

## **Blasting FAQs**

### **Why is There Blasting?**

The purpose of blasting is to loosen and fragment in-place rock materials to a size that can be removed, transported or crushed. Often the rocks are turned into aggregate, which is used to build and pave roads, or simply removed for utilities or to lower a site for building construction. Within construction blasting, holes commonly range from 2 to 4 inches in diameter and are drilled down into a rock mass. The holes are filled with an explosive, which is a chemical mixture that reacts at a high speed to generate gas and heat. Upon initiation, this reaction causes tremendous outward pressures and energy.

### **Why Does Blasting Sound So Loud? Why Can I Feel It?**

Two basic forms of energy are released when explosives react: shock and gas. Shock energy is the pressure transmitted outward from the hole in the rock and causes microfractures to form and travel outward for a short distance. Gas energy is pressure caused by expanding gases, created by the chemical reaction. These gases follow the path of least resistance along existing and newly formed fractures in the rock and cause the majority of rock breakage in blasting.

Energy not used for rock breakage is wasted in the form of ground vibration and airblast. Ground vibrations are seismic waves that spread out along and through the ground from the drill hole and are measured with a seismograph. Vibrations, typically far below the levels required to produce damage to plaster or windows in houses, can be felt by humans. Airblast is an airborne wave created by the blast and is observed by people as sound and pressure. Again, sound and pressure below the levels required to damage walls and windows, can be felt by humans.

Extensive research about blasting has been conducted by the United States Bureau of Mines (USBM) and the Office of Surface Mining (OSM), universities, and private groups for more than 40 years. This has led to the development of acceptable vibration standards that greatly reduce the risk of off-site impacts. Ground vibration levels have been set by law to avoid off-site damage and should feel the same as a loaded truck or bus driving by 50 to 100 feet away.

## **Why Do I Feel the Blasting?**

Most of the energy from a blast is used to break rock, but some energy will travel from the blast site in the form of ground and airwaves. Each of these can cause your house to vibrate or shake. Humans are very sensitive to all vibrations. It is possible that you will feel or hear your house shake from the blasting, even at very low levels.

## **Why Do Some Blasts Feel Stronger Than Others?**

How a blast feels depends on ground or airwaves that reach your house. These are influenced by the type of blast, the distance from the blast and the amount of explosives.

Your location on the property also affects your perception of the blast. If you are outside a house, you will tend to feel the ground vibrations in your feet and legs. Inside a house, you sense the structure and objects responding to the vibrations. You may also hear objects rattle. This is why you and your neighbors may feel or describe blast vibrations differently.

## **How Am I Protected?**

West Virginia Department of Highways (WVDOH) has stringent regulations governing blasting. First, a professional blasters license is required by the state for the individuals designing and loading shots to ensure they have a thorough understanding. Next, they require the general contractor to procure multiple other entities besides the blasting contractor that do not pose a direct relationship. A specialty engineering or monitoring is hired to conduct surveys of houses prior to blasting which protects everyone. A separate vibrations and air blast monitoring specialist is contracted to monitor the seismic events which cannot be altered by any parties. Lastly, a blasting consultant is hired to support all segments of the blasting process as well as protect the public, stakeholders, and contractors. Though a full-service company generally reduces the overall blasting costs, it does not eliminate the potential for negligence or greed. This is the main reason WVDOH protects everyone affected by the project. Dyno Consult, Wampum, Kokosing, and the State of West Virginia will use a variety of safeguards, technology and knowledge to make this inherently dangerous project safe for all parties involved.

## **How Does the Blasting Company Protect My Property?**

Typically, blasters are licensed professionals who are required by regulation or by their employers to continually obtain training. They are trained to plan, design, implement and monitor blasts. This training stresses safety in all aspects including protection of your property. Prior to blasting, pre-blast inspections/pre-blast surveys may be offered to

nearby property owners to document the existing condition of buildings and identify any sensitive structures, building components or contents. The site conditions and the inspection information are employed to design the blast to minimize effects to your property. To ensure that the blasts are working as planned, the resulting ground and airwaves can be measured with a blasting seismograph.

### **What Does a Seismograph Do?**

A blasting seismograph measures and records the ground and airwaves from a blast. The information is reported as waveforms, also known as time history records. Time histories show how the strength (amplitude) of the waves varies over time. Amplitudes are reported as particle velocity (inches per second) for ground waves and pressure (pounds per square inch) or decibels for airwaves.

Another important characteristic of the time history is frequency. Frequency is the number of complete waves that pass by in one second. It is reported in cycles per second or hertz. Both amplitude and frequency are needed to describe the motion from ground and airwaves. The blasting seismograph information is used to show compliance with regulations or specified limits and to evaluate blast design performance. Most importantly, it verifies that the ground and air vibrations are within standards set to protect structures.

### **What Are Safe Vibration Standards for Blasting Near Homes?**

In North America, safe vibration standards are based on scientific studies conducted by the U.S. Bureau of Mines (USBM). These studies recommend ground and air vibration limits based on scaled distance, peak particle velocity, air pressure and frequency. Meeting these standards will prevent even cosmetic cracking in structures. On the other hand, slightly exceeding these conservative standards will not necessarily harm a structure.

For ground vibrations, the standard is a function of frequency and peak particle velocity. At low frequencies, the limit is 0.5 inches per second (in./sec.). At high frequencies, the limit is up to 2.0 in./sec. For the best representation of the standard, see the graph showing the USBM recommended limits.

For air vibrations, the standard is a function of pressure that is most often reported as decibels with a common limit of 133 decibels (dB).

A blasting seismograph is one tool that can be used to document compliance with these standards. Another method sometimes used is a minimum scaled distance which is a relationship of explosive quantities and distance.

### **Can You Alter the Data on the Seismograph?**

No. Blasting seismograph data is stored digitally and coded internally to prevent tampering. The data is printed with proprietary software from the manufacturer.

### **Why Don't You Monitor the Vibrations Inside My House?**

Research has shown that it is more consistent to measure the ground waves entering the structure. Therefore, the seismograph sensor is attached to the ground outside your house. By installing the sensors outside, the measured vibration levels can be compared with known safe limits, existing regulations or industry standards.

### **What Does the Seismograph Reading Mean on the Richter Scale?**

The two scales are not related and cannot be interchanged. A blasting seismograph simply reports how much the ground vibrates in one particular location. It measures the intensity of ground motion. This measured intensity will be stronger if the seismograph is close to a blast and lower if the seismograph is far away. In blasting, the unit of measurement we use to describe this motion is peak particle velocity.

The Richter Scale reports the power of an earthquake or its magnitude. It's an estimation of the energy released at the source. In blasting, it would equate roughly to the total weight of explosives used in a blast.

Earthquake scientists do use seismographs to measure the intensity of the ground waves at different locations and then calculate a Richter Scale magnitude. This value is based on two things: how far the seismograph was from the earthquake and the intensity of the ground waves at numerous seismograph locations.

### **Is My House in More Danger Because It's on the Same Rock Ledge That They're Blasting?**

Ground waves change as they pass through different kinds of materials, and in general, the strength (amplitude) decreases rapidly as it moves farther from a blast. This happens regardless of whether they follow the same rock layer or whether that layer changes. As these waves reach your property, your house will be protected if the strength of the

vibrations are within allowable limits. These limits are conservatively set to protect surrounding houses regardless of the underlying material.

### **Will the Blasting Vibrations Damage My Foundation?**

The foundation is the strongest part of a house. Vibration standards are designed to protect the weakest parts of the house, such as plaster and drywall. Ground vibrations strong enough to crack foundations consisting of concrete and masonry would far exceed the limits set by typical standards.

### **Will the Blasting Vibrations Damage My Water Well/Cistern/Septic Tank?**

Below-ground structures are confined in the ground and can only move as much as the ground itself moves. They respond less to the ground waves than a house or other buildings above ground. Therefore, standards that protect houses will also protect below-ground structures.

### **Will Blasting Cause Soil Settlement?**

Only unusual soils like very loose, saturated sands are susceptible to settlement from ground vibrations. Even where these soils are present, typical blasts do not create conditions which cause settlement due to the short duration and relatively low amplitude of the ground waves.

### **How Long After Blasting Can My House Be Affected?**

Vibration energy is not stored in the house and has no potential to be cumulative. Each blast affects your home as a single event and rarely lasts for more than a few seconds. As ground and airwaves pass, the house will begin to vibrate. When the ground and airwaves end, the house will stop vibrating and there will be no further effect from the blast.

### **Can Repeated Blasting Over Long Periods of Time Affect My Home?**

This question relates to the concept of structural fatigue, which has been studied by the USBM. In one study, a house was intentionally shaken to find the fatigue limit. Over 50,000 cycles of motion were needed to cause a cosmetic crack. For most blasting projects, the total number of significant ground wave cycles reaching a house is fewer than 1000. Vibration limits have been set accordingly.

## **Doesn't the Pre-Blast Inspection/Pre-Blast Survey Only Protect the Blaster?**

The pre-blast inspection/pre-blast survey protects both the homeowner and the blaster by documenting the condition of the home before blasting. After blasting has started, any suspected changes that are found can be compared to the initial condition.

## **I Found a Crack that Wasn't Noted on the Pre-Blast Inspection/Pre-Blast Survey. Does This Mean That Blasting Caused It?**

An undocumented crack isn't necessarily the result of blasting. There are other factors to consider in determining whether blasting caused any crack. For example, environmental effects such as temperature, humidity and wind, as well as homeowner activity may contribute to cracking. On rare occasions, a crack may be the result of blasting if ground or air vibrations exceed recommended standards.

## **How Can I Tell if this Crack/Nailpop/Water Leak Etc. is from Blasting?**

A blasting specialist needs to look at the blast and seismograph records to determine the intensity levels of ground and air vibrations at your home. Based on the estimated or recorded vibration levels at your house, as well as other factors, it can be determined whether blasting could have been responsible.

## **Since Blasting Didn't Cause the Damage, Then What Did?**

There are many possible causes. Every day, construction elements of your house shrink and swell from environmental changes. And movement occurs from human activities such as opening and closing doors and windows, hanging pictures on a wall or simply walking through the house.

Continued research has shown that changes in temperature, humidity and soil moisture can yield greater changes to a structure than ground and air vibrations from a blast that are within recommended standards.

## **How Will the Blasting Affect My Pets?**

Pets, like humans, are sometimes startled by the sound of a blast or warning signals, just as they might be startled from thunder. Like humans, animals are subjected to a variety of vibration sources and events each day with no long-term effect.

## **Are There Blasting Signals and Warnings?**

Blasting zone signs will be located at all site access points and entryways. Typically, it is required that anyone attempting to enter checks in with the blaster in charge. Prior to the blast loud horns will be heard.

## **Who Do I Contact with Questions?**

In the event of an issue or suspected blasting damage, please contact the project at [info@jeffersonroadwv.com](mailto:info@jeffersonroadwv.com). We can and will assist with your concerns as well as evaluate the propensity for blasting damage. The most common complaint is that something was cracked after blasting, though the crack had been there for years and owners only started looking near or after blasting began. If grass, dirt, dust, and other interdependent structural movements occur it is highly unlikely to have blasting damage. The blasters from Wampum Hardware pride themselves in designing, monitoring, and safeguarding every single one of its blasts. In the event of an issue please reach out to the email provided above or, if not satisfied, the West Virginia Fire Marshal's Office.