U.S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration

1200 New Jersey Ave, SE
Washington, D.C. 20590

DEC 22 2010

Ms. Rebecca Spaulding
Environmental Resource Center
101 Center Pointe Dr.
Cary, NC 27513

Ref. No. 10-0222

Dear Ms. Spaulding:

This responds to your October 7, 2010 email regarding the transportation of a calcium oxide-based powder under the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180). According to your letter, the New York City Fire Department (NYCFD) has specifically requested that the manufacturer of a calcium oxide-based powder that you represent supply documentation from PHMSA indicating the product does not require approval for use. You indicate that the material is primarily calcium oxide (up to 95%) mixed with other ingredients. When mixed with water, the product expands and generates heat. You also provide an MSDS and a technical data sheet for further information about the product.

Under § 173.22, it is the shipper's responsibility to properly classify a hazardous material. This office does not normally perform this function nor do we provide documentation indicating a product does not require our approval for transport or its intended use. Unless the HMR directs a person to obtain approval for the transport of a material (e.g., an explosive approval in accordance with § 173.56), a material meeting the definition of a hazardous material in § 171.8 and properly classed and described in accordance with the HMR may be transported in authorized packaging and by authorized modes. Based on the information provided in your letter, the calcium oxide-based powder would not meet the definition of an explosive under § 173.50 of the HMR. Thus, for purposes of applicability of the HMR requirements to explosive material, the material does not need PHMSA approval for transportation.

I hope this information is helpful. If you have further questions, please contact this office.

Sincerely,

Ben Supko

Ben Supko
Acting Chief, Standards Development Branch
Standards and Rulemaking Division

Der Kinderen
§ 172.101

Drakeford, Carolyn (PHMSA)

Classification
10-0223

From: Vos, Brian (PHMSA)
Sent: Friday, October 22, 2010 12:30 PM
To: Drakeford, Carolyn (PHMSA)
Subject: FW: Question from Rebecca Spaulding
Attachments: Bristar Tech Manual (2).pdf; Da-mite MSDS ANSI Form REV 09 24 2010.pdf

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From: Rebecca Spaulding [mailto:rspaulding@ercweb.com]
Sent: Thursday, October 07, 2010 4:08 PM
To: Vos, Brian (PHMSA)
Subject: FW: testing information

Hi Brian,

Thank you for your time yesterday on the phone, and more importantly, helping me tackle this issue of how to respond to the FDNY's concerns about this non-explosive material which is used as an alternative to blasting where and when vibrations cannot be tolerated.

Attached is the MSDS and a technical data sheet (same product marketed under a different name – "Bristar"). In summary, it is basically calcium oxide (up to 95%) with a kiln dried outer coating (represented by the remaining ingredients in the MSDS) to prevent contact with air and oxygen so that it can be stored for longer periods of time without losing its effectiveness. This outer coating also functions to reduce the permeability of the water penetration to the Calcium Oxide allowing you to mix it, pour it, pump it, etc. with a slowed down reaction time (similar to a time release capsule effect).

Here is the direct request by the FDNY:
1) Provide evidence showing that the product has been approved by the DOT for the intended use. (Or provide documentation from DOT indicating that such product does not require special approval from DOT for intended use.)

Based on our conversation, you mentioned that a person within the Special Permits dept. may be able to advise whether any explosivity (or other) testing would be required for other hazards and if testing is conducted and it does NOT meet the Div. 1.1-1.6 definitions, then a document would be issued to indicate that the approval is not necessary.

If it helps you out, here is some additional information:

1) Calcium oxide is already defined in the DOT Hazardous Materials Table 49 CFR 172.101 as class 8, PG III for air transport only.
2) It has been designated under the NFPA 704 reactivity definition (scale 0-4) as having a rating of 1. The explanation of 1 is the following:
   - Materials which in themselves are normally stable, but which can become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently.
3) Other than calcium oxide, the remaining ingredients listed in the MSDS are essentially by-products during the kiln drying process that have been explained by the chemist (author of the MSDS) as follows. The raw material (limestone) is passed through the kiln at a temperature of over 1100 C. The final "hard burnt" coating consists of a fused mass of a number of complex chemical entities. These are predominantly anhydrous calcium oxides, and calcium salts. The water and carbon dioxide is eliminated in the kiln drying process. These resulting oxides are presented on the MSDS in the final composition in order of magnitude.
   Silicon Dioxide exists in the material as the oxide, as is the Ferric Oxide. Whereas alumina combines

with Calcium ions to form Calcium Aluminate, and Sulfur Trioxide as Calcium Sulfide. On addition of water Calcium Sulfide hydrolyzes, some of it dissolving in the water. Hence at anytime, there is never any free Sulfur Trioxide present.

Please contact me with any question you might have on this issue. I thank you again for your assistance in this very complicating matter.

Kind regards,

Rebecca Spaulding
Environmental Resource Center
101 Center Pointe Dr.
Cary, NC 27513
919-469-1585 x 400
919-342-0807 fax
rspaulding@ercweb.com

1. WHAT BRISTAR IS

"BRISTAR" is a soundless and safe demolition agent which is quite different from ordinary demolition agents such as explosives and dangerous materials. It does not cause any flyrock, noise, ground vibration, gas, dust or any other environmental pollution when used properly.

As requirements for demolishing rock and reinforced concrete in construction increase in tight quarters, the use of explosives and explosive agents are becoming more restricted as far as safety and environmental pollution problems are concerned. "BRISTAR" is a solution.

When "BRISTAR" mixed with an appropriate quantity of water is poured into cylindrical holes drilled in rock or concrete to be demolished, it hardens and expands and then generates cracks as planned previously. After that, the material with cracks can be easily removed with pick breaker, pneumatic breaker, excavator etc.

Family of "BRISTAR"

These are currently on the market 3 grades of BRISTAR designed for various temperature ranges (shown in Fig. 1) of material to be cracked. Since a chemical reaction of BRISTAR depends on temperature, use the proper type of BRISTAR listed in Table 1.

Table 1. BRISTAR designed for various range of temperature

Item / Kinds	Material Temperature	
	Range	Maximum
BRISTAR 100	Hot	35°C (95°F)
BRISTAR 150	Mild	20°C (68°F)
BRISTAR 200	Cool	15°C (59°F)
BRISTAR 300	Cold	5°C (41°F)

*B-100, B-150, B-200 and B-300 used in this brochure indicate BRISTAR 100, 150, 200, and 300, respectively.

**Consult our agent in the case of a high temperature (over 35°C).

2. ADVANTAGES

I. "BRISTAR" is a safe substance.
BRISTAR is not controlled by any legal regulation such as explosives and explosive agents etc. No qualified persons for handling are required and the demolition can be easily and safely performed anywhere.

II. "BRISTAR" is a soundless cracking agent.
Unlike the existing method of demolition done by explosives or breaking equipment, BRISTAR does not make any noise, vibration, flyrock, dust and gas so that rocks and reinforced concrete may be demolished safely without environmental pollution. Furthermore, as the expansive stress due to BRISTAR is kept even after the crack initiation, the crack opening distance becomes wider as time passes.

III. "BRISTAR" handles easily.
No lid (or cap) is necessary at all after BRISTAR is poured into a hole of rock or reinforced concrete. Nor is tamping required as with explosives, BRISTAR exerts its strength in a short time, and because of its strong adhesion and frictional resistance to inner surface of the hole, there does not occur any spurt due to heat-generation (blown-out shot) when used within the parameters as noted in the conditions. The expansive stress along the hole depth is almost constant except for that near the entrance of hole. Generally the expansive stress loss from the hole entrance has little effect on the demolition work when hole depth is long.

IV. "BRISTAR" has an expansive stress of more than 3000 t/m^2 (Fig. 2, 3, 4)
Generally, the compressive fracture stress of rocks is 1000 to 2000 kg/cm^2 and that of concrete 150 to 500 kg/cm^2. However, the tensile fracture stress is very small, i.e., it ranges from 40 to 70 kg/cm^2 in rocks and 15 to 30 kg/cm^2 in concrete, respectively. Since demolition by using BRISTAR is based on a fracture due to a tensile stress, all kinds of rocks and concrete can be cracked and broken by using BRISTAR when appropriate holes are properly drilled.

3. PROPERTIES

I. Chemical components of "BRISTAR"
BRISTAR is a powder consisting of an inorganic compound made mainly of a special kind of silicate and an organic compound. BRISTAR does not contain any harmful components.

II. Some effects on the expansive stress of "BRISTAR".
1) The expansive stress increases more than 6,000 t/m^2 (Fig. 1, 3, 4)
2) The larger the hole diameter is, the greater the expansive stress becomes. (Fig. 2)
3) There is little change in the expansive stress when the water ratio is in the neighborhood of approximately 30%. However, the stress is decreased as the water ratio is increased or decreased.

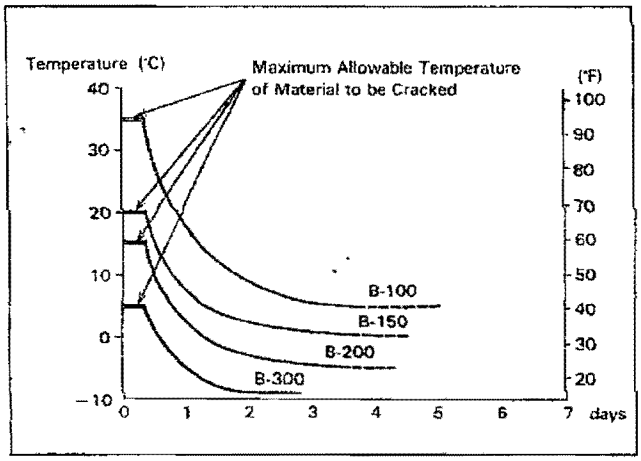


Fig. 1 Time required that expansive stress reaches 3000 t/m² and Temperature

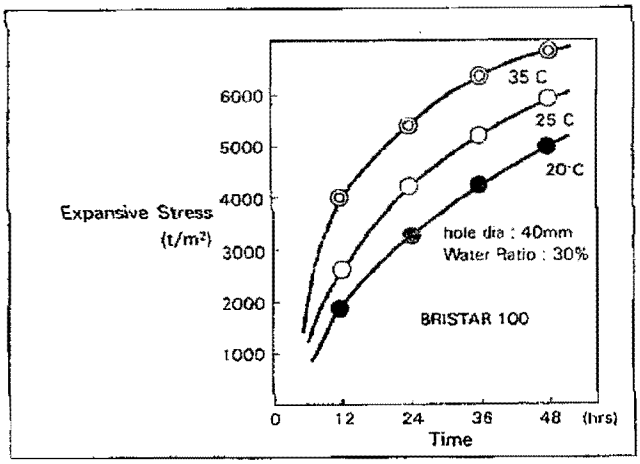


Fig. 3 Changes in the expansive stress of B-100

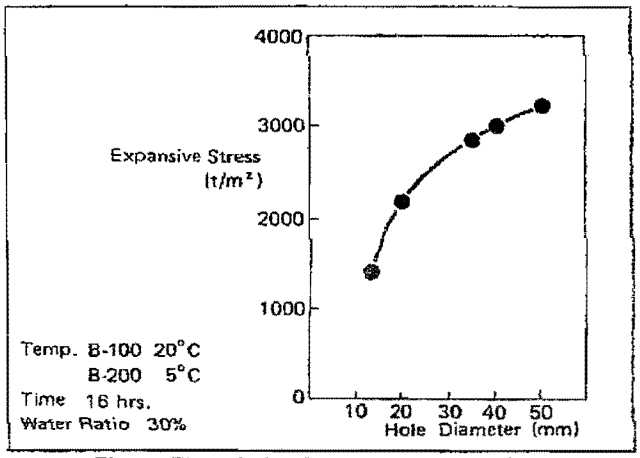


Fig. 2 The relation between the expansive stress and hole diameter.

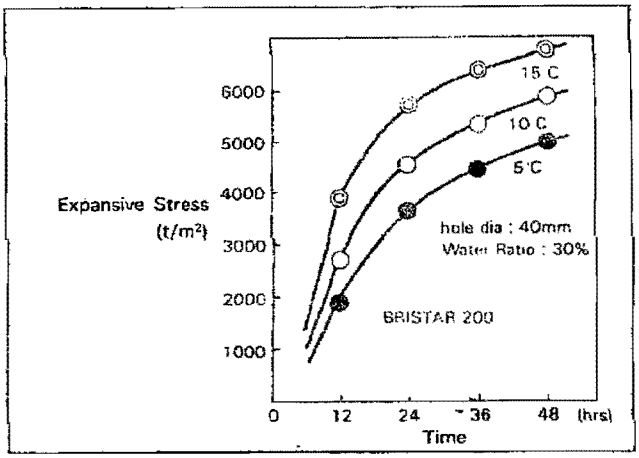


Fig. 4 Changes in the expansive stress of B-200

There are many superior points in the demolition works performed by "BRISTAR" as compared the other demolition methods. It is also seen to be more economical. The outline is indicated in Table II.

Table II. Comparison of BRISTAR with others

Item / Kinds	Breaking Power	Situations at the work site				Safety	*Simplification of Protection	Economy *
		Noise	Ground Vibration	Dust Gas	Flyrock			
Explosives (Dynamite)	◎	×	×	×	×	×	×	◎
Explosives (Concrete Cracker)	○	△	△	×	△	△	×	○
Rock breaker	△	△	○	○	◎	○	◎	△
Hydraulic Splitter	○	◎	◎	◎	◎	◎	◎	×
"BRISTAR"	○	◎	◎	◎	◎	◎	◎	○

REMARKS:
◎ Superior (or Pollution-free)
○ Good
△ A little inferior
× Inferior (or with pollution)

*Results differ subject to the circumstances

5. FRACTURE MECHANISM

After "BRISTAR" is poured into the holes drilled in rocks and a concrete, the expansive stress gradually increases with time and it gets to more than 3000 t/m^2 at room temperature after 16 hours. As the "BRISTAR" generates its expansive stress, the material to be cracked undergoes a process of (1) crack initiation, (2) crack propagation, (3) the increase of crack width. Therefore, this fracture mechanism is distinguished from a breakage by blasting.

The mechanism by the expansive stress of "BRISTAR" is shown in Fig. 5. Cracks initiate from an inner surface of the hole, being caused by tensile stress at a right angle with the compressive stress which occurs by the expansive stress of "BRISTAR". Then, as the expansive stress of "BRISTAR" is kept up even after the appearance of cracks, the cracks propagate and also new cracks initiate during the process. Usually, for a single hole, 2~4 cracks initiate and propagate. When a free surface exists, the crack, as shown in Fig. 6, is pushed apart mainly by the shear stress, and a secondary crack also arises from the bottom of the hole running toward the free surface.

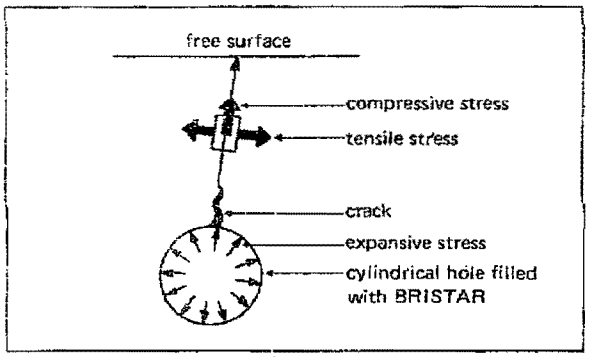


Fig. 5 Fracture mechanism by the expansive stress of BRISTAR

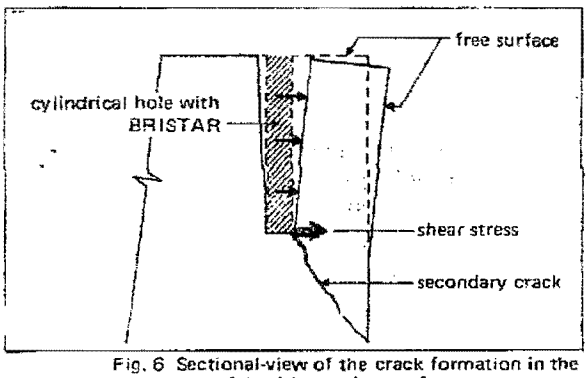


Fig. 6 Sectional-view of the crack formation in the material with two free surfaces

When multiple numbers of holes are filled with "BRISTAR", that are properly adjacent to each other, the cracks from the hole propagate to connect with the neighboring holes, as shown in Fig. 7.

It is therefore possible to determine the directions of the cracks as planned by appropriately arranging the hole spacing and its depth and its inclination.

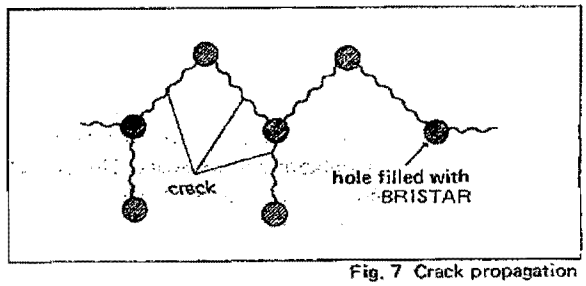


Fig. 7 Crack propagation

Establishment of free surface

In the case of trenching, shafting or tunneling, if all holes are drilled vertically and filled with BRISTAR, the crack width can not increase but horizontal cracks initiate. Therefore, in order to obtain two free surfaces, inclinated holes or presplitting must be required. (Refer to APPENDIX)

6. TEST BREAK AND DRILLING

Since work using "BRISTAR" depends on the placement of the holes, the drilling must be done in relation to the job to be performed.

6.1 Test design and breaking

The design for breaking should be done according to the properties of rocks, joint, volume to be removed, secondary breaking, and work period etc. Table III should be taken into account for the design.

Prior to the execution of test break, reference should be made to APPENDIX to assist in break design.

To determine which combination of hole size and spacing is most desirable, drill several holes of different diameter at different burden and spacing, check each of the break conditions and then decide hole diameter, depth, burden and spacing.

Table III Type of Breaking by BRISTAR

Type	Secondary breaking
Fragmentation	Hammer, Power shovel
Crack formation	Hand breaker, Power shovel, Hydraulic breaker
Presplitting	Combination of mechanical breaker or dynamite

6.2 Drilling

I. Drilling machine : Use electrical drill, rock drill or crawler drill.

II. Drilling direction : It is preferable to drill holes vertically, but in cases of a wall or pillar of reinforced concrete where vertical drilling is hard, an inclined hole may be drilled. Since a greater effect is achieved with a deeper hole, in case of a thin material, consideration should be given so as to get a long hole depth by drilling it obliquely if necessary. Horizontal holes can be applied the same idea of spacing as with vertical holes.

III. Hole diameter and hole spacing: The breaking plan of Table IV can serve as a guidance in making a decision. In general, the preferable hole diameter is from 40 to 50 mm (1½" to 2").

Table IV. Material and proper hole spacing

(Hole Diameter : 40mm)

material to be cracked \ hole spacing		cm	20	40	60	80	100
		feet		1	2	3	
hard virgin rocks				⟷			
soft virgin rocks					⟷		
presplitting of the above rocks				⟷			
Reinforced concrete	foundation, pillar, beam			⟷			
	wall, slab			⟷			

IV. Hole depth: This varies with the shape of the material to be cracked or the break plan. Refer to APPENDIX as a guide line.

It should be noted that "BRISTAR" mixed with water can easily be applied by hand, when the hole depth is up to approximately 10 meters. When the depth is less than 3 times the diameter of the hole, less cracking will occur, the breaking effect is lessened and the time required for demolition is increased.

6.3 Use of thin steel pipe

In the case of a temporary concrete structure (to be demolished), place thin steel pipes (the thickness : < 0.8 mm ($\frac{1}{32}$") i.e. a sheath pipe for P.S. concrete) as holes before placing concrete instead of drilling. Whenever the structure need to be cracked, fill **BRISTAR** in the pipes. There is no change in breaking effect by the use of pipe.

7. MIXING AND FILLING

7.1 Mixing of "BRISTAR"

I. Mixing Equipment:

Mix one bag (5 kg, 11 lb) of BRISTAR with water at a time by hand or preferably with a mechanical mixer. Prepare the following equipments.

(1) Container : For one bag of "BRISTAR" — a metal bucket or clean can of 10–20 liters capacity.

(2) Mixer : For instance, hand-mixer.

(3) Water meter : Breaker or measuring cylinder.

(4) Protector : Rubber gloves, safety goggles.

II. Mixing Method

Pour approximately 1.5 liter (0.4 U.S. gallon) of water into container beforehand and add one bag of **BRISTAR** gradually and mix well until it has a good fluidity.

When a viscosity of the mixture of BRISTAR and water is too high to pour into the hole, add a little water to get a good fluidity. Do not exceed 34% of water ratio (1.7 liter; 0.45 U.S. gallon per 5 kg; 11 lb of **BRISTAR**). The mixing time by hand-mixer is about 2~3 minutes (it is recommended that mechanical mixer be used on large volume jobs). When mixing by hands, wear rubber gloves.

III. Mixing Water

Use clean water of below 30°C for "B-100", 15°C for "B-150" and 10°C for "B-200" (city water or clean river water). Especially, cool water below 15°C (59°F) must be used when an average atmospheric temperature is more than 30°C (86°F) for "B-100." The cooler the water, the longer **BRISTAR** will remain fluid.

IV. Standard Quantity

The quantity of **BRISTAR** to be used for cracking differs with the hole spaces and diameters. In Table V, the relation between the quantity of **BRISTAR** used and the

hole diameters is indicated for the hole of 1 m depth, where **BRISTAR** was mixed at a water ratio of 30%.

Table V. Quantity of **BRISTAR** used per hole depth and the hole diameters.

Hole Diameter	(mm)	36	38	40	42	44	46	48	50
BRISTAR	(kg/m)	1.7	1.9	2.1	2.3	2.5	2.8	3.0	3.2
Hole Diameter	(inch)	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2		
BRISTAR	(Lb/yd)	3.1	3.7	4.4	5.1	5.8	6.7		

The average quantity of "BRISTAR" used per 1 m^3 is 5 kg for the material to be broken when working at in virgin rock (8.4 lb/yd^3).
For fragmentation and reinforced concrete, an amount of 2 to 4 times of that is required.
Design the hole diameter and the spacing by also referring to Table IV or APPENDIX.

7.2 Filling of the hole with "BRISTAR"

I. "BRISTAR" should be poured into holes within 10 minutes after mixing with water. "BRISTAR" may set up within 10 minutes loosing its fluid properties and becoming difficult to pour. Once its fluidity is gone, it should not be diluted by re-mixing with water, as the strength is greatly reduced.

II. "BRISTAR" is best placed using a bucket with pour spout, coking gun or grouting pump, especially for a horizontal hole. Try to drill horizontal holes with some slope to help in filling.

III. "BRISTAR" must be poured into a hole to the brim.

IV. For a horizontal hole, the hole can be easily plugged with "BRISTAR" as it reaches a clay like consistancy as it starts setting up. A slight slope makes their use much easier.

7.3 Use of polyethylene sack in hole

I. If there is water in the hole, place a polyethylene thin sack equal to the hole diameter into the hole, insert a wooden rod into the bag and then fill **BRISTAR** into the sack. (See Fig. 8) The **BRISTAR** in the sack will displace the water in the hole. There is no change in the breaking effect by the use of this kind of sack.

II. When there are many joints or large voids in the material to be cracked or when "BRISTAR" somewhat leaks from the hole, use the sack.

III. When much water of the slurry is absorbed to the material to be cracked (for instance, a dry concrete), use the sack or spray water into the hole. In cold temperature, avoid the water sprayed freezing in the hole.

IV. When the material to be cracked is in water, use the sack indicated in Fig. 8 . Try to use the bucket or the pump when filling into the pipe, remove it up, and then tie the sack to avoid **BRISTAR** filled diluting. If there is no flow of water around an entrance of the hole, **BRISTAR** may directly be poured into the hole using the pump so on. It should gently displace the water in the hole.

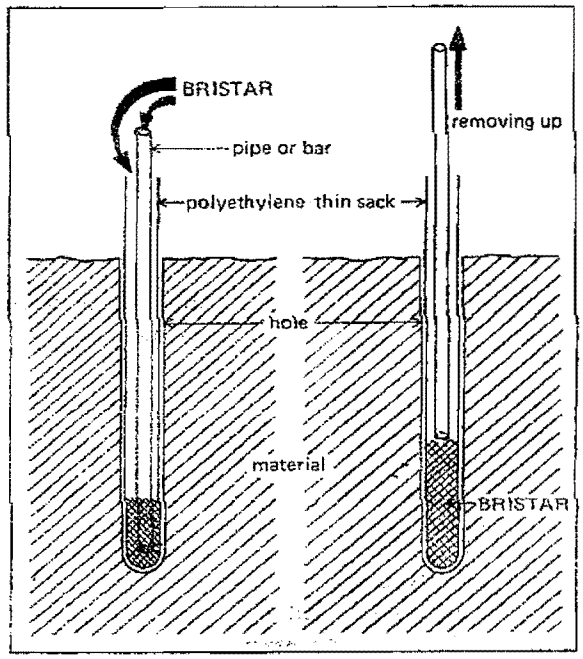


Fig. 8 Use of polyethylene sack in hole

7.4 After treatment

I. Tamping with mortar or sand is not required at all after the filling of "BRISTAR". It is also not necessary to put on any restrictive cap. Just leave as it is and wait until crack initiates.
Covering the filled hole with a plastic cover is desireable to avoid dilution of "BRISTAR" from external water source until cracking starts.

II. Spraying the surface with water after the cracks initiate tends to increase the width of cracks and speed the cracking process.

8. TIME REQUIRED FOR CRACK FORMATION

The time required for crack formation in material at 20°C (68°F) is about 10~20 hours. The lower the temperature the longer crack formation takes. The crack width for rock continues to increase with time and can become 10~30 mm ($\frac{3}{8}$"~$1\frac{1}{8}$") after several days, depending on free surfaces available. It is best to wait until the "BRISTAR" has worked to full depth before removing rock as premature removal at the first sign of a crack can hamper the leverage effect of "BRISTAR".

9. CONTAINER AND STORAGE

"BRISTAR" is packed in 4 anti-moisture plastic bags of 5 kg (11 lb) each and the placed in a water proofed carton with a total weight of approximately 20 kg (44 lb).

I. Although "BRISTAR" is packed in anti-moisture paper bags, long storage may cause deterioration of its working ingredients. Therefore, store in a dry place and use it as soon as possible.

II. When storing, do not place the bags of "BRISTAR" directly on floor, put them on a pallet and keep in a dry warehouse etc. "BRISTAR" so stored can be effectively use for about 1 year.

III. "BRISTAR" should be unpacked before use.

IV. When storing the portion of "BRISTAR" remaining after use, please push the air out of the bag, then seal it up with gum tape and use it as soon as possible. However, as it may get exposed to moisture there is risk of BRISTAR losing its effectiveness once the bag has been opened.

V. If you receive broken bags of "BRISTAR", they may not work due to chance of moisture absorption.

10. CAUTION

I. **Do not use "BRISTAR" for other purposes** besides the cracking of rocks or concrete as instructed in this brochure.

II. **Rinse with water,** when any portion of the skin comes in contact with **"BRISTAR".**

III. **When mixing and filling "BRISTAR" in holes, wear rubber gloves and safety goggles.**

IV. **Do not pour and leave "BRISTAR" in bottle or can** to avoid shattering of the can or bottle.

V. **Do not look directly into any holes for at least 6 hours** after pouring "BRISTAR" into a hole. It may splatter or blow out of the hole due to heat generation when temperature of material to be broken is over 35°C (95°F) for "B-100", 20°C (68°F) for "B-150" and 15°C (59°F) for "B-200" or when hole diameter exceeds 51 mm (2"). If these conditions occur, **cover the holes with a cloth sheet.**

VI. **Do not use hot water.** Use clean water of below 30°C (86°F) for "B-100", 15°C for "B-150" and 10°C (50°F) for "B-200". Use cool water below 15°C (59°F) when an average atmospheric temperature is more than 30°C (86°F) for "B-100".

APPENDIX

...e Design of Rock"

- d: Hole Diameter
- L: Hole Space
- D: Hole Depth
- θ: Angle
- : Hole Direction

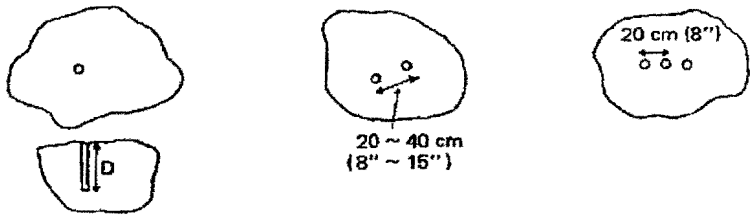
1 General Concept for Boulder (1 ~ 1.5m³ ; 1.5 ~ 2yd³)

d	38~44mm
	1½" ~ 1¾"
D	70% of Height

(1) Soft Rock (Tensile Strength: < 60 kg/cm² ; 850psi)

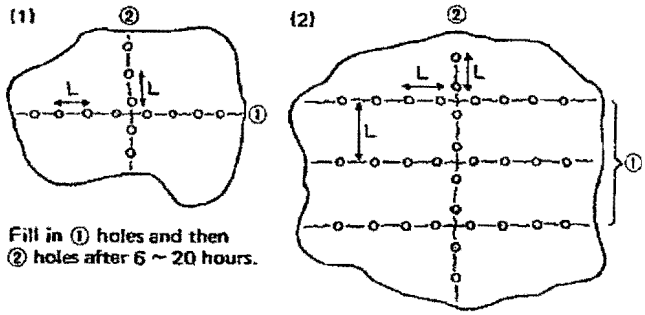
(2) Middle Hard Rock (Tensile Strength: 60~100kg/cm² ; 850~1400psi)

(3) Hard Rock (Tensile Strength: > 100 kg/cm² ; 1400psi)



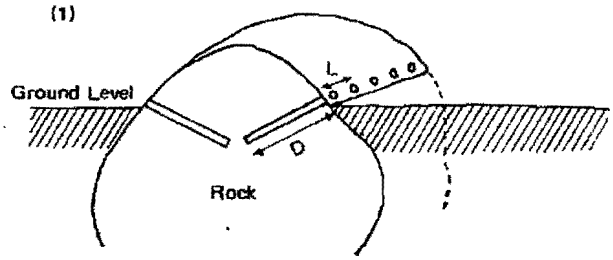
2 Splitting of Large Boulder

d	32 ~ 35 mm	44 ~ 51 mm
	1¼" ~ 1⅜"	1¾" ~ 2"
L	30 ~ 40 cm	60 ~ 90 cm
	1' ~ 1'4"	2' ~ 3'
D	70% of Height	

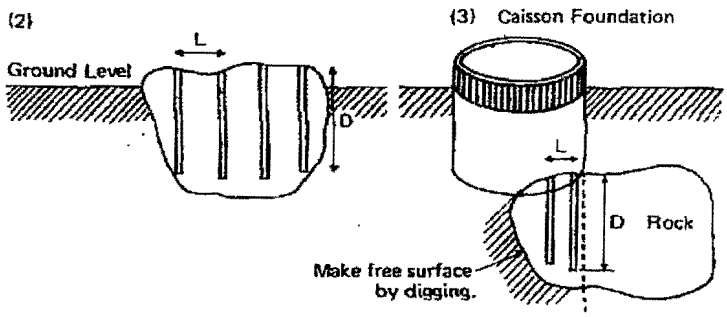


3 Underground Excavation

d	38 ~ 44 mm
	1½" ~ 1¾"
L	30 ~ 60 cm
	1' ~ 2'
D	Shown in Figure



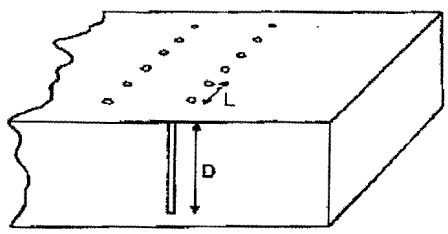
d	38 ~ 51 mm
	1½" ~ 2"
L	60 ~ 90 cm
	2' ~ 3'
D	90% of Height



4 Slabbing

d	32 ~ 35 mm	44 ~ 51 mm
	1¼" ~ 1⅜"	1¾" ~ 2"
L	20 ~ 30 cm	40 ~ 50 cm
	8" ~ 1'	1'4" ~ 1'8"
D	90% of Height	

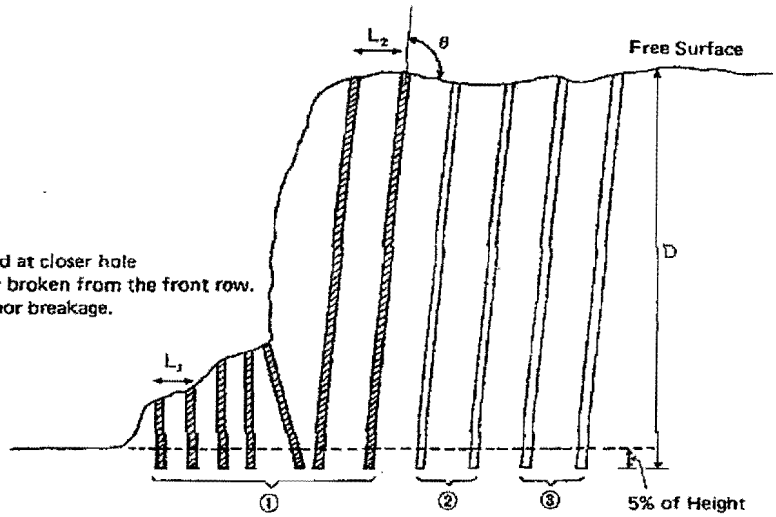
Small d and L should be used to obtain a straight crack line.



5 Breakage of Virgin Rock

d	44 ~ 51 mm
	1¾" ~ 2"
L_1	30 ~ 40 cm
	1' ~ 1'4"
L_2	60 ~ 90 cm
	2' ~ 3'
D	Adding 5% of Height
θ	80 ~ 90°

The toe should be drilled at closer hole spacing and successively broken from the front row. No drilling will cause poor breakage.



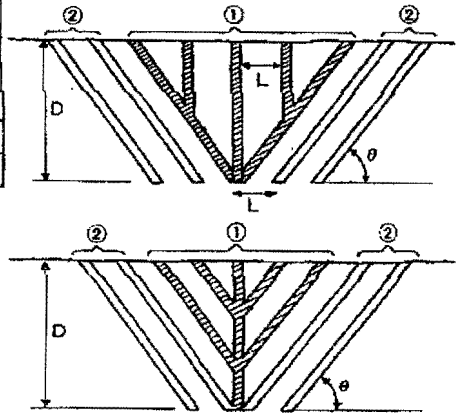
The front holes (up to sixth row) may be simultaneously filled in. It is more effective for the removal to fill in ① holes and then each two rows (②,③) after a delay of 6 ~ 20 hours.

6 Trenching and Tunneling

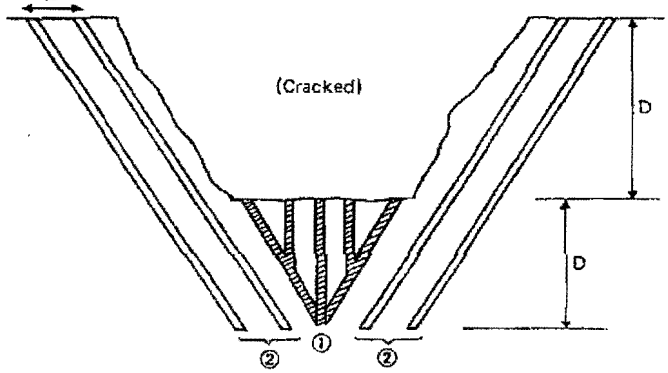
(1) V-cut

d	38~51 mm
	1½"~2"
L	30~60cm
	1'~2'
D	1~1.8m
	3'~6'
θ	45~60°

Reliever holes are necessary when trench is deep.

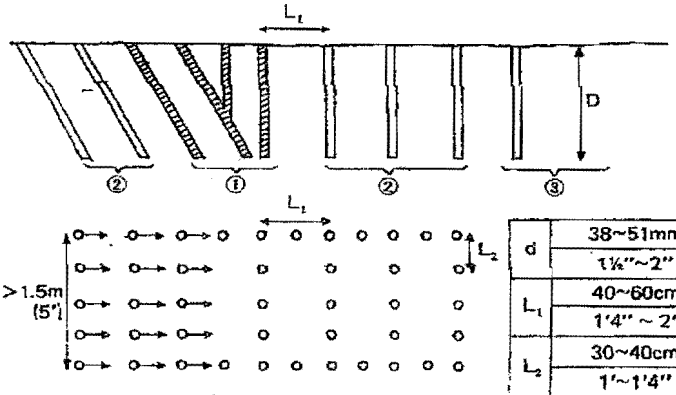


Repeat the same procedure for deeper case.



Fill in①holes and then②holes after delaying.

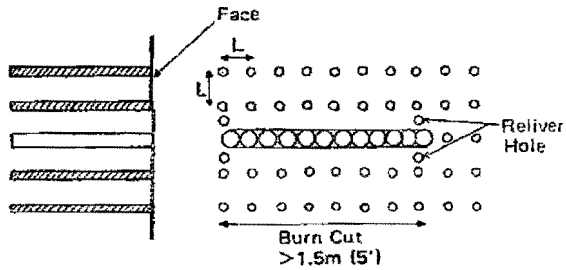
(2) V-cut



Fill in ① holes and then ② and ③ after delaying.

d	38~51mm
	1½"~2"
L_1	40~60cm
	1'4" ~ 2'
L_2	30~40cm
	1'~1'4"
D	1~1.8m
	3'~6'

(3) Burn Cut



d	38~44mm
	1½"~1¾"
L	30~60cm
	1'~2'

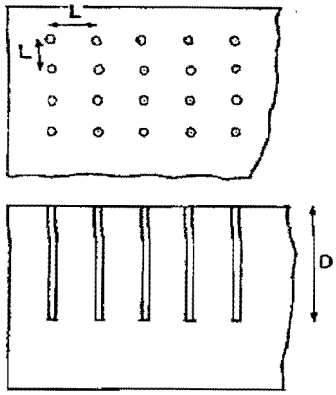
For horizontal holes, drill them with some slope to help in filling.

APPENDIX

"Hole Design of Concrete"

- Hole Diameter
- Hole Space
- Hole Depth
- Angle
- Hole Direction

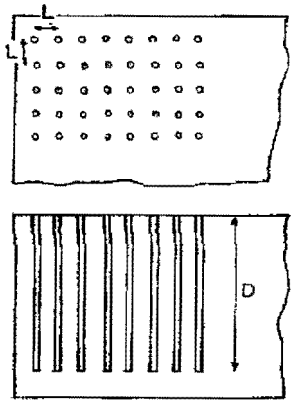
1 General Concept for Concrete



d	38~44mm
	1½"~1¾"
L	40~60cm
	1'4"~2'
D	70% of Height

When vertical drilling is difficult, drill horizontal holes with some slope.

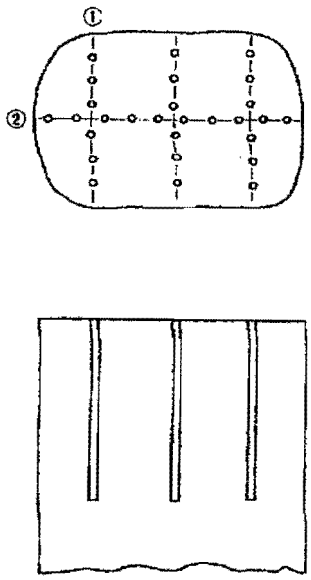
2 General Concept for Reinforced Concrete



d	35mm	38~44mm
	1 3/8"	1½"~1¾"
L	20~25cm	30~40cm
	8"~10"	1'~1'4"
D	90% of Height	

d and L depend on both quantity of reiforced steel and shape of that.

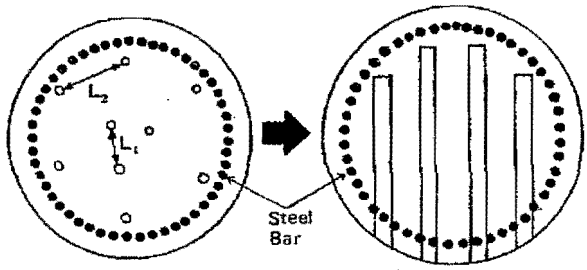
3 Mass Concrete (Bridge pier and Foundation etc.)

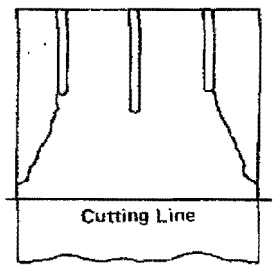


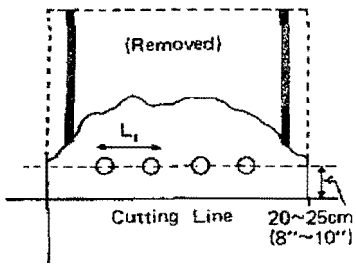
	Concrete	Reinforced concrete
d	38~51mm	38~44mm
	1½"~2"	1½"~1¾"
L	50~90cm	40~60cm
	1'8"~3'	1'4"~2'

Fill in ① holes and then ② holes after delaying.

4 Pile Foundation



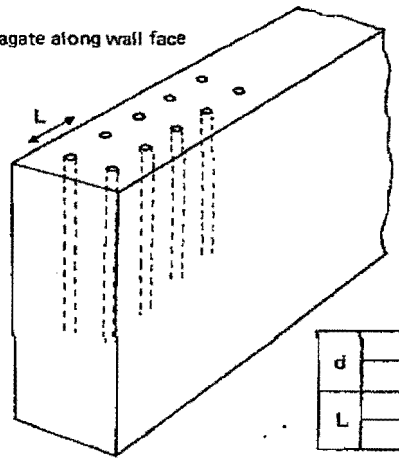




d	38 ~ 44 mm
	1½" ~ 1¾"
L_1	20 cm
	8"
L_2	20 ~ 25 cm
	8" ~ 10"

5 Thick Wall

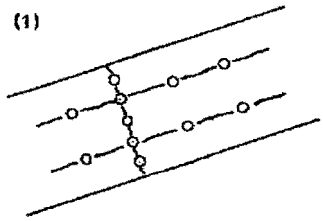
Cracks propagate along wall face



d	38~44mm
	1½"~1¾"
L	30~60cm
	1'~2'

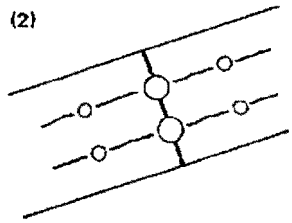
When perpendicular cracks to wall face are necessary:

(1)



Add a reliever hole.
Spacing may be 10cm (4')
though 20cm (8').

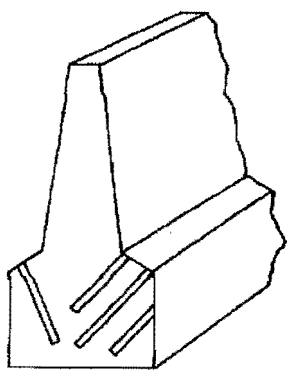
(2)

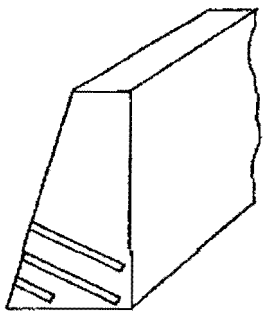


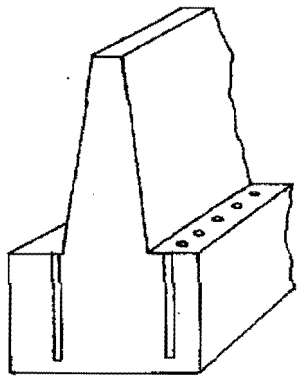
Drill larger d of holes.

6 Pier, Bridge Foundation, Retaining Wall

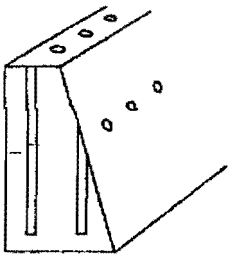
Drilling depends on a shape of structure
and a circumstance.

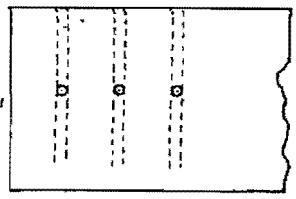




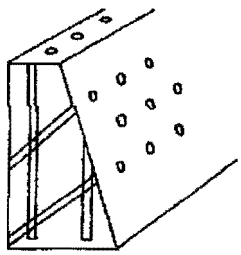


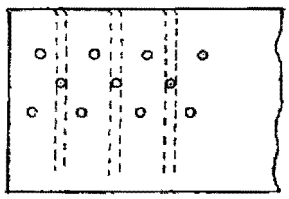
(1) Making of large block;
Secondary breaking with
large rock breaker.



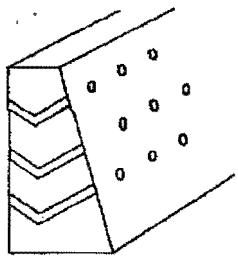


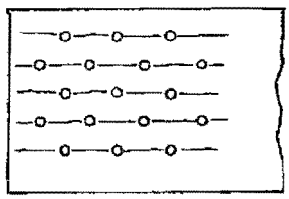
(2) Making of small pieces;
Drilling is only from one side.



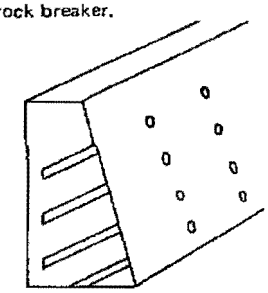


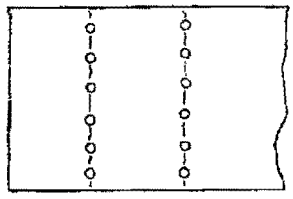
(3) Wall is very high;
Vertical drilling is difficult.





(4) Foundation is thick,
Secondary breaking with large
rock breaker.



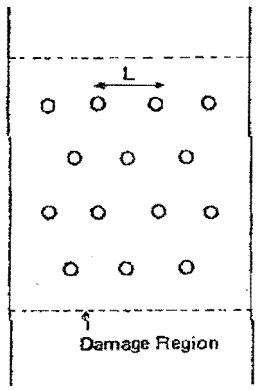


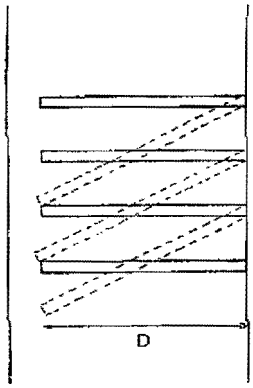
Side
View

7 Zone Demolishing (Pillar, Beam, Wall)

(1) Stagged Arrangement (Pillar)

d	38~44mm
	1½"~1¾"
L	30 ~ 40 cm
	1'~1'4"
D	90% of Width or Height

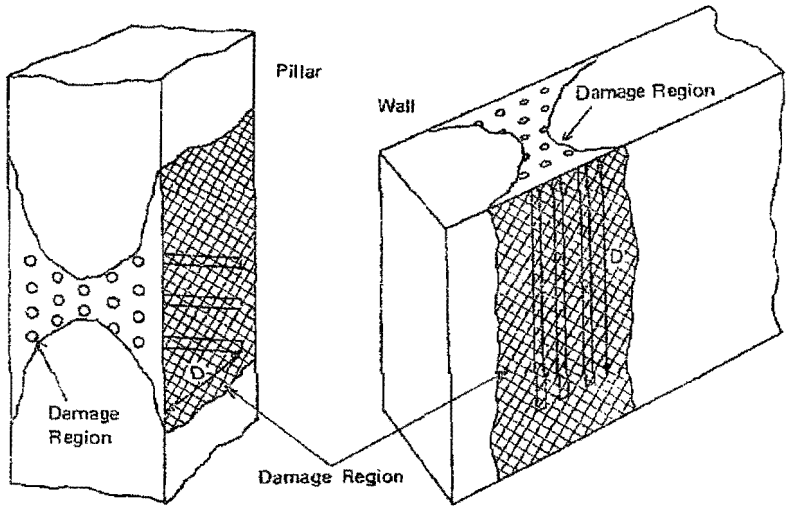




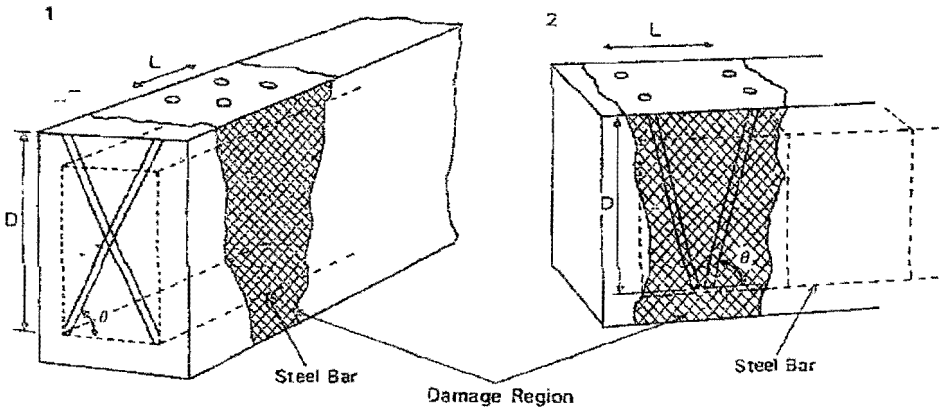
Horizontal or Inclinated Hole (60 ~ 80°)

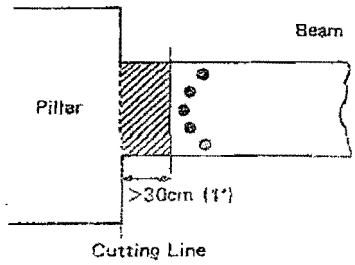
(2) X Figure Arrangement (Pillar, Wall)

d	38~44mm
	1½"~1¾"
L	30 ~ 40 cm
	1'~1'4"
D	90% of Width or Height



(3) Cross Drilling (Beam)





Try to set safety zone to avoid pillar cracking.

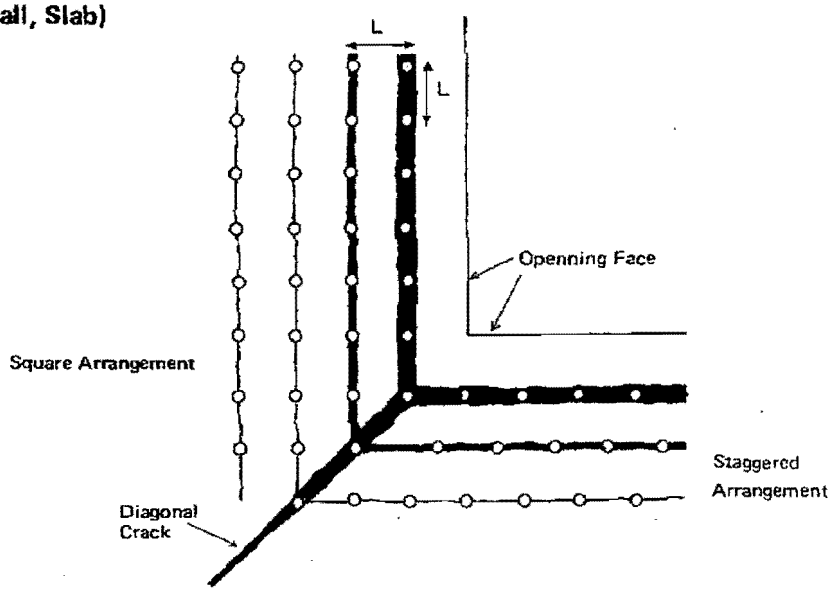
d	38~44mm
	1½"~1¾"
L	30 ~ 40 cm
	1'~1'4"
D	90% of Width or Height
θ	60~80°

8 General Concept for Thin Concrete (Wall, Slab)

1)

d	32~38mm
	1¼"~1½"
L	25~30cm
	10"~1'
D	Around Wall Thickness

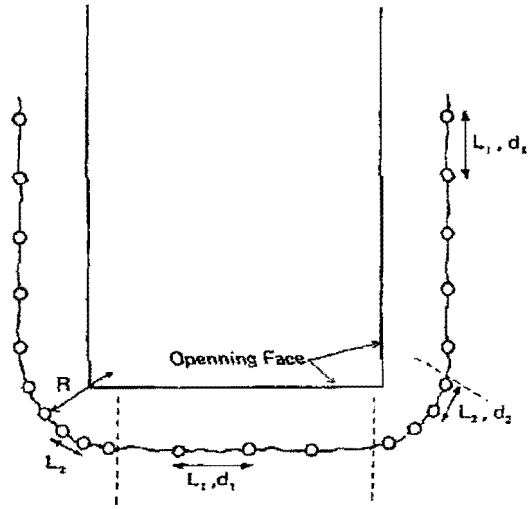
Crack width of the front row is opened much larger than that of the behind rows.



2) Avoid diagonal crack

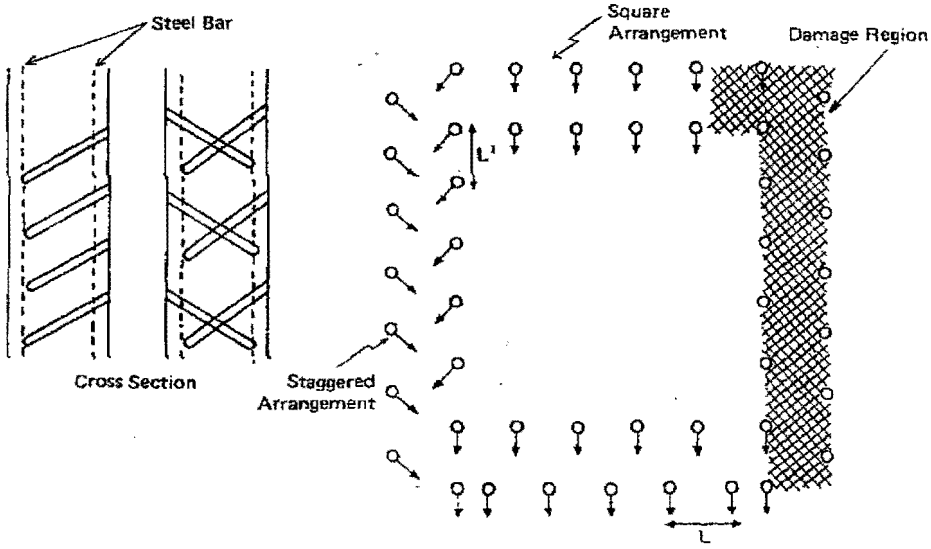
d_1	32~38mm	d_2	25mm	32~38mm
	1¼"~1½"		1"	1¼"~1½"
L_1	25~30cm	L_2	10cm	10~15cm
	10"~1'		4"	4"~6"

The curvature at corner (R) should be more than 15cm (6').



3) Splitting of Wall

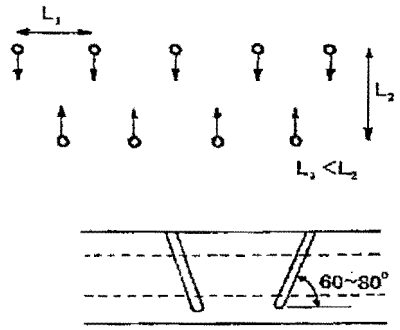
d	38~44mm
	1¼"~1½"
L	25~30cm
	10"~1'



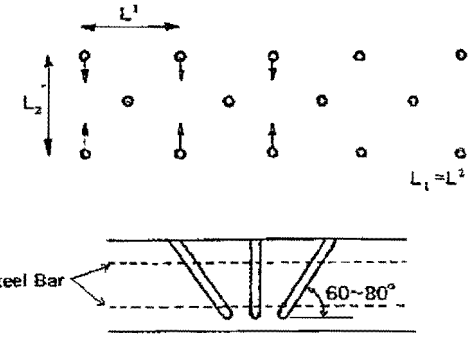
4) Splitting of Slab

d	38~44mm
	1½"~1¾"
L_1	25 ~ 30 cm
	10" ~ 1'

1 Staggered Arrangement



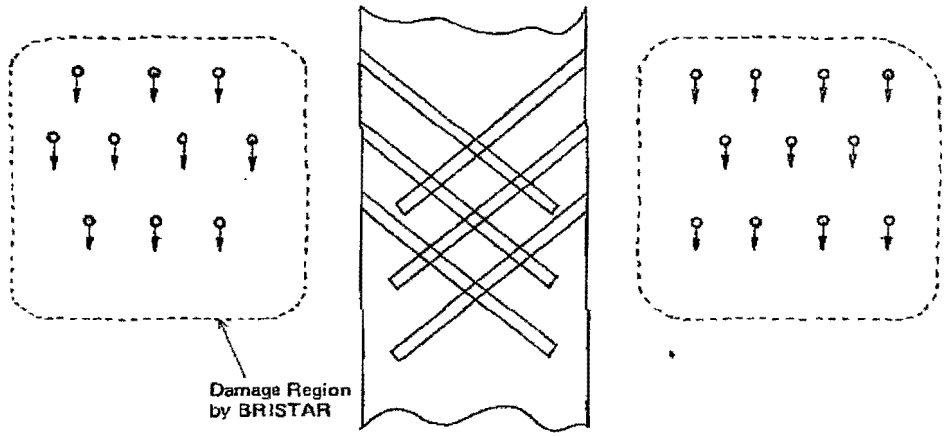
2 Square Arrangement



5) Establishment of free surface

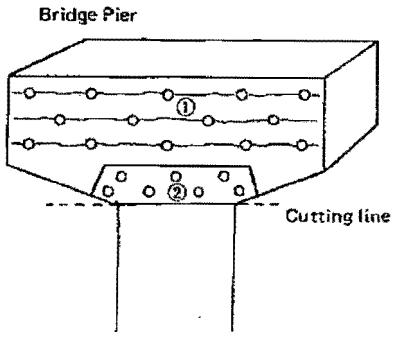
In stead of Burn Cut (chapter 6 of Rock), cross drilling may be used to establish the free surface for wall case.

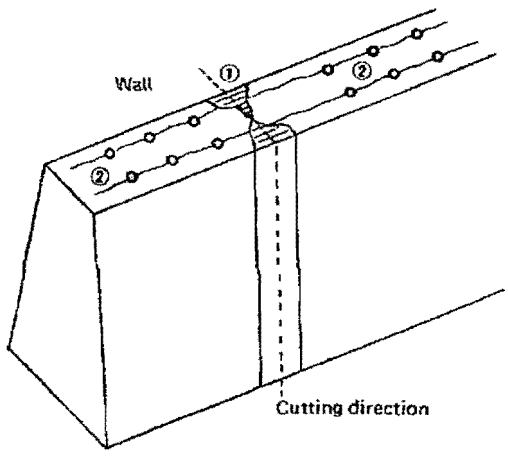
d	38~44mm
	1¼"~1½"
L	20 ~ 25cm
	8"~10"



9 Delay Filling

Fill in ① holes and then ② holes after delaying. (See 2, 6 of Rock, and 3 of Concrete.) This can be applied for controlling of a crack direction.





MATERIAL SAFETY DATA SHEET

(Conforms to the ANSI Z400.5.2004 Standard)

SECTION 1 – CHEMICAL PRODUCT & COMPANY IDENTIFICATION

Product Identifier:	Dā-mite® Rock Splitting Mortar (Dā-mite). Non Explosive Demolition Mortar
Product Use:	For controlled, silent, non-vibration demolition of stone, rock, and concrete.
Manufacturer's/Supplier's Name:	Daigh Company Inc.
Address:	2393 Canton Hwy, Suite 400, Cumming, GA 30040
Emergency Telephone #:	770-886-4711
Date MSDS Prepared	September 24, 2010

SECTION 2 – COMPOSITION

Hazardous Ingredients *(specific)*	%	CAS Number
Calcium Oxide (CaO)	85-95	1305–78-8
Silicon Dioxide (SiO2)	4-9	60676-0
Iron Oxide (Fe3O4)	1.5-3	1309-37-1
Aluminum Oxide (Al2O3)	1-5	1344-28-1
Sulfur Trioxide (So3)	0.5-3	7704-34-9

Toxicological Data on Calcium Oxide LD50: Not Available	LC50: Not Available
OSHA PEL for calcium oxide - 5 mg/m^3	
ACGIH TLV for calcium oxide - 2 mg/m^3	

SECTION 3 – HAZARDS IDENTIFICATION

Emergency Overview:	Danger! Harmful if swallowed or inhaled. Causes burns to skin and eyes. Causes severe irritation to the respiratory tract, characterized by burning, sneezing and coughing. Inflammation of the eyes is characterized by redness, watering and itching.

SECTION 4 – FIRST AID MEASURES

Eyes:	Immediately flush eyes with water for a period of 15 minutes. Pull back the eyelid to make sure all the dust has been washed out. Seek medical attention immediately.
Skin:	Flush exposed area with large amounts of water. Seek medical attention immediately.
Inhalation:	Remove to fresh air. Seek medical attention if necessary.
Ingestion:	Give large quantities of water or fruit juice. Do not induce vomiting. Seek medical attention immediately.
Note to physicians:	Provide general supportive measures and treat symptomatically.

SECTION 5 – FIREFIGHTING MEASURES

Fire Hazards:	Dā-mite is not combustible or flammable. However Dā-mite reacts with water releasing sufficient heat to ignite highly combustible materials in certain instances. Dā-mite is not an explosion hazard. However' reaction with water or other combustible material causes the material to swell and may rupture containers.
Hazardous Combustion Products:	None identified.
Extinguishing Media:	Use dry chemical fire extinguisher. Do not use water or halogenated compounds, except that water may be used to deluge small amounts of Dā-mite.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Spill/Leak Procedures:	Do not use water on bulk material spills.
Small Spills:	Use dry methods to collect spilled materials. Do not clean up with compressed air. Store spilled materials in dry, sealed, plastic or metal containers. Do not store clean up residuals in aluminum containers. Surfaces contaminated with residual amounts may be washed down with water.
Large Spills:	Use dry methods to collect spilled materials. Evacuate area downwind of clean-up operations to avoid dust exposure. Store spilled materials in dry, sealed, plastic or metal containers. Do not store clean up residuals in aluminum containers.
Containment:	For large spills avoid the generation of dust. Do not release into sewers or waterways.
Clean-up:	Residual amounts can be flushed with large amounts of water. Equipment can be decontaminated by washing either in mild vinegar and water solution, or detergent and water solution.

SECTION 7 – HANDLING AND STORAGE

Handling:	Keep in tightly closed containers. Protect from physical damage. Avoid direct contact with material.
Storage:	Store in a cool, dry and well ventilated location. Keep stored Dā-mite away from moisture. Do not store or ship in aluminum containers.

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION EQUIPMENT

Airborne Exposure Limits:	
OSHA Permissible Exposure Limits (PEL)	5 mg/m^3 (TWA)
ACGIH Threshold Limit Value (TLV)	2 mg/m^3

Ventilation System:	A system of local and/or general exhaust is recommended to keep employee exposures below the airborne exposure limits.
Personal Respirators (NIOSH Approved):	If the exposure limit is exceeded and engineering controls are not feasible a full-face piece particulate respirator (NIOSH Type N100 Filters) may be worn.
Skin Protection:	Use an approved water resistant barrier cream. Wear impervious protective clothing, including boots, gloves, head protection and approved eye protection, long-sleeves, apron or coveralls to prevent skin contact.
Eye Protection:	Use chemical safety glasses/goggles and/or full-face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick drench facilities in the work area.
Footwear:	Resistant to caustic solutions.

SECTION 9 – PHYSICAL & CHEMICAL PROPERTIES

Appearance:	Light gray powder
Odor:	Odorless
Solubility:	Slightly soluble in water with the release of heat and formation of calcium hydroxide
Specific Gravity:	3.2 – 3.4
pH:	10 (1% solution of Dā-mite in water)
% Volatiles by volume at 21C (70F):	0

SECTION 10 – STABILITY & REACTIVITY

Stability:	Chemically stable. Unlike normal Calcium Oxide which reacts quickly with water, Dā-mite is specially kilned to provide a hard outer coating which allows slow penetration of water resulting in a controlled reaction, expansion and heat evolution to take place. This process generates the highest tensile forces necessary to split rock.
Hazardous Decomposition Products:	No hazardous decomposition products
Incompatibilities:	Dā-mite should not be mixed or stored with the following materials due to the potential for violent reaction and heat: Acids, reactive fluorinated compounds, reactive brominated compounds, reactive powdered metals, organic acid anhydrides, nitro organic compounds and reactive phosphorous compounds.
Conditions to Avoid:	Air, moisture and incompatibles.

SECTION 11 – TOXICOLOGICAL INFORMATION

No LD50/LC50 has been identified for the components of Dā-mite. The main component is calcium oxide which is not listed by MSHA, OSHA, or IARC as a carcinogen.