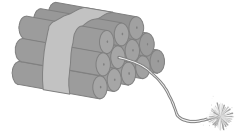


The Primer



Newsletter of the Golden West Chapter, International Society of Explosives Engineers
23633 Brewster Drive, Columbia, CA 95310

Volume 22

Spring 2011

Issue 1

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The Primer is published
four times per year
on the web site of the
Golden West Chapter
of the ISEE:

www.iseegoldenwest.org

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President's Message...

On behalf of the board and officers, we want to welcome you to another year as a member of the GWC of the ISEE. If you haven't heard by now, my name is Mike Chiurato and I was elected to be your president for the year. But I got a tell ya , it's the officers and the board working together as a team that makes this chapter work. You have Carey Haughy as secretary and Gerald Fulghum as treasurer as well as Mike Burneson as a board member that bring the experience and dedication to help make this club work. To round out the board we have past president Sandy Figures and Nick Cunningham. A huge help this past year and ongoing has been Wes Bender and his dedication to not only offer his advice and vast experience but to offer his skills in writing this newsletter and maintaining this web site. Past officers Bill Warfield and Gordon Coleman have also made themselves available to us.

If you couldn't make the annual meeting in January you missed a good one. Shawn Meyer put on a very interesting presentation on the Klamath Marsh National Wildlife Wetlands restoration project with the use of explosives. We also had a great dinner and a lot of socializing. Going forward the board and officers will offer more opportunities to get together as a chapter besides our annual meeting. We are scheduling an MSHA refresher course, and hopefully a Salmon fishing trip if the salmon cooperate this year. We are also working on one more activity to be announced later.

To close I want to add one more vital point to this message. We need your participation. Without your active participation the works of the board and officers is just a waste of time. So take the time to contact us in regard to the dates of upcoming events and get involved. It's your chapter!

Be Safe!

Mike Chiurato

The Primer

Editor's Notes...

If you've been planning to sign up for Alpha's Blaster Refresher seminar in Roseville, March 14th through 16th, you'd better do it soon. It's only a week or two away. It has been the best attended and most appreciated seminar in our Chapter's area and actually dates back to the early '70s. (Trust me, the info they put out is a lot newer than that...).

Call (916) 645-3377 for details and to reserve a seat.

We had hoped to include a comprehensive Chapter activity schedule for 2011 in this issue of *The Primer*, but a huge snow storm left our President and the Board on opposite sides of the Sierra at meeting time, and just when they thought they had finally gotten everyone's schedules to mesh. Best laid plans of mice and men (and Chapter volunteers too), etc, etc. They're working on rescheduling so we should have something definitive fairly soon.

This is the fourth and last issue of *The Primer* for our advertising year. A new year for ads starts with the next issue. Almost all of our previous advertisers have signed up again for 2011, but there are a few that haven't. I'll be checking with them before dropping their ads. I've said it before, but we really do appreciate the support that our long-standing advertisers have given us through the years. Please give them the pleasure of your business and, the next time you have a chance to talk with them, thank them for supporting us. They're what make this newsletter and our website possible.

The article that starts on page 7 contains some rather old technology so, after you read the article, I'm asking you to do a little blast designing of your own and then share it with us. Details are on page 13. Give us your best shot.

I belong to an organization of former B-47 Stratojet crews and maintenance people. (It was known to the rest of the world as the Stratojet, but none of us affiliated with it ever called it that.) It was the Air Force's first swept-wing jet bomber, designed during WWII, but not placed in the USAF inventory until after the war. It never fired a shot in anger (well, almost never), but played an important role in the cold war, with several being shot down over Russia in the '50s. Lots of interesting tales to be told about the B-47 and the exploits of those who flew and maintained it. I had the distinct pleasure of being a crew chief and flying with them for about three years. Why am I telling you this? Because, as I've mentioned before, my blasting and explosive inkwell has basically dried up. If you don't start contributing some articles or ideas for articles that we can publish in *The Primer*, you're going to get a dose of 1950's jet bomber life. I know that some of you out there have some really interesting blasting stories to tell. I just can't seem to get you off your duff to write about them. So drag out those blast reports, sit down and make some notes and send them to me. It's either that, or we're going flying.

Cheers,
Wes Bender

The Golden West Chapter Library has Moved...

The Al Colflesh Memorial Library, the official library of the Golden West Chapter, has been relocated to Syar Industries' Lake Herman Quarry at 885 Lake Herman Road in Vallejo. Hours of availability are from 7:00 a.m. to 3:30 p.m., Monday through Friday, holidays excepted. The phone number is (707) 558-1510. Lake Herman Mike says, if needed, he can make copies for \$.05 per page.

Bear in mind that this isn't a 'lending' library. It is there for your use as a reference. There is a wealth of information contained in the library. Don't hesitate to make use of it.

The Chapter would like to thank the Mining and Tunneling Unit of CalOSHA, the previous custodians of the library, for providing a home for it for several years.

* * * * *

Chapter Annual Dinner Meeting...

The Golden West Chapter held its annual dinner meeting on Saturday, January 15th at Marie Callender's Restaurant in Stockton. The meeting was called to order at 7:00 p.m. by the President, Sandy Figuers. The minutes of the previous meeting were approved as read by the Secretary, Carey Haughey. The financial statement was adopted as presented by the Treasurer, Jerry Fulghum.


Election of officers for 2011 was held. Mike Chiurato of Alpha Explosives was elected President. Carey Haughey was re-elected as Secretary for the next two years. Nick Cunningham of Alpha Explosives was elected to the Board of Directors. (Jerry Fulghum's term as Treasurer and Mike Burneson's term as a Director continue through 2011.)

It was decided that the Chapter will pursue the possibility of renewing the annual salmon fishing trip. It was also suggested that an MSHA refresher training course would be beneficial.

The evening's program was a very interesting presentation by Shawn Meyer on blasting to enhance wildlife wetlands at the Klamath Wildlife Refuge in Oregon.

Following the program and a raffle of door prizes, the meeting was adjourned.

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Blasting to Open Ramelli Pit...

by Wes Bender

This article is about a blast that was used to open Ramelli Pit. The site is located west of Doyle in the Plumas National Forest and is situated on a basalt knoll on the west side of the valley extending northwesterly from Frenchman Lake. The owner, the US Forest Service, did not want the pit to be visible from the road that ran through the valley. This meant designing a blast that would break out approximately 29,000 yd³ of in-place rock, yet hold short of breaking through the east side of the knoll. My client requested my assistance, but wanted to use equipment he had on hand and also wished to use explosives and detonators that his people knew. He would drill 3" diameter holes on a 6' x 6' square pattern and use electric initiation. After asking how much buffer zone I needed to preserve the east skyline of the knoll, he laid out the general site plan. The blast zone was roughly 140' wide (up to 24 holes) and 225' long (37 rows), with the protective buffer zone on the east end and a pad for his crushing/screening plant on the west end. Holes were mostly 36' deep, tapering to 12' at the west end. It took a fair amount of time to drill the 820 holes and I visited the site several times during drilling to look for signs of mud seams and to make sure that they weren't drilling through the bottom of the basalt flow. I had them drill an occasional hole one steel deeper to check for bottom. They would then backfill that hole to the requisite depth.

The 6 x 6 pattern resulted in a powder factor of almost 1.6 lbs per yd³ which I thought was a bit excessive for basalt. I would have leaned toward a 6 x 8, 7 x 7 or maybe even a 7 x 8 pattern, but the client indicated that he'd rather spend a little more on blasting than on crushing and I couldn't argue with that, although diced and columnar basalt (some call it "hero rock" for what it does for your reputation) breaks out rather well.

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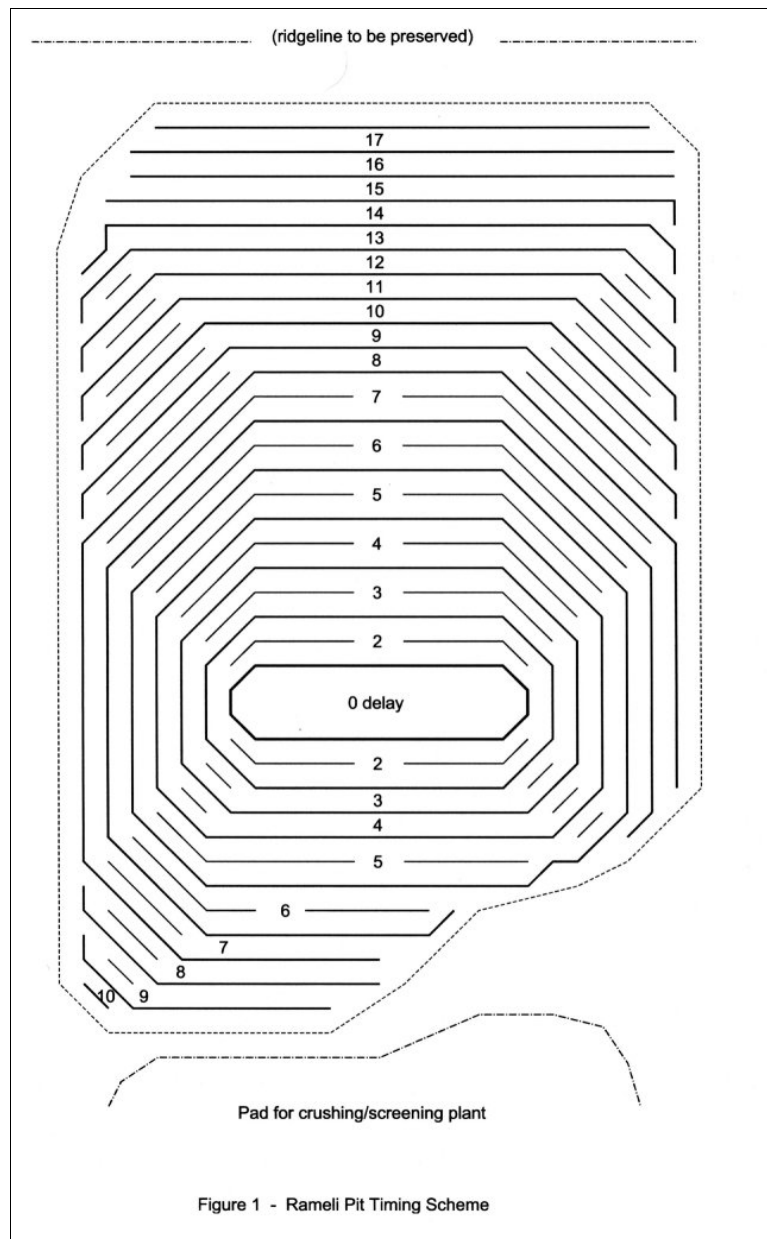
Ramelli Pit (cont.)...

The client didn't want me to heave much rock onto his pad for the crushing plant, and because of the need to leave the east skyline of the knoll intact, I had to design a sinking cut blast. I started with an opening cut of 44 holes detonated on Zero delay that would move rock upward and form some relief into which the balance of the holes could break. I skipped the 1st delay to provide a bit more time for that. The surrounding 2nd and 3rd delay holes were top and bottom primed in the event their powder columns were cut off by the opening holes detonating. Since I preferred bottom initiation throughout, the top detonators in the 2nd delay rows were number 3s and the top detonators in the 3rd delay rows were number 4s. Hopefully, these top detonators would be set off by the column detonating from below rather than initiating the top themselves. Delays through 17 were then used to initiate the remaining holes. A diagram of the timing sequence is depicted in Figure 1. Some delays occupied two rows. Others only one. Note that, with two minor exceptions, there are no square corners in the rows of delays. This is consistent with good blast design in that it allows the rock to break out more easily from the corners.

Today, one would use a non-electric or other sophisticated initiation system for such a shot, but the client's desire to use standard electric caps meant that I would have to make sure that all 933 of them (actual count) fired reliably. No power lines were available as a source of power. I did have a VME-450 capacitive discharge (CD) blasting machine. Depending upon whose specs you read, it was rated at either 1000 or 1200 caps for a series-in-parallel circuit. These ratings were based on caps of 2.0 to 2.5 ohms resistance each. The 24' and 40' Hercules Millidets that we were going to use were 2.95 ohms each. Obviously, careful circuit design was needed.

A considerable amount of rock would be thrown straight up in the air. For safety, the blaster firing the shot would be behind a huge pine tree about 750 feet from the shot.

(continued on the next page)



Ramelli Pit (cont.)....

To reduce resistance in the blasting circuit, rather than use a couple of standard 14/2 firing lines, I opted to use two 750 ft lengths of 10 gauge solid copper wire as a firing line. To assure that all series saw the same current, I used a reverse series-in-parallel circuit that utilized 12 gauge bare aluminum buss wires, strung on top of powder carton lids, one on each side of the shot. This wiring scheme is depicted below in Figure 2.

If a 440 volt power line had been available to fire this blast, one could use Ohm's Law to calculate the current flow through each circuit and divide the series accordingly to obtain the optimum current. When using a CD blasting machine however, the voltage (and current) decays exponentially as the capacitors discharge so that, at some point, the available current falls below that which will reliably shoot a series of detonators. To determine available energy, it was conventional at the time to use the average energy that a CD blasting machine could supply within the first .005 seconds.

In this article I won't go into the actual calculations for determining what the CD machine's available energy was because it requires rather complex math using the machine's voltage, capacitor size and internal resistance, if any, and the total blasting circuit resistance. We now use blasting systems that eliminate the modern blaster's need to do such mental gymnastics. If you really want to know how it was calculated, contact me and I'll send you the numbers and the methods involved. In actuality, most blasters who used electric initiation shot somewhat smaller blasts and just stayed well within the capabilities of their respective CD machines, keeping the number of series smaller than the number of caps in a series, mostly balancing each series, and letting it rip. Most CD blasting machines were powerful enough and had enough built-in safety factor to keep blasters out of trouble. But then again, there have been a few exceptions.... If you approach the limits, you better know what you are doing.

After calculating current levels for various configurations, I decided to divide the shot into 24 series; 21 series of 39 caps and 3 series of 38. In a reverse series-in-parallel circuit, this resulted in a total detonator circuit resistance of 4.77 ohms. The total blast circuit resistance was:

The above detonator circuit -	4.77 ohms
plus 2 x 750' #10 copper firing lines @ 1.0 ohm/1000' -	1.50 ohms
plus 2 x 225' #12 aluminum buss wire @ 2.61 ohms/1000' -	1.17 ohms *
Total blasting circuit resistance -	<u>7.44 ohms</u>

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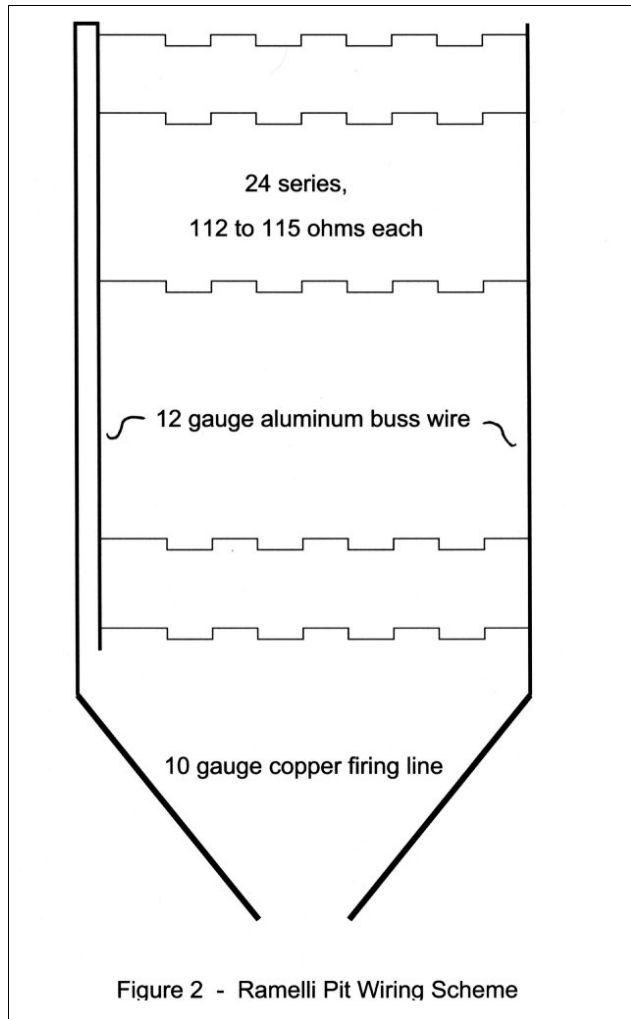


Figure 2 - Ramelli Pit Wiring Scheme

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Ramelli Pit (cont.)....

* Note - In a reverse series-in-parallel circuit, only 1/2 of the buss wire is used in the resistance calculations because the voltage path through any individual series only passes through half the buss wire. To this, I added one extra 225' length of buss wire to go from the firing line to the far end on one side, all of which counted. This resulted in the total of 450' used in the calculations.

A good VME-450 CD blasting machine with fresh batteries will produce an average of 46 amps through a 7.44 ohm blasting circuit (for the first .005 second). The 46 amps divided across the 24 series pretty much equally, resulting in a current flow through each series of 1.91 amps. I considered this sufficient current to reliably detonate the entire shot.

It's interesting to note that, had we used 14 gauge duplex firing line instead of 10 gauge, the total blasting circuit resistance would have increased to approximately 9.7 ohms, reducing the current flow into the blasting circuit to about 37 amps. This would have only provided about 1.5 amps per series, which would have been marginal and may not have been enough to reliably detonate all the holes.

We knew it would take more than one day to load the shot. Early on the morning of the first day, Alpha Explosives delivered the detonators, 18 cases of Hercules Gelaprime F and 30,500 lbs of AN/FO. The client brought in 32 cases of Unigel 2 x 16 and 7500 lbs of AN/FO from his stock. I had several loading teams, each with a licensed blaster. I went ahead of them laying out the detonators according to my plan. When we ran out of powder in the afternoon, I picked up the unused detonators and marked those holes with spray-painted numbers so that I'd know exactly where to start again in the morning. (Good idea, right? That night it snowed 2" and covered all my numbers....) We left the shot for the night under the watchful eyes of one of the client's employees. The next morning, Alpha delivered another 10,000 lbs of AN/FO. With the help of the sun melting the snow, I eventually figured out where I was cap-wise and we continued the loading process. After we finished loading, the client sent the remaining detonators and powder back to his magazines.

I then started marking the various series so that a couple of the more experienced blasters could begin hooking them up. Hercules Millidets had one green and one yellow leg wire. In wiring, I had the blasters carry the yellow wire forward to the next hole because it was easier to see on the ground. For the double primed holes, I had them connect both in and out to the yellow wires and connect the two caps' green wires together at the hole to assure that both caps were wired into the series. As they completed each series, the blasters carefully measured its resistance with a blaster's multimeter and then connected it to the shunted buss lines. We couldn't afford to have any series vary much in resistance or it would take more or less than its allotted amperage and could possibly result in one or more mis-fired series. Those series with double-primed holes required inserting a small amount of connecting wire to reach from the end of the series to one of the buss wires, but that extra wire was offset by the shortened leg wires in the series. As I had anticipated, the last series came up a few holes short, so we added 3 caps to increase its resistance and balance the circuit. After un-shunting the buss lines and connecting them to the firing lines, we verified the total blast circuit resistance with a blaster's multimeter and proceeded to clear the area.

A blaster's multimeter was used in place of a blaster's galvanometer because you can't read the scale on an analog galvanometer accurately enough. With a large series-in-parallel blasting circuit, it was extremely important that we balance each series carefully so that the firing current would be divided accurately across each series.

(continued on the next page)

Ramelli Pit (cont.)...

After the area had been cleared and checked and guards posted on the access road, we proceeded to a safe viewing site about 2000 feet away. The proper signals were given, the blaster took up his position behind the large pine and detonated the shot. The rock behaved as predicted. Rock from the opening holes shot just about straight up, which started making room for successive rows that pulled away from the side and back walls. (It took a little while for the rock from the opening holes to come down though.) The overall swell in the middle of the shot was approximately 70 feet above original ground. Before and after photos are contained in Figures 3 through 7. We were quite happy with the results.

Figure 3 - View looking east prior to initiating the blast. The gray area and part of the brown is the blast zone. The pad is on this side of the blast zone behind the near trees and the valley is just beyond the blast zone.



Figure 4 - Same view as Figure 3. The opening holes have detonated, along with probably the next two or three delays. (Unfortunately, clouds blocked the sun on some of these photos.)

(continued on the next page)

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Ramelli Pit (cont.)....

Figure 5 - The dust is clearing and the amount of swell and mounding is visible. Compare this with the pre-blast photo (Figure 3).



Figure 6 - The east wall where the ridge line has been preserved. The road in the valley beyond is just visible. The fragmentation is typical for the entire shot and is what one can expect from a decent blast in columnar or diced basalt.

Figure 7 - Looking down on the crushing / screening plant pad from the top of the muck pile. The smoke is from the residue of empty cartons and sacks that had been burned.

(And, yes, we did manage to throw a little rock onto the pad.....)



How Come??? *it's time once again for a bit o' the Irish....*

Brenda O'Malley is home making dinner, as usual, when Tim Finnegan arrives at her door.

"Brenda, may I come in?" he asks. "I've somethin' to tell ya."

"Of course you can come in, you're always welcome, Tim. But where's my husband?"

"That's what I'm here to be tellin' ya, Brenda. There was an accident down at the Guinness brewery..."

"Oh, God no!" cries Brenda. "Please don't tell me..."

"I must, Brenda. Your husband Shamus is dead and gone. I'm sorry."

Finally, she looked up at Tim. "How did it happen, Tim?"

"It was terrible, Brenda. He fell into a vat of Guinness Stout and drowned."

"Oh my dear Jesus! But you must tell me true, Tim. Did he at least go quickly?"

"Well, no Brenda... no. Fact is, he got out three times to pee."

Your Turn....

OK, let's try something a little different. By now you've probably read the article in this issue concerning the blast to open Ramelli Pit and recognize that the electric initiation that was used is considered a bit outdated in modern times for large blasts. Most of you who design blasts are either using some non-electric (or other somewhat sophisticated) system. What I would like you to do is re-design this blast using the system of your choice. If you wish to move or reposition the opening holes, or even design other than a sinking cut blast, feel free to do so, or you can just use the original timing sequence. It's your choice. The only restrictions you have are those that also applied to me. Namely, preserve the ridgeline on the east end and don't heave most of the muck pile onto the pad on the west end, although a little rock tossed there is acceptable. You're also stuck with my client's 6' x 6' pattern and 3" diameter holes. Assume that you are dealing with the same area 140' wide and 225' long, with some rounding of the corners as indicated in Figure 1 on page 8. No restriction on airblast or vibration. Put your designs down on paper and send them to me. They should be complete enough that a reasonably competent blaster could use them to lay out the blast. My contact information is on the cover page. We'll publish the better responses in future issues. If you wish to remain anonymous, that can be arranged. In case it helps, below is a profile (looking north) showing the depth of the shot. Good luck with it.

Wes Bender

