

## SECTION 00335 - BLASTING METHODS AND PROTECTION OF EXCAVATION BACKSLOPES

*(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [purple text] above a subsection, paragraph, sentence, or bullet, then include it in the Project. Delete all purple text before preparing the final document. All other modifications to this Section will require ODOT Technical Resource and State Specifications Engineer approval.)*

~~*(Use the following lead-in paragraph when none of the following subsections are included in the Project.)*~~

~~Comply with Section 00335 of the Standard Specifications.~~

~~*(Use the following lead-in paragraph when any of the following subsections are included in the Project.)*~~

Comply with Section 00335 of the Standard Specifications modified as follows:

**00335.01 Definitions** - Replace the paragraph that begins "**Buffer Row** - In multiple-row ..." with the following paragraph:

**Buffer Row** - In multiple-row blasts where perimeter control blasting techniques are used, the first row of production holes immediately adjacent to and drilled along a plane parallel to the perimeter control blast line. The Buffer Row is located between the production holes and the perimeter controlled blast line.

Replace the paragraph that begins "**Presplitting** - A Perimeter Control ..." with the following paragraph:

**Presplitting** - A Perimeter Control Blasting method where the perimeter row of blast holes are drilled along the plane of the specified final excavation backslope and that utilizes reduced drill hole spacing and reduced diameter explosives decoupled from the drill hole wall, and whose initiation precedes the initiation of the adjacent production holes by a minimum of 25 milliseconds.

Replace the paragraph that begins "**Trim (Cushion) Blasting** - A perimeter ..." with the following paragraph:

**Trim (Cushion) Blasting** - A perimeter control blasting method where the initiation of the perimeter row of blast holes drilled along the plane of the specified final excavation backslope follows the initiation of the adjacent production holes within 25 to 75 milliseconds, if production holes are being employed in the blast.

**00335.10 Materials** - Replace this subsection, except for the subsection number and title, with the following:

Furnish all explosives and blasting caps that are no more than 1 year old. Furnish blasting caps from one lot number.

**00335.40(a) General** - Replace the bullet that begins "**Production Blasting** - Design blasting ..." with the following bullet:

- **Production Blasting** - Design blasting in the Rock mass to be excavated to control flyrock, minimize ground vibration and air blast, and result in loosened and fragmented in-place Rock of a size that can be removed, transported, or crushed to produce specified products. Lay out production blast holes in a consistent pattern that does not affect the perimeter control blast holes. Where production blast holes are made adjacent to Highways with specified closure restrictions, do not exceed the Contractor's ability to remove the volume of blasted material from the adjacent Highway within the specified closure time.

**00335.40(d) Blasting Plan** - Replace the paragraph that begins "Provide a separate blasting plan ..." with the following paragraph:

Provide a separate blasting plan for each cut that requires blasting, prepared by a person qualified and experienced in blasting Work. Include in each plan individual major Rock cut areas or Rock production from a Material source. Similar minor Rock cut areas of less than 50 cubic yards, as well as Utility and culvert trenches, may be covered as a group in one generalized blasting plan.

Replace the paragraph that begins "The blasting plans will be ..." with the following paragraph:

The Engineer will review the blasting plans and discuss any concerns with the Contractor. Submit any proposed changes to the blasting plans in writing to the Engineer for review before implementation. Submittal of blasting plans is for quality control and record-keeping purposes.

Replace the paragraph that begins "Each blasting plans shall ..." with the following paragraph:

Include the full details of the drilling and blasting patterns, vibration, flyrock, and noise reduction methods, blast area security measures and traffic control the Contractor proposes to use, in each blasting plan and provide the following information:

**00335.40(f) Blasting Test Sections** - Replace the paragraph that begins "If the results of the test ..." with the following paragraph:

If the results of the test shots are unacceptable revise the methods, techniques and procedures, at no additional cost to the Agency, so that the results achieved are acceptable. No further drilling and blasting is allowed until the revised methods are reviewed according to 00335.40(d) and verified by additional test shots.

**00335.40(g) Blasting According to Plan** - Replace the paragraph that begins "After the Engineer has reviewed ..." with the following paragraph:

After the Engineer has reviewed the blasting plan and determined that test sections have demonstrated acceptable results, perform all perimeter controlled and Production Blasting according to the plan that produced acceptable results. Notify the Engineer when any changes in conditions or results are observed. On the Day of each blasting occurrence and before detonation of the blast, the supervisor or blasting specialist in charge is required to certify, in writing, that the shots being carried out are consistent with the reviewed blasting plan.

**00335.40(h) Blasting Report** - Replace the bullet that begins "A copy of the color video ..." with the following bullet:

- A copy of the color video recording of the blast area(s), with sound, high definition (at least 1080p resolution, 24 fps), in a format commonly used for viewing with a computer or DVD player. Show an unobstructed view of the blast area, framed to show both above and below the blast area. Begin recording at least 10 seconds before the blast and continue recording until there is no visible dust. Use a free-standing recording device that is not a cell phone or similar device, as approved by the Engineer. Submit the type of recording device to be used at least 7 Calendar Days before the blast.

**00335.41(a)(1)** Replace this subsection, except for the subsection number, with the following:

Attach mechanical devices to all drilling Equipment used to drill the presplit holes to determine, within an accuracy of 1 degree, the angle that the drill steel enters the Rock.

**00335.41(a)(5)** Replace this subsection, except for the subsection number, with the following:

Ensure the length of presplit holes for any individual lift does not exceed 30 feet unless the Contractor can demonstrate to the Engineer's satisfaction that hole alignment can be maintained within the above tolerances. Upon satisfactory demonstration, and with written permission of the Engineer, the length of holes may be increased to a maximum of 60 feet. If more than 5 percent of the presplit holes are misaligned in any one lift, reduce the height of the lifts until the 9-inch alignment tolerance is met.

**00335.41(a)(7)** Replace this subsection, except for the subsection number, with the following:

When the cut height will require more than one lift, a maximum offset of 18 inches between lifts is allowed to allow for drill Equipment clearance. Adjust the Slope angle of lower lifts to compensate for drill offsets and any drift that may have occurred in upper lifts.

**00335.41(a)(8)** Replace this subsection, except for the subsection number, with the following:

Use only explosives manufactured specifically made for Presplitting in the presplit holes. Furnish explosives for presplit holes with a maximum diameter not greater than half the diameter of the presplit hole. Bulk ammonium nitrate and fuel oil (ANFO) is not allowed in the presplit holes.

**00335.41(c) Buffer Row** - Replace this subsection, except for the subsection number and title, with the following:

Locate the buffer hole line a minimum of 3 feet away from the perimeter control blast line, or 1 foot for every inch of buffer hole diameter, whichever is greater. Space Buffer Row holes 3 to 5 feet center-to-center. Ensure the explosive load in buffer holes does not exceed 50 percent of the full explosive load that could be placed in a 3-inch production hole. Initiate the buffer holes in a delayed sequence toward a free face.

*(Use the following paragraph and subsection .44 when directed by the Geotechnical Group.)*

Add the following subsection:

**00335.44 Blasting Consultant** - Retain a recognized blasting consultant to assist in the blast design. ~~The~~ Provide a consultant ~~shall be~~ who is an expert in the field of drilling and blasting who specializes in providing blasting consulting services. ~~The~~ Provide a consultant ~~shall that is~~ not ~~be~~ an employee of the Contractor, explosives manufacturer, or explosives distributor. A list of approved blasting consultants may be obtained from the Engineer.

If the proposed blasting consultant is not on the approved list, submit the credentials of the proposed blasting consultant not later than the preconstruction conference. Use the blasting consultant only after approval is obtained from the Engineer and before beginning any drilling and blasting work. ~~The blasting consultant shall make~~ Perform an on-site inspection of the Project Site with the Engineer and the blasting consultant before developing a blasting plan. ~~The blasting consultant shall m~~ Make additional on-site inspections of the Project Site with the Engineer and the blasting consultant before revising a blasting plan, before all additional blasts with different conditions than those described in the originally submitted blasting plan, and after any unacceptable test blasts, unless otherwise directed. Provide A ~~all~~ blasting plans, including revisions, ~~shall be approved,~~ in writing, by the blasting consultant.

Submit the consultant assisted blast design to the Engineer according to 00335.40(d).

*(Use the following paragraph and subsection .45 when directed by the Geotechnical Group.)*

Add the following subsection:

**00335.45 Vibrations Specialist** - Provide a qualified vibrations specialist in vibration monitoring and analysis using seismographs to confirm the safe vibration and air overpressure limits. Submit documentation of prior experience for all personnel involved in monitoring. ~~The~~ Have the vibrations specialist ~~shall also~~ interpret the seismograph records to ensure that the seismograph data is effectively utilized in the control of the blasting operations with respect to the existing Structures.

*(Use the following paragraph and subsection .46 when directed by the Geotechnical Group.)*

Add the following subsection:

**00335.46 Vibration Control and Monitoring** - Control ground vibrations by using properly designed blast hole patterns, delay sequences, stemming, and allowable charge weights per delay. Base the allowable charge weights per delay on ground vibration levels ~~which that~~ will not cause damage. Establish allowable charge weights per delay by carrying out test blasts and measuring ground vibration levels. Perform test blasts according to 00335.40(f), modified as required to limit ground vibrations to a level ~~which that~~ will not cause damage.

Monitor each blast with an approved seismograph located, as approved, between the blast area and the closest Structure, facility, or Utility subject to blast damage. ~~The Provide and use a~~ seismograph ~~used shall be~~ capable of recording particle velocity for three mutually perpendicular components of vibration in the range generally found with controlled and production blasting.

Operate the seismographs according to the recommended guidelines of the International Society of Explosives Engineering Seismograph Section, titled *ISEE Field Practice Guidelines for Blasting Seismographs*. The applicable guidelines are those contained in the current publication on the date the Project is advertised.

Do not allow peak particle velocity of each component to exceed the safe limits of the nearest Structure subject to vibration damage as follows:

Structure	Maximum Peak Particle Velocity at the Structure (Inches/Second)
Standard Construction Timber Frame, Brick, and Concrete Buildings .....	2.0
Reinforced Concrete Structures .....	4.0
Steel Structures.....	4.0
Buried Utilities .....	2.0
Wells and Aquifers .....	2.0
Green Concrete (Less than 7 Days).....	1.0

If the vibration levels exceed the limits, immediately report the measurements to the Engineer.

*(Use the following paragraph and subsections .47 when directed by the Geotechnical Group.)*

Add the following subsection:

**00335.47 Air Overpressure and Noise Control** - Install an air overpressure monitoring system of the type specifically manufactured for that purpose between the main blasting area and the nearest Structure subject to blast damage. Limit air overpressure to 133 dBL (0.013 psi) at nearest Structure, facility, or other designated location. Use appropriate blast hole patterns, detonation systems, and stemming to prevent venting of blasts and to minimize air overpressure and noise levels produced by the blasting operations. Lower the air overpressure limit if it proves too high based on damage or complaints. If the air overpressure levels exceed the limits, immediately report the measurements to the Engineer.

*(Use the following paragraph and subsections .48 when directed by the Geotechnical Group.)*

Add the following subsection:

**00335.48 Vibration and Air Overpressure Monitoring Report** - ~~Furnish~~ Provide a vibration monitoring report for each shot before the next blast that includes the following:

- Manufacturer, model, and serial number of blasting-type seismograph for each monitoring location.
- Name of qualified seismograph operator and interpreter.
- Distance and direction of recording station from blast area.
- Geophone coupling method.
- Maximum particle velocity and peak frequency of each component.
- Maximum value of air overpressure and the peak air overpressure frequency.
- A dated and signed copy of time-histories of all seismograph and air overpressure monitoring system readings.

**00335.90 Payment** - Replace the paragraph that begins "Payment will be payment ..." with the following paragraph:

Payment will be payment in full for furnishing and placing all Materials, and for providing all Equipment, labor, and Incidentals necessary to complete the Work as specified.