NONEX^{TM}: FREQUENTLY ASKED QUESTIONS

Q. What is NoneX^{TM}?

A. The NoneX^{TM} Technology is based on a non-detonating propellant compound enclosed in a cartridge, which reacts very quickly when ignited to produce high volumes of harmless gas, mainly consisting of nitrogen, carbon dioxide and steam. When the cartridge is sealed in a drill hole, the high pressure gas generated by the ignition of the propellant enters into the micro-fractures created from the percussive drilling process and into the natural fractures and planes of weakness of the rock, expanding the fractures and propagating cracks towards the nearest free face of the rock. The number of cracks propagated is related to the maximum pressure and peak pressure rate achieved by the expanding gasses within the drill hole. The gas pressure, within the drill hole and propagated cracks, then causes the fractured rocks to heave apart, producing a shearing of the rock often called splitting.

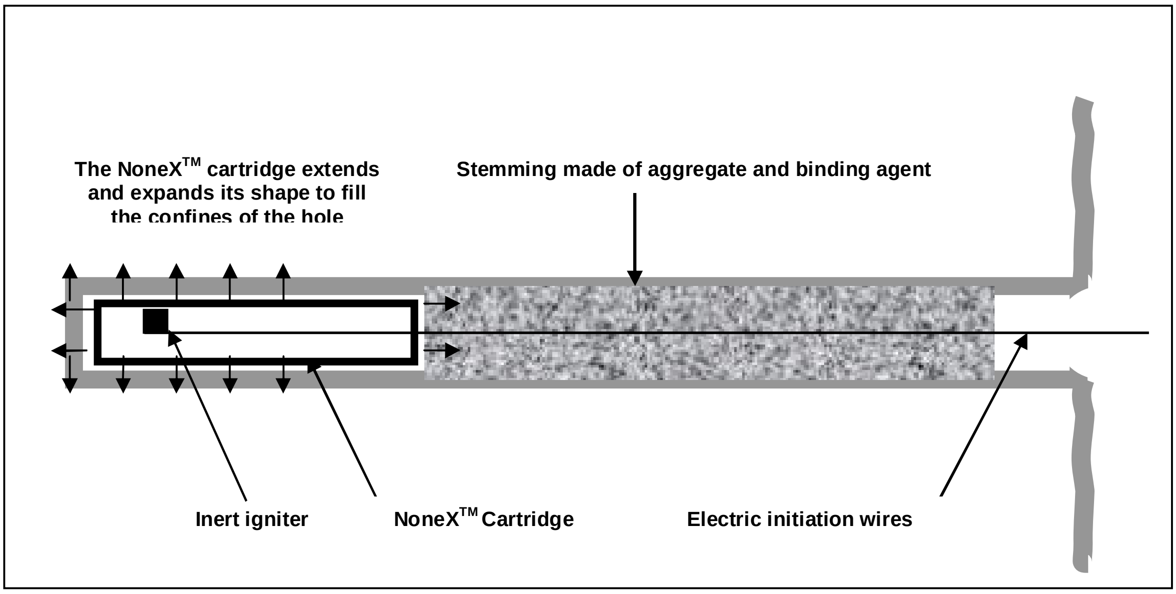


Figure 1 - The NoneX*TM* Cartridge inserted in a drill hole

Q What is NoneX^{TM} used for?

A. The NoneX^{TM} rockbreaking technology was developed to solve problems associated with specialist excavations and rockbreaking in sensitive conditions. The collateral damage associated with excavations using explosives in poor rock conditions or in blast sensitive areas often creates a larger problem than the original explosive solution set out to address. Problems of blast damage in highly jointed rock and collateral damage to sensitive installations and infrastructure have persisted in the industry for many years due mainly to the absence of credible alternative methods to address such situations. NoneX™ offers the industry a solution, which allows a controlled approach to excavation in these difficult situations without the vestiges of damage associated with traditional methods of rockbreaking using explosives.

The NoneX™ rockbreaking method, developed by NXCO Mining Technologies, has recently been applied to several applications in a wide variety of rock conditions. The NoneX™ technology allows a tailored rock breaking ("TRB") approach whereby energy can be applied more efficiently to break and dislodge the rock in a controlled fashion, which can be optimally adapted to suit the rock breaking requirements of any particular situation in all types of rock conditions.

ADVANTAGES & DISADVANTAGES OF NONEX™

Q. What are the advantages of using NoneX™?

A (1) NoneX™ is environmentally sensitive
  a minimal fly rock (< 10m)
  b minimal vibration
  c lower noise and overpressure levels than conventional explosives
  d negligible noxious gasses

(2) Similar yields to small-diameter conventional blasting can be achieved with NoneX™ using smaller charge weights. Primary rockbreaking yields typically around $1m^3$, in hard in-situ rock pavements, can be achieved using a 100g NoneX™ cartridge. Significantly greater secondary-breaking yields are produced when breaking boulders rather than in-situ rock

(3) Only localised clearance of personnel is required with NoneX™. Production is optimised as no downtime to loading and hauling equipment is experienced due to site evacuation during initiation.

(4) NoneX™ is safer to transport, store and use than conventional explosives.

(5) NoneX™ can be used with low capital, lightweight equipment – One small hand-held drill rig is all that is needed to drill the hole.

Q. What are the NoneX™ cartridge sizes?

A. NoneX™ cartridges come in a range of diameters and charge weights:

CARTRIDGE DIAMETER (mm)	HOLE SIZE DIAMETER (mm)	NONEX CHARGE WEIGHT (grams)
28	30mm – 34mm	20g – 120g
34	36mm – 42mm	20g – 180g
60	64mm – 76mm	200g – 500g

Table 1: NoneX™ Cartridge Sizes

Q. Is NoneX™ an explosive?

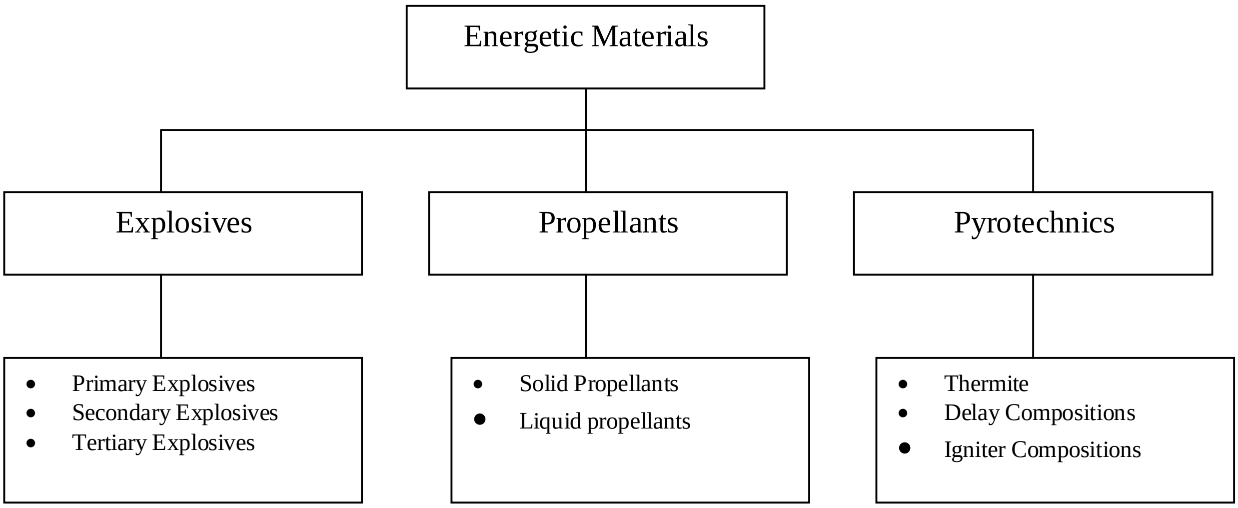
A. The NoneX™ cartridge is classified as a 1.4 S product under the United Nations hazardous substances classification, in the same category as small arms ammunition. This classification is given to products that do not explode when ignited in their original packaged state and as such the classification defines NoneX™ as a non-explosive product for transport and storage purposes.

An explosion is basically any rapid expansion of matter into a volume much larger than the original. The rapid expansion of a gas from the bursting of a latex balloon can be classed, according to some definitions, as an explosion. Equally, the bursting of a pneumatic tyre or the rupturing of a pressurised gas tank can be termed as explosive events. As mining engineers we are more attuned to the term explosion being applied to the exothermic chemical reaction caused by the initiation of an explosive.

In general, the term explosive is used to describe a material that can undergo an exothermic chemical reaction resulting in a rapid expansion of the reaction products into a volume larger than the original.

A wider term, *energetic material,* is mostly used to comprise all materials that can undergo exothermic chemical reaction releasing a considerable amount of thermal energy, which may or may not cause an explosion. A widely used classification of energetic material is illustrated in figure 2.

Figure 2: Classification of Energetic Materials (After Per-Anders Persson)



The reason why a NoneX™ cartridge does not explode, and is therefore not explosive in its packaged state, is that the velocity of deflagration or burning of the propellant is almost directly proportional to the degree of confinement of the chemical reaction. Thus, in an unconfined environment such as the product's original packaging, the propellant if ignited will only burn at a very low velocity, which is incapable of causing an explosion. In contrast, an explosive if detonated or initiated in its original packaging, will produce a major explosion the result of which historically has had fatal consequences. The end result is that propellant-based cartridges are much safer to transport, store and use than explosives and for that reason the regulations relating to the transport and storage of NoneX™ are considerably less stringent than for explosives such as Ammonium Nitrate/ Fuel Oil (ANFO).

Q. Does NoneX™ detonate?

A. One of the most salient features distinguishing NoneX™ from high explosives is that explosives detonate whilst the propellant used in a NoneX™ cartridge deflagrates. Deflagrations are thermally initiated reactions propagating at subsonic speeds that proceed radially outwards in all directions through the energetic material, away from the ignition source. The maximum pressure developed by deflagration is dependent on the energetic materials involved; their geometry; and the strength (failure pressure) of the vessel or structure confining the materials. Deflagration speeds of propellants are in the order of 200 to 1000 metres per second producing pressures reaching 1000 Mpa, which are developed in thousandths of a second.

High explosives are defined as materials intended to function by detonation (2). The reaction speeds of detonation are higher than the speed of sound in the explosive material. The speed of sound through a material is dependent on the density of the material; the higher the density, the higher the speed of sound will be through it. A reaction speed of 1000 metres per second is set as the minimum speed that distinguishes detonations from deflagrations (2). Detonation speeds are in the order of 1000 to 10 000 metres per second producing pressures from 1500 to 15 000 Mpa which are developed in millionths of a second.

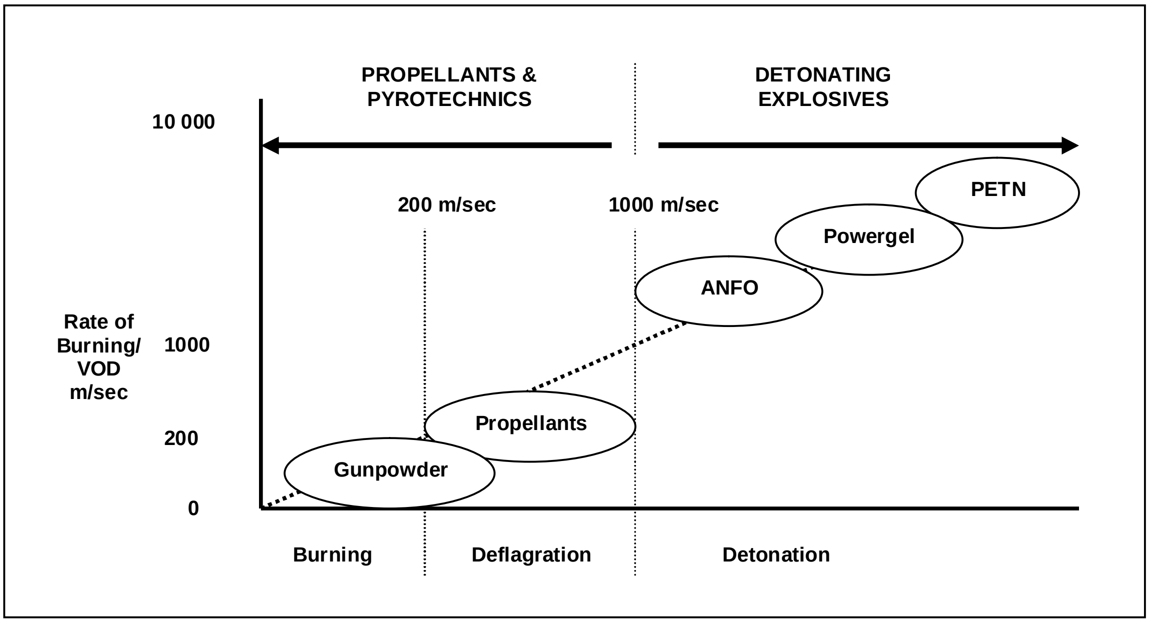


Figure 3 – Burning, deflagration and detonation of commonly known energetic materials

The effects of detonations are very different from those of deflagrations. The supersonic reaction speed of detonation develops a shock wave in the explosive, which triggers the propagating reaction. The propagation of the shock wave is accompanied by a chemical reaction that furnishes energy to sustain the shock wave advance in a stable manner, followed by the formation of the final gaseous products and their associated pressures at some time later. Conversely, deflagration produces no shock wave and only those pressures produced by the formation of gaseous products are present.

The rock to which an explosive detonation is applied will experience a supersonic blow from the detonation front's pressure pulse followed quickly by a prompt release of pressure and then followed immediately by a build up of pressure imparted by the gaseous products of the explosion, which will be applied in a more or less sustained manner. Deflagration produces only the last effect as it does not produce a shock wave.

In Figure 3 a range of energetic materials used for rockbreaking is shown in ascending order of burning or detonation speeds. Pyrotechnics such as black powder are represented in the lower end of the scale with a burning speed of less than 200 metres per second, whilst propellants occupy a range of burning speeds from 200 to 1000 metres per second. The higher order propellants are double based or composite propellants. Blasting agents such as ANFO and AN slurries are represented in the 3200 to 3500 metres per second range whilst Powergel has a VOD of approximately 4 000 metres per second. High explosives such as TNT and PETN have VODs in the range 6500 to 7 000 metres per second. In general, the higher the VOD of the explosive, the greater the shock wave produced, which is responsible for the shattering action of the blast. In high VOD explosives much of the energy is disseminated in the detonation shock wave whereas in propellants and pyrotechnics, as well as explosives with lower VODs, most of the energy is used in the heaving action produced by the gaseous products pressurising the drill hole.

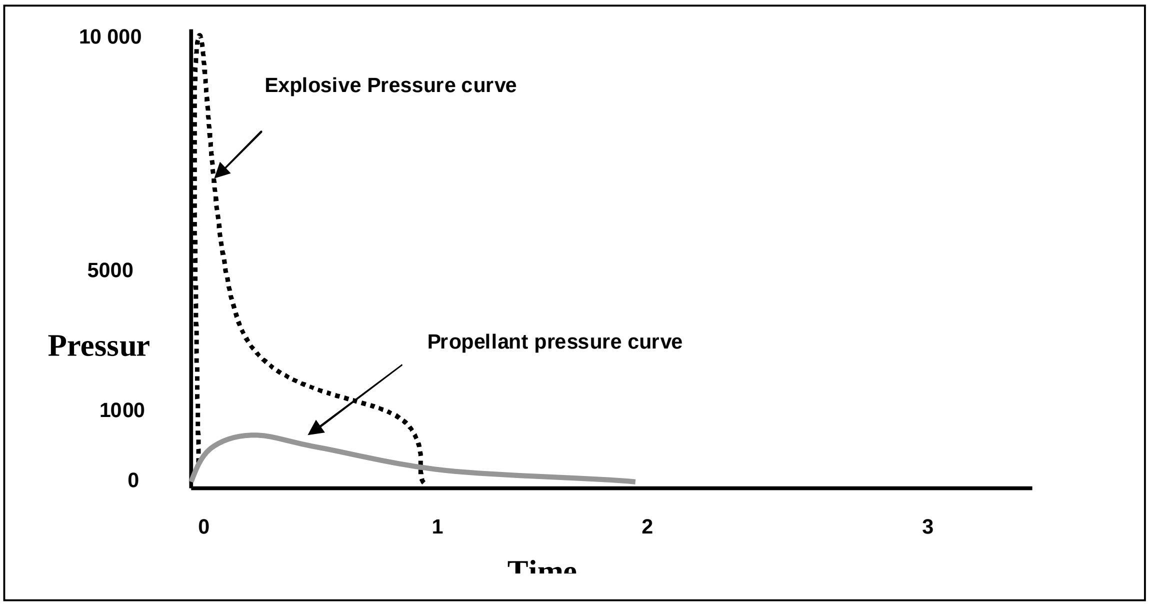


Figure 4 – Increase of pressure over time curves for explosives and propellants confined in a drill hole in rock

Figure 4 illustrates the vast difference in drill hole pressures developed by detonating explosives compared to deflagrating propellants – a difference in the order of 10 to 20 times. As a result of the relatively low-pressure regime developed by a propellant in a drill hole, the shock wave inherent in rockbreaking using high explosives is avoided, which allows propellant-based rockbreaking methods to be used in situations where high explosives are prohibited.

ADVANTAGES OF USING NONEX^{TM} OVER CONVENTIONAL EXPLOSIVES

Q. How does NoneX^{TM} rockbreaking differ from rockbreaking using conventional explosives?

A. The major difference between NoneX^{TM} and explosives can be summarised as follows:

- Explosives can explode in their packaged state whereas NoneX^{TM} cartridges do not explode in their packaged state.
- Explosives are designed to detonate whereas NoneX^{TM} cartridges are designed to deflagrate
- Explosives produce a destructive shock wave giving rise to high vibration-levels, which damage the surrounding rock mass whereas NoneX^{TM} cartridges produce a controllable pressure wave with low vibration levels.
- The rockbreaking event produced by explosives is a largely uncontrolled, violent event producing large amounts of fly rock, noxious gases and dust whereas the deflagration of a NoneX^{TM} cartridge confined in a drill-hole is a controlled event which produces minimal fly rock, low concentrations of noxious gases and negligible amounts of dust.
- Rockbreaking using NoneX^{TM} cartridges can be carried out continuously with re-entry periods measured in seconds whereas explosive blasting using conventional explosives requires the mine to be evacuated for up to 4 hours after each blast.

What are the transport and storage requirements for NoneX^{TM}?

The NoneX^{TM} cartridge is classified according to the United Nations Classification of Hazardous Substances as a Division 1.4 S hazardous substance. The UN classification system is used by most countries of the world to classify hazardous products according to the danger that each of the products poses whilst in storage and transport. The 1.4 S classification that applies to NoneX^{TM} cartridges is the same classification as that applied to small arms ammunition. The NoneX™ cartridge was tested by a UN accredited testing agency and subsequently classified under UN1.4S as a “Cartridge Power Device”.

The UN 1.4S classification is defined as follows:

> “Articles and substances that present no significant hazard. This division comprises articles and substances, which present only a small hazard in the event of ignition or initiation during transport. The effects are largely

confined to the package and no projection of fragments of appreciable size or range is to be expected.

Articles and substances in this Division are placed in Compatibility Group S when they are so packaged or designed that any hazardous effects arising from accidental ignition are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder fire-fighting or other emergency response efforts in the immediate vicinity of the package".

The 1.4 S classification described above is awarded to only those products that attain the classification by undergoing a series of strenuous testing under the supervision of the SABS. The successful outcome of the testing requires that the product is incapable of an explosion whilst in its packaged state even if it is accidentally ignited or otherwise initiated by external means.

ENVIRONMENTAL ADVANTAGES OF NONEX™

Q. What are the environmental benefits of NoneX™?

A. Environmental Benefits of NoneX™ rocksplitting NoneX™ rocksplitting produces low vibration resulting in significantly reduced damage to surrounding rock and infrastructure; minimal fly rock resulting in minimal scatter of blasted rock; low overpressures resulting in minimal concussion effects; and minimal fumes and dust allowing operations to be carried out continuously without the need to evacuate the mine as is the case with conventional explosives blasting. These benefits are explained below.

Q. What vibration levels are produced by NoneX™ rockbreaking?

A. When the propellant mixture in a NoneX™ cartridge deflagrates, the almost instantaneous change from solid to gaseous matter is accompanied by a very sharp increase in the blasthole pressure and temperature. This is accompanied by a pressure wave that radiates from the drillhole, its amplitude decreasing as the distance from the drillhole increases. The primary factors known to influence the level of ground vibration from the NoneX™ cartridges include:

i. The weight of propellant per cartridge;
ii. The distance between the drillholes and the point of measurement;
iii. The local geological conditions, and the influence of geology and topography on vibration attenuation.

The most common form of the vibration equation to predict the amplitude of ground vibration from blasting at any distance from the blasthole has the general form:

$$PPV = K\left(\frac{Distance}{\sqrt{Weight}}\right)^{-b}$$

Figure 5: General Vibration Equation for Blasting

where Dist is the distance from the drillhole in metres, and Weight is the mass of propellant contained in the cartridge in kilograms.

The constant K in the above equation can be thought to reflect the energy of the propellant per unit mass, and the efficiency with which the energy is transferred to the rock mass. Higher values of K would be expected with more energetic propellants, or instances where the energy from the propellant is better contained within the drillhole. The β term is considered to reflect the competency of the rock type between the drillhole and the monitoring location, and the ability of the rock type to transmit vibration. Higher values for β (increased attenuation) could be expected in heavily fractured rock types. A typical value for β is in the range 1 to 2 with values beyond these limits cautiously applied.

A NoneX^{TM} specific vibration equation (figure 6) has been developed from monitored data collected from several NoneX^{TM} rockbreaking excavations in sensitive civil applications. These data have been collected by an independent group and have been regressed, according to the distance and propellant weight, to give the following equation.

$$PPV = 670\left(\frac{Dist}{\sqrt{Weight}}\right)^{-1.39}$$

Figure 6: NoneX^{TM} Specific Vibration Equation

The "Distance" in metres, divided by the square root of the "Charge Weight" in kilograms is referred to as the Scaled Distance, where:

$$\text{Scaled Distance } (m/kg^{1/2}) = \frac{\text{Distance } (m)}{\text{Charge Weight } (kg)^{1/2}}$$

The maximum peak particle velocity is normally represented in terms of a graph of PPV against the Scaled Distance (figure 7), which is derived from the NoneX™ specific vibration equation, as shown below. The PPV vs Scaled Distance graph in figure 7 shows how the peak particle velocity falls away very rapidly as the Scaled Distance is increased.

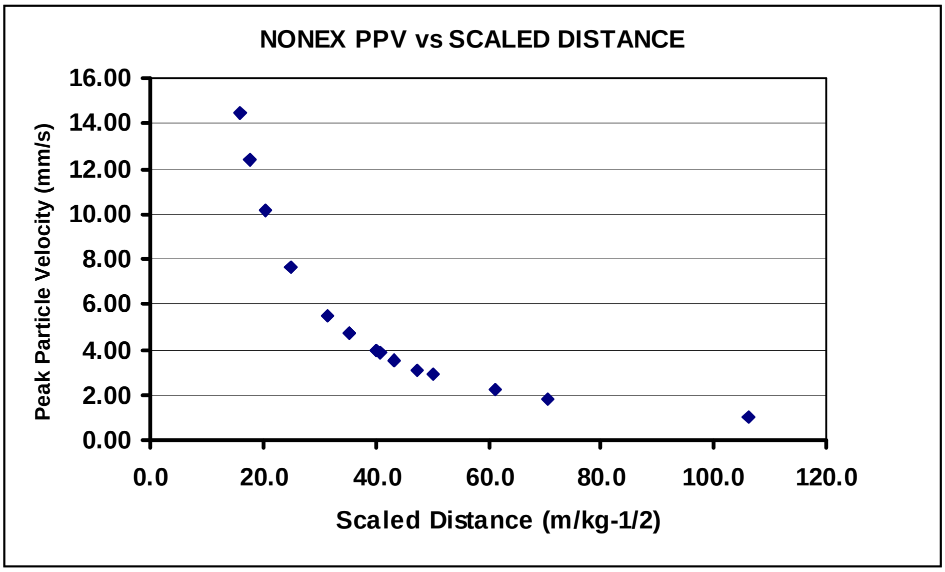


Figure 7: NoneX™ Specific Graph of PPV vs Scaled Distance

The values in table 2 below, which can be calculated from the NoneX™ specific vibration equation or read-off the scaled distance graph above, show the minimum distance between the rockbreaking event and the point of compliance (*ie* closest structure), that can be achieved, using the stated NoneX™ cartridge charge weights, for a given acceptable level of vibration, in terms of Peal Particle Velocity ("PPV") in mm/s,

NONEX PEAK PARTICLE VELOCITIES

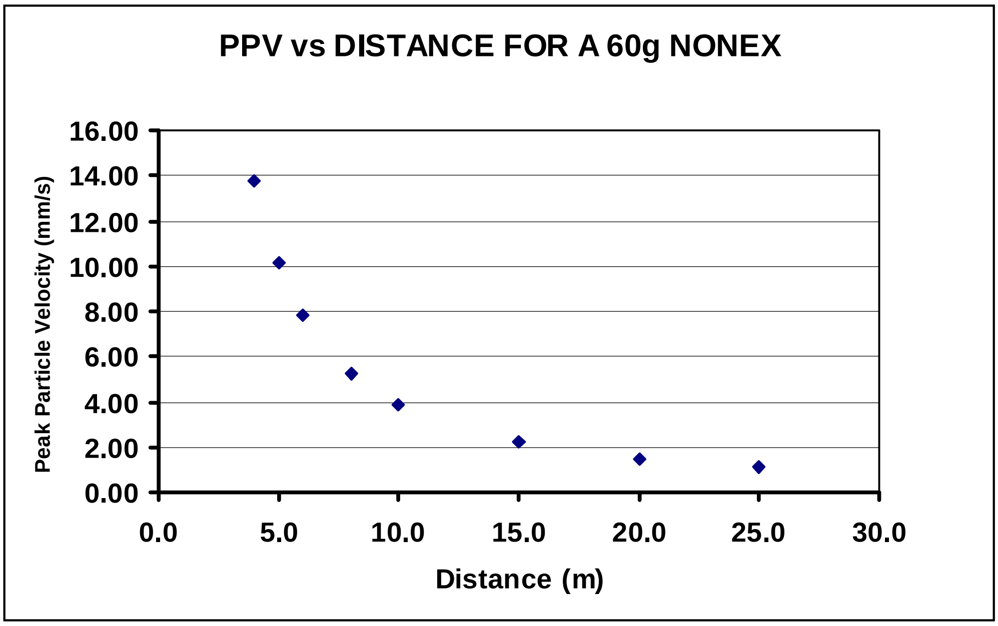
Max PPV (mm/s)	NoneX Charge Weight (g)	Distance from Structure (m)
25	0.100	3.4
25	0.060	2.6
25	0.020	1.5
16	0.100	4.6
16	0.060	3.6
16	0.020	2.1
8	0.100	7.6
8	0.060	5.9
8	0.020	3.4

Table 2: Table of NoneX™ PPVs for Varying Charge Weights and Distances

Table 2 above, indicates that for a 20g NoneX™ cartridge weight, a minimum distance between the site and the closest affected structure is 1.5m for an imposed 25mm/s limit, 2.1m for a 16mm/s restriction, and 3.4m for an 8mm/s limit.

The following graph (figure 8) and table 3 show the calculated Peak Particle Velocity values for a 60 gram NoneX™ cartridge at varying distances from the drill hole.

Figure 8: Graph of PPV vs Distance for a 60 gram NoneX™ cartridge



PPV FOR A 60g NONEX CARTRIDGE

Distance from Structure (m)	PPV (mm/s)
25.0	1.08
20.0	1.47
15.0	2.20
10.0	3.86
8.0	5.27
6.0	7.86
5.0	10.12
4.0	13.80

Table 3: Table of PPVs and distance for a 60 gram NoneX™ cartridge

Although the NoneX™ specific vibration equation (figure 6) and the calculated parameters shown in the graphs and tables above are derived from site specific data, these values can be used as a planning tool to estimate the minimum distance from a sensitive structure that NoneX™ rockbreaking can be carried out, using the stated

NoneX™ cartridge charge weights, to satisfy the relevant peak particle velocity which is required at the site.

Q. Are Vibration Levels Produced by NoneX™ Safe for Sensitive Structures

A. Vibration levels induced by NoneX™ are particularly low when compared to explosives of the same weight. This enables the method to be used in close proximity to built-up, populated areas. In sensitive sites where conventional blasting is prohibited or impractical the NoneX™ method becomes particularly attractive for vibration control.

Ground borne vibrations from blasting can cause damage to buildings and infrastructure, which are in the vicinity of the blast. The degree of vibration-induced damage caused by blasting is dependent on the magnitude, frequency and duration of the vibration. Generally, low frequency, long duration vibrations are more damaging than higher frequency, short duration vibrations.

This general rule is contained in recommendations by both the US Bureau of Mines ("USBM") and the British Standard ("BS"), both of which are widely used in vibration specifications for rockbreaking near sensitive structures. The USBM criteria is as follows:

Frequencies above 40 Hz

- § PPV < 50 mm/s - safe zone
- § PPV > 50 mm/s - damage zone

Frequencies below 40 Hz

- § PPV < 13 mm/s - safe zone (old wooden house)
- § PPV > 19.5 mm/s - safe zone (modern house)

The vibration waves produced by NoneX™ are mostly of a higher frequency, with a mean of 450 Hz, and of short duration and are therefore the least harmful to sensitive structures. In addition, the magnitude of the vibration levels produced by NoneX™ is particularly low when compared to explosives over the same distance from the shothole. The vibration signature produced by the combination of high frequency, low duration and low magnitude vibration waves enables NoneX™ to be used in close proximity to vibration sensitive sites where conventional blasting is prohibited or impractical.

In addition, the reduced quantities of propellant used to break the rock compared to explosives means that considerably less energy is emitted by a NoneX^{TM} rockbreaking event than by a conventional explosives' rockbreaking event. For example, typical relative charge weights used to charge drill holes when breaking rock near sensitive structures are 60 grams for NoneX^{TM} charged holes and 300 grams for explosives charged holes. A 60 gram NoneX^{TM} charge releases less than one eighth of the energy that is released by a 300 gram charge of Powergel when detonated.

As a result of the reduced charge weights used for NoneX^{TM} rockbreaking and its favourable vibration signature, the vibrations generated by NoneX^{TM} are well within most imposed restrictions for rockbreaking close to sensitive structures. As can be seen from Figure 9, safe vibration levels for rockbreaking, as defined in the USBM guidelines, can be achieved by NoneX^{TM} within 5 metres of a sensitive structure.

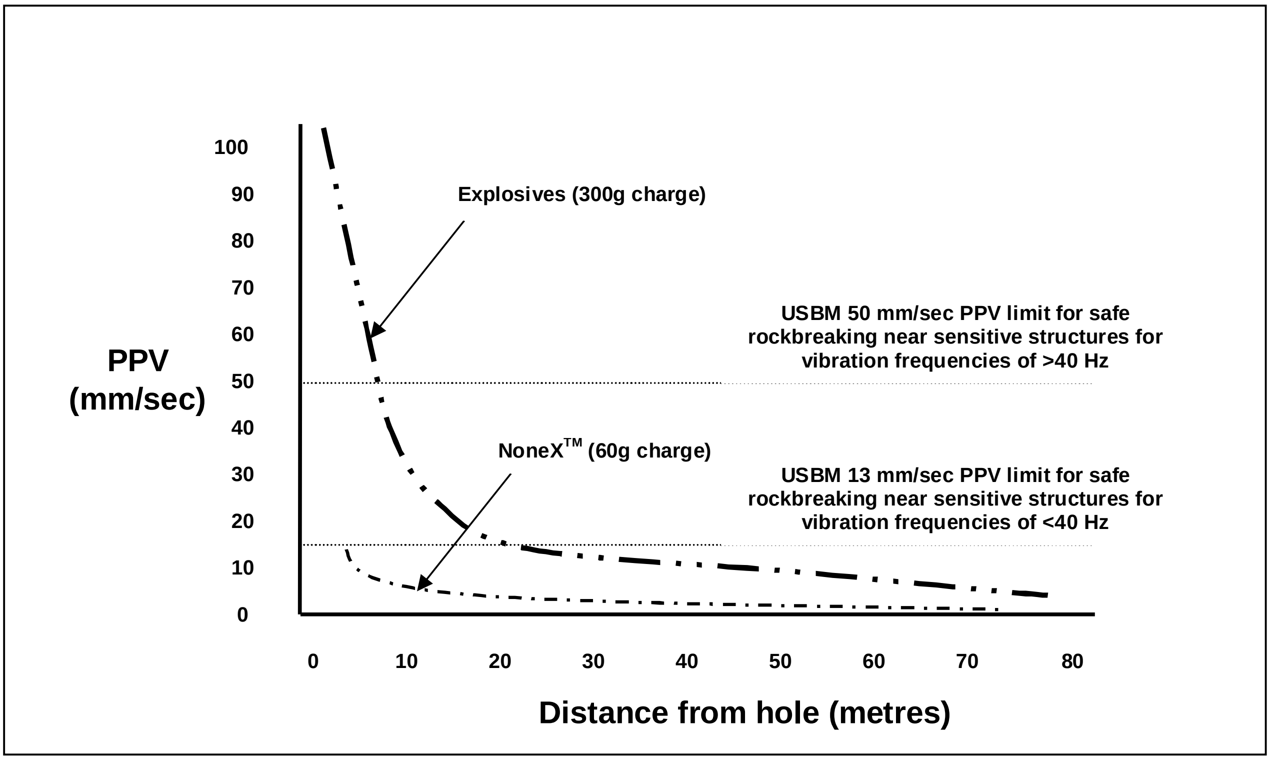


Figure 9 – Typical ground vibration levels (PPV) against distance comparison for NoneX^{TM} and explosives (tests conducted in norite)

Q. Does NoneX™ cause damage to the surrounding rock?

A. In addition to causing damage to infrastructure, vibrations from blasting using conventional explosives often cause extensive damage to the rocks surrounding the excavation being blasted. In the case of explosives contained in a drill hole in rock, the sudden release of energy and reaction products at high pressure by a rapid chemical reaction gives rise to compression waves in the explosive and in the surrounding rock material. These waves are called detonation waves or shock waves and play a central role in shattering the rock, through what is known as the brisance effect. As a result of these shock waves, high vibration levels are produced in the surrounding rock causing high stresses to be developed in the rock and damaging the integrity of the surrounding rock.

The most common measure of potential vibration damage is using the peak particle velocity as an indicator. The particle velocity is the rate of displacement, or the velocity of motion, of a particle in the rock during the passage of a seismic wave (4). There is a body of data available, which relates the peak particle velocity, as an indicator of the intensity of the vibration level, to the amount of damage inflicted on rock excavations by the detonation waves of an explosive. Potential damage to tunnels and other rock openings caused by high vibration levels, as indicated by the peak particle velocity are shown in Table 4.

Form of Damage	Peak particle Velocity mm/s
Breakage of rock	2 500
Onset of rock breakage	650
Rockfalls in unlined tunnels	300

Table 4– Forms of damage to tunnels related to shock wave intensity (after Hoek and Brown (5))

The damaging vibration levels caused by the shock wave produced by the detonation of explosives result in a destructive halo or blast damage zone forming around the detonation region that often penetrates more than a metre beyond the broken perimeter of the rock, causing movement in joints and faults and creating an unstable environment in the surrounding rock.

In contrast to the destructive effect on the surrounding rock caused by explosive blasting, propellant-based cartridges do not detonate and therefore do not produce a region of high vibration levels; but instead utilise the gases produced by the deflagration of the propellant to pressurise the hole, thereby propagating cracks in the rock and causing the fractured rocks to heave apart. Consequently, NoneX™ does not produce a blast damage zone in the surrounding rock which results in a much safer and stable hangingwall and sidewall. It is for this reason that rockbreaking using NoneX™ is often referred to as rocksplitting.

Q. What are the overpressure (airblast) effects of NoneX™?

A. Overpressure or airblast is simply the pressure over and above that of atmospheric pressure. Overpressure is caused by air transmitted vibrations or compressional waves (similar to ground vibration waves). Overpressure levels produced by NoneX™ are low when compared to conventional explosives and are of a shorter duration and less damaging frequency. This gives NoneX™ a major advantage over explosives in environmentally sensitive areas.

Q. What are the noise levels produced by NoneX™ rockbreaking?

A. Noise measurements should not be confused with overpressure measurements. Noise measurements are made with standard sound level meters, which record air vibrations falling in the audible frequency region only. There are times when relatively high overpressures are not audible because their frequency is outside the audible frequency region.

Noise levels produced by NoneX™ depend largely on the type and nature of the rock being broken, charge weight, burden, depth of the hole and the effectiveness of the stemming used. A well-stemmed NoneX™ cartridge in granite will generally produce a noise level in the range 80 to 85 dbL at 50 metres from the hole. Noise levels can be attenuated by the use of conveyor belting to cover the holes being fired.

Q. What are the flyrock effects of NoneX™

A. The NoneX™ breakage process drastically reduces the potential for fly rock due to the controlled manner in which the rock is broken. Fly rock that does occur is of a lower velocity and is normally confined to a distance within 10 metres of the hole. As a result, NoneX™ rockbreaking can be used with a minimal clearance zone from the point of initiation. A personnel clearance zone of 30 metres normally provides a sufficient factor of safety from inadvertent flyrock.

At the point in time at which the rock surrounding the drill hole starts to dislodge, the gas contained in the drill hole is released. In the case of explosives, the pressures in the drill hole are so high, due to the rate of detonation of the explosive, that the release of the gases is a violent event that results in a high level of fly rock and a high overpressure which produces a destructive concussion effect especially in confined spaces such as are found in underground mines.

In contrast, a tailored NoneX™ charge produces an optimal pressurisation of the hole for a given burden and type of rock. By controlling the characteristics of the pressure pulse, the velocity and distance traveled by the dislodged rock can be limited. Controlled gas release from the NoneX^{TM} cartridge at a relatively low pressure, obviates the destructive side effects such as fly rock and concussion effects caused by explosives. The net effect of optimally charged drill holes using NoneX^{TM} is a minimal quantity of low velocity flyrock.

Q. What local clearance is required for NoneX^{TM} rockbreaking?

A. The NoneX^{TM} cartridge provides similar hole-breakage performance to standard explosives in terms of burden and spacing; but has the important distinction that it produces low vibration, low flyrock, minimal concussion effect and negligible fumes and dust. As a result, NoneX^{TM} does not require the mine to be evacuated during the firing of the cartridges and allows rockbreaking to be carried out safely on a continuous basis during the shift with only localised clearance of the rockbreaking area to a distance of 30 metres required.

Q. Does NoneX^{TM} produce noxious gasses?

A. The NoneX^{TM} cartridge is oxygen balanced so that sufficient oxygen is available for the chemical reaction to achieve optimal oxidation to produce gases consisting of carbon dioxide, nitrogen and steam and thus avoiding the production of noxious gases such as carbon monoxide and nitrous fumes.

The efficient ignition of the NoneX^{TM} propellant mixture is represented in the generic formula:

Nitrocellulose + ammonium nitrate (oxidiser) ⟶ steam + nitrogen +carbon dioxide + energy

$$(X)\ C_6 N_3 H_7 O_{11} + (Y)\ NH_4NO_3 \longrightarrow H_2O + N_2 + CO_2 + \text{energy (joules)}$$

In addition, the quantity of propellant in a NoneX^{TM} cartridge used to break rock is less than the comparable quantity of explosives that is historically used to break the same amount of rock by a factor of six. A single 180 gram NoneX^{TM} cartridge can be used in a 1.2 metre long hole, to break a 50cm burden in most rock types; compared to a 1.1kg charge of ANFO that is commonly used for the same application. The reduced quantities of propellant required to break the rock compared to explosives means that considerably less fumes are emitted by the rockbreaking event.

As a result of the degree of oxidation achieved in the deflagration process, through the incorporation of an effective oxidising agent and the relatively small amount of propellant used in each hole, the NoneX^{TM} cartridge produces a negligible level of noxious gases which are cleared in minutes when an adequate standard of airflow (nominally a velocity of 0.25 metres per second) is available.

Q. What are the dust levels produced by NoneX™ rockbreaking?

A. Due to its tensile breakage mechanism, NoneX™ produces a much coarser fragmentation when compared to the smaller particles produced by the crushing effect of explosives. A major advantage of the coarse fragmentation is that the dust emitted is significantly reduced.

Due to the absence of large compressive stresses on the walls of the drill hole, which explosives use to pulverise the immediate rock zone around the drill hole; and the tensile nature of the NoneX™ rockbreaking mechanism, which is achieved by propagation of cracks by the emitted gases, the dust produced in the NoneX™ rockbreaking process is significantly less than the dust produced by blasting using detonating explosives.

APPLICATIONS

Q. What applications is NoneX™ used for?

A. NoneX™ is used in a wide variety of rockbreaking applications, which include the following:

- (i) Boulder breaking (i.e. breaking of oversize rocks) in surface mines and quarries.
- (ii) Civil excavation and demolition on environmentally sensitive sites.
- (iii) Slyping or stripping of underground tunnels & excavations
- (iv) Continuous mining in underground narrow vein mines

NONEX™ OPERATIONS

Q. What is involved in the drilling and breaking cycle?

A. Six easy steps is all it takes

1. Short holes of the relevant diameter are drilled at a depth of 0.5m to 2 metres.
2. The cartridge is placed at the bottom of the hole.
3. Stemming is used to firmly tamp the NoneX™ cartridge in the hole.
4. Once all the holes are charged, the area is cleared for a distance of at least 30m and guards are posted to prevent inadvertent access.

5. The cartridge wires are attached to a firing cable, which is connected to the NoneX™ Initiator.
6. The NoneX™ cartridges are fired from a safe position.

HOW TO FIND OUT MORE

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