maybe it's time to have a good long look at what you are doing.

If you aren't familiar with them then we will give you a quick crash course to bring you up to speed so you can save time, money, the planet and keep the HSE happy. We will show you how to work out the amount of carbon dioxide you produce when blasting, and how to reduce it. We will also look at the implications of lowering face heights and the most cost-effective way of creating stable final faces.

Since the last edition our roving reporter has not been idle, judging by his expenses. He describes what it's like to slip on his head torch and go underground in Spain.

We want you to be safe when reading this, so we have been advised by our legal team to issue the following warning.

'Paper cuts can kill. Keep the edges of the paper away from arteries and other exposed veins. Display your blood group in a prominent place, e.g. on your forehead. Have a nice day.'

So if you are prepared to take that risk, turn over carefully and start saving the planet.

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AIR/WATER DECK APPLICATIONS AND THEORY

First the theory stuff. When explosives are detonated in a borehole they produce a single high amplitude stress wave which crushes the borehole and moves further into the surrounding rock producing a crack mechanism. During or after the stress wave propagation, high temperature/pressure gases assist and extend the crack formation and produce the expansion and movement of the rock mass. The borehole pressure produced by a commercial explosive is far in excess of that required to fracture the rock.

By incorporating an air column (air-deck) above or within the explosive column, secondary or multiple stress waves are produced which extend the duration of their action, thus increasing the extent of crack propagation.

The reduced borehole pressure caused by the air-deck is still capable of creating an extended fracture system and there is sufficient high-pressure gas produced to obtain the desired amount of ground movement. The lower peak borehole pressure reduces the loss of explosive energy associated with excessive crushing of the rock adjacent to the borehole.

Now the practical stuff. We can create air-decks by using gasbags. These are high strength balloons capable of locking off a borehole and bearing heavy loads for a long period of time. And here's the clever bit. You don't have to blow them up yourself. They are activated on the surface by pressing a button on the aerosol and placed at the desired depth using a tape or string. A built-in delay allows you plenty of time to get it into position.

So, what size can this air-deck be? This will depend very much on the prevailing conditions but it is easy to determine an appropriate starting point from which you can 'fine tune' your application. In simple terms it is the amount of explosives that can be removed from a borehole and substituted with air (or water). We have produced an applications guide which illustrates many practical examples.

Water has often been regarded as a problem in boreholes, particularly if you want to use bulk ANFO. However many operators use any water to their advantage by simply dropping a gasbag on top of it. For more serious water problems an alternative is to dewater the hole using a displacement pump and then line the hole with an anti-static plastic liner. We can cut these liners to the length required and put them on a spool which makes deploying them very easy and quick.

For a more detailed explanation check out our website (www.stemtek.co.uk) where you will find it in Issue 5.

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The other main applications for air-deck techniques are in the production of armour stone and pre-splitting to create smooth stable final walls. With the HSE making faces a high (no pun intended) priority, particularly final ones, then creating them is going to be critical for many quarries.

'Traditional' methods of pre-splitting involves the use of detonating cord, either multi-strand or so-called high-energy cord with core loading of 100-120gm/metre. This method is time consuming, potentially noisy and expensive.

A much simpler, quicker and cheaper method is to use air-deck techniques. About 10% of the hole is filled with explosive and then a gasbag is placed at about 2m from the top (depending on its competence). Experience has shown that the spacing between holes can also be increased compared to det cord methods.

Check out Issue 8 on the website where you will find details of a trial we carried out at Chipping Sodbury. Issue 10 describes the parameters for producing armour stone.

CALCULATING THE QUANTITY OF CARBON DIOXIDE IN A BLAST USING ANFO

Explosives work by producing large quantities of gases. If we take ANFO, (assuming it has been mixed correctly), it will produce water in the form of steam, nitrogen and carbon dioxide. To work out the quantity of carbon dioxide produced you need to write down the chemical equation for the reaction between the diesel and ammonium nitrate. You then add up the molecular weights to arrive at the answer.

To save you the trouble of going back through your old chemistry notes, or asking the kids to do the calculations, we can tell you that for every tonne of ANFO you use, it produces 176 kg of carbon dioxide.

Let's take as an example a quarry producing one million tonnes per year. They blast using ANFO with a ratio of 7 tonnes/kg. That would require 143 tonnes of ANFO. This would produce around 25 tonnes of carbon dioxide.

However if your blast ratio is at the lower end, say 4 tonnes/kg, you would be using 250 tonnes of ANFO. This would produce some 44 tonnes of carbon dioxide, a 76% increase in emissions. So the blast ratio can have a significant impact on your carbon footprint as well as your fragmentation.

Air-deck techniques can reduce the quantity of ANFO used. So as well as saving money, you can reduce your carbon footprint, a real win-win situation for very little effort.

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On a general note remember that for every tonne of diesel used in the quarry, it produces 3.16 tonnes of carbon dioxide. Just think about that when you are filling up the drill rig and secondary breaker to drill all those extra holes and deal with more oversize as a result of lowering your bench heights. Which leads nicely onto the next article……..

APPARENT TREND TOWARDS REDUCING FACE HEIGHTS

It won't have escaped anyone's attention that a debate about face heights has been ongoing for some considerable time. At the time of writing we are all waiting for the publication of the QNJAC document on 'Control of Face and Stockpile Operations', which has been some four years in the making. The bumper book of regs regards any face above 15m as a significant hazard and subject to a geotechnical assessment. Thus some quarries have opted to keep their face heights below this figure. However with the view of the HSE appearing to be that the face machine must be capable of reaching the top of the face without standing on the rock pile, then even lower faces might be necessary.

Any reduction in face heights (regardless of the reason for it) has serious implications for a quarry. The creation of more benches will have an impact on reserves. There will be extra access roads required, longer haulage distances, more wear and tear on equipment, the list just goes on.

A reduction of face heights by a third (e.g. 15m to 10m) will require a 50% increase in the number of holes drilled to achieve the same levels of production. Consequently initiation costs, face profiling and shot loading times will similarly increase. There will be more non-productive drilling time. With drill rigs consuming typically 30-60 litres (or more) per hour, this increase can only worsen the carbon footprint of a site. Typically 15-25,000 metres are drilled to produce one million tonnes, so this will lead to a significant increase in fuel consumption.

A further consequence will be the increase in oversize from the blast. Since the stemming depth is a function of the burden, this will not reduce with a reduction in face height. So the proportion of the face not being subjected to explosive energy will increase, thereby creating more oversize from the stemming area. This is exacerbated by the fact these blocks do not fall as far, and so are less likely to break as they drop.

Unfortunately it doesn't end there. The above assumes the blast pattern doesn't alter. However the fact is the blast ratio deteriorates. To compensate for this the pattern will need to be 'tightened up', which in turn requires additional holes to be drilled etc, etc…….. It's the classic falling dominos scenario where one action has consequences way down the line. Just remember every time you blast there is a risk of misfires, flyrock and complaints. The fewer blasts needed to achieve production reduces exposure to these risks.

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More drilling and blasting has implications beyond the quarry. There will be more vehicle movements of explosives and rigs on the roads and more journeys for contractors. The use of bulk trucks may become uneconomic for some quarries. In trying to reduce the risk in one area it may well create more risks in others.

Gasbags can play an important part here. By stopping the explosives column at the conventional depth of stemming and then placing a gasbag at say 2m, an air-deck can be created above the explosive. This will allow energy from the blast to work on rock that would normally have been in the stemming area. With breakers costing £30 - £40/hour (and more carbon footprint), any reduction in secondary breakage has to be a welcome saving.

MISFIRE KIT

Hindsight is a wonderful thing. The police claim that most people only fit a burglar alarm after they have been robbed. On the basis of this rather wobbly concept a very good thing to have about the place would be a misfire kit. You may never need it but when you do you'll be glad you read this. Probably the worst kind of misfire to deal with is when using packaged explosives. After all the risk assessments have been done and the drawing of short straws, someone has to go in there and retrieve the stuff. That's when you need the right tools for the job. Based on our own experiences this would be the kind of kit to have around.

Firstly the essential items.

- Drain rods and assorted pigtails (so you can extract any difficult to reach pills)
- Waterproof notebook, pens pencils (it's bound to be raining)
- Plastic bags (to put the explosive in)
- Labels, marker pen (so you don't forget what it is)
- Paper bags (in case you come across any detonators)
- Spring balance (so you can weigh the plastic bags to see how much explosive you have recovered)
- Safety gloves (you will need to move rocks out of the way)
- Disposable gloves, wet wipes, hand cleaning gel, old tea towel (things can get messy)
- Marker paint (just to let everyone know where it is)
- Tape measures (30m and 5m)
- Camera (ideally waterproof, shockproof, idiot proof)
- Knife (preferably a multi-tool)
- Torch (LED type)
- Magnifying glass (to examine any shock tube)
- Assorted crowbars (there's always a bit of rock in the way)
- Blaster's mirror (you might be lucky with the weather)
- Hi-viz rucksack (you need something to carry all this and it looks cool)

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Other useful stuff.

- Binoculars (to scan the horizon for HSE Inspectors)
- Pocket guillotine (in case you need to cut any tube)
- Dictaphone (might be difficult to write sometimes)
- GPS (to help you pinpoint the misfire location if you haven't got surveying kit on-site)
- Compass (might be handy to know which direction things are)
- Inclinometer (to check angle of misfired hole as part of investigation)
- Cyclops camera (this really should be in the 'essential' list –Ed)
- Warning/barrier tape (so you can quickly cordon off any affected areas).

By the strangest of coincidences we just happen to supply most of these things, especially the hard to find items like waterproof notebooks and pens that will write upside down over greasy paper. Now that we have got you thinking, there may well be other items that either you have found useful in the past or might be in the future. If so let us know and we can add it to our list.

GOING UNDERGROUND

Over the last year Julian has been helping out our Spanish distributor in one or two projects. Below he gives us an insight into a quarry where they have decided to mine it.

'Apart from being the title of a song by that well-known beat combo The Jam, which topped the charts in March 1980, this idea has a lot going for it. In one stroke you get rid of such problems as visual impact, dust and noise emissions and overburden removal. You also keep dry, save on suntan lotion and turn your hobby of breeding canaries into a business. So why don't we do it more often? It's just too expensive for all but a material that has special properties. However that has not stopped a few people from thinking outside the box (or inside the tunnel).'

'I came across such a project last year when I was doing some air-decking and dewatering trials in three quarries belonging to Cementos Lemona, near Bilbao in Northern Spain. Their Apario quarry produces a million tonnes per year of limestone. The structure of the deposit is long, narrow and deep. If you can picture a cheese sandwich standing upright, you can see that to get at the cheese you need to remove a lot of bread. So the quarry decided to investigate the possibility of mining the limestone. The whole project involves not just the mining but also the installation of a 154m long, 4.4m diameter glory hole to extract as much stone from the surface. The mining method employed is known as vertical crater retreat mining but basically it looks like room and pillar. I was back there in July of this year and they had just started production blasting in the first of the chambers.'

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‘These chambers are big. They are about 25m wide, 5m high and 80 –90m from front to back and will be 60m from top to bottom. There is a chamber at each of the three levels, directly above each other, 30m between them. In the corner of the top chamber they had blasted a shaft down to the middle chamber. Using conventional drill and blast techniques, they were blasting a slot along the back wall. Once that slot is created they can then blast the full width of the chamber into the one below. Needless to say being Spain, there wasn’t anything in the way of edge protection. At the entrance to the mine is a statue of Santa Barbara, the patron saint of mining. She also looks after the safety of artillerymen, engineers, architects, builders, stonemasons, gravediggers and sailors. I was hoping she would have enough time in her busy schedule to look after me. Working on the edge of the shaft, loading holes just with the light of your head torch concentrates the mind wonderfully.’

‘They were concerned about the accuracy of their drilling. They need to drill 30m deep holes vertically to ensure the sides of the chamber are vertical. They are using a standard DTH air rig converted to run on electrical power. They have fitted an electronic angle indicator to the mast. They have also added a modification of their own. Attached to the mast is a small hydraulic ram with a point on the end. When the driller sets up the mast he drives the point into the roof to keep the mast as rigid as possible. The quarry wanted some means of checking the angle quickly. After talking to our good friends at Pulsar Measuring Systems, Mike Ewer suggested that rather than use a probe, he had a hand held laser distance measurer that also had a very accurate inclinometer. You simply put a torch down the hole (facing upwards of course), aim the device at the light source and press the button. You get an immediate read-out accurate to within 0.2 of a degree. The device is known as a Trupulse and you can get a Bluetooth version so the data can be easily transferred to a laptop.’

‘The good news was that the drilling was spot on. They had originally planned to blast the chambers in two drops of 30m but now the likelihood is that they will drill the full depth of 60m, thus avoiding loading out at the intermediate level. That’s good news for them but bad news for us. At the moment they are drilling into the middle chamber so the bottom of the holes are open. They block them off with a gasbag. Drilling full depth down to the lower chamber means they won’t need so many gasbags.’

‘The master plan is to extract some 9 million tonnes by this method with over twenty such chambers spread along the deposit, thus creating the biggest toast rack in the world.’

‘I did a talk on the project to the IOQ West of England Branch in September. I carry it around on a memory stick so next time you bump into me, ask to see it. It is a truly fascinating undertaking and well worth having a look at.’

‘P.S. They bought the Trupulse.’ (Well done. Our profit on the deal just about paid for your meals - Ed).

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FINALLY

At the time of writing it seems the financial world is collapsing around our ears. Its effect on our industry is already making itself known with lay-offs, redundancies, mothballing and even closure of units.

Pressure to cut costs will now be even greater. We firmly believe that drilling and blasting is one area that can deliver cost savings without compromising performance. Remember everything we have described in this newsletter is based on what we have done in the field. Plenty of other people are using our ideas so why don't you give it a try?

On a happier note if you are looking for last minute Christmas gifts for the explosives supervisors and shotfirers in your life why not surprise them with some goodies from our misfire kit list. Start off with a high-viz rucksack and pop in it some essential items like a waterproof notebook and pens. Or how about a pocket guillotine to make sure of a clean cut in your starter line? If you are looking for a present everyone can play with, the ideal choice would be our Cyclops camera. It can be used to inspect places you wouldn't want to put your head in, as well as checking boreholes for blockages. Have a look at one on our website.

We would like to thank you all for your support during the

year and to wish you and your families a very Happy

Christmas and a prosperous, peaceful New Year.

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