

**SECTION 22153  
ROCK REMOVAL (AS REQUIRED)**

**PART 1 - GENERAL**

**1.1 INDEX**

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1.2 GENERAL

- A. This section provides the specifications for removal of rock. The project name, scope of work, definitions and other general conditions and requirements are specified in Section 22010 – General Technical Conditions.
  - 1. Work included for the removal of rock is specified as drilling, blasting, removal and disposal of rock to the lines and grades shown on the Project Plans.
  - 2. Rock removal is to be completed by the Contractor. Any rock removal outside of pole hole drilling will typically be completed by hydraulic excavation hammer. Blasting is generally the last method attempted for rock removal.
  - 3. Rock Drilling for pole holes is described in Part 3.5.
  - 4. Any deviations from this Specification requires Owner’s review and approval.
- B. Refer to Section 22010 Part 2 for all requirements associated with materials provided by the Owner which are installed by the Contractor.

1.3 REFERENCES

- A. NFPA 495 – Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.
- B. State of Vermont, Agency of Transportation Safety – Rules and Regulations for storage, transportation and use of explosives and blasting agents.
- C. Occupational Safety and Health Act
- D. Vermont Agency of Natural Resources – Best Management Practices for Blasting Activities to Avoid Environmental Contamination-2016.
- E. Latest explosive regulations regarding transfer, storage and use published by the U.S. Department of Transportation, and the Bureau of Alcohol, Tobacco, and Firearms.

1.4 PERMITS

- A. All required federal, state and local permits for blasting and explosives shall be obtained and paid for by the Contractor. Copies of such permits shall be furnished to the Owner before any blasting operations may be started.

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- B. All blasters, blasting foremen, and helpers shall be properly qualified and licensed in accordance with the applicable laws and regulations of federal, state and local governments. Copies of such licenses shall be furnished to the Owner before any blasting operations may be started.

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**PART 2 – PRODUCTS**

**2.1 EXPLOSIVES**

- A. The explosives used shall be of such quality and power and shall be used in such locations as will neither open seams nor crack or damage the rock outside of the prescribed limits of excavation.

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**PART 3 – EXECUTION**

**3.1 EXPLOSIVES AND BLASTING**

- A. General – The Contractor or Sub Contractor must follow all applicable rules and regulations regarding explosives from all applicable agencies. The Contractor shall use the utmost care in the use of explosives necessary for the prosecution of the work, so as not to endanger life or property. All blasting operations shall be conducted by experienced personnel only. The Contractor’s blasting supervisor shall be subject to the Owner’s approval. No explosives shall be stored on the jobsite overnight. All vehicles used to transport explosives and such storage places as power magazines shall be clearly marked “Danger – Explosives” and shall be in the care of competent watchmen at all times. No battered holes, other than where indicated by the Project Plans, shall be used without the approval of the Owner.
1. Before conducting electric blasting operations in the vicinity of transmission lines, the Contractor shall check for stray ground currents. Care should be exercised when conducting the stray current tests to avoid contacting the high-voltage lines with test wires or equipment.
  2. If hazardous stray and/or induced currents above 50 milliamperes are detected, or if the shot point cannot be relocated to insure the blast wiring will not be thrown over power lines, detonating cord with MS nonelectric surface and in-hole delay detonators should be used.
- B. Submittals – The Contractor shall submit to the Owner prior to the commencement of blasting operations, plans containing materials and methods of operation for rock removal. The Contractor shall be required, before each blast, to submit a shot proposal in rock excavation work to Owner. The proposal shall be made on an Owner approved form which shows for each blast the number of holes, the depth of each hole, and the delay number max. Lbs. per delay and the amount of explosive for each hole. Review of the method of blasting, the strength and the amount of explosives and provisions for protection of life and property will not relieve the Contractor of his responsibility in the blasting operations.
- C. Explosives – Caps or other exploders or fuses in no case shall be stored, transported or kept in the same place in which dynamite or other explosives are stored, transported or kept. The methods of transporting and handling explosives and the precautions taken to prevent accidents shall be subject to the provisions of these Specifications and review by the Owner. However, such review by the Owner shall not relieve the Contractor of liability in accordance with the General Terms and Conditions herein, for injuries to, or deaths of persons or damage to property caused by blasts, blasting or explosives.

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- D. All necessary precautions shall be taken in blasting operations to preserve the rock outside the lines of excavation in the soundest possible condition. Blasting shall be done only to the lines and grades shown on the Project Plans or approved by the Owner. Blasting operations shall not be carried out within 10 feet of the existing structures. Rock removal within 10 feet of the existing structures shall be by mechanical methods. Particle velocities due to blasting shall be limited to a maximum of 1 inch per second, as measured at the nearest structure. Overpressure values shall be limited to a maximum of 134 dB, also measured at the nearest structure.
- E. The firing of systems or blasts shall be controlled by the use of delay exploders. Millisecond delay firing shall be used in all blasting operations except in holes for presplitting, unless otherwise approved by the Owner. As the excavation for the structures approaches the final lines, the depth of holes for blasting and the amount of explosives used per hole shall be progressively reduced. Whenever, in the opinion of the Owner, further blasting may injure the rock or existing structures, the use of explosives shall be discontinued and the excavation shall be completed by wedging, barring, channeling, line drilling, broaching, or other suitable methods.
- F. Records – In addition to the requirements of the Specifications for handling and storing explosives, the Contractor shall maintain an inventory for storage and withdrawal of powder stock and detonators and in addition to any other agencies requiring notification; the Owner shall be notified immediately of the loss or theft of explosives. The Contractor shall provide such reasonable and adequate protective facilities as may be necessary to prevent the theft of explosives and to minimize hazards of subversive action or sabotage to property. Only experienced persons properly cleared by all other agencies, and subject to the Owner’s approval, shall be permitted to handle explosives. The Contractor shall not leave explosives on the jobsite at the end of the work day. The Contractor shall bring a one-day supply of explosives to the site at the beginning of the day.
- G. Blasting – Blasting will be permitted only when proper precautions are taken for the protection of persons, the work, and public or private property. Any damage to the work, or to public or private property by blasting, shall be repaired by the Contractor, to the satisfaction of the Owner, at the Contractor’s expense. Due to the close proximity of existing structures the Contractor will be required to take the following protective measures in blasting:
1. Prior to the start of blasting operations the Contractor shall make, or have made an inspection of all properties within an appropriate distance to the blast site to determine pre-existing deterioration and damage. Accurate records with written description and photographs of all potential problem areas shall be made so as to provide a record against future damage claims. One copy of the survey shall be provided to the Owner for record purposes. The Contractor shall be liable for all damage to property caused by his blasting operations.

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2. All blasting shall be done in such a manner as to minimize vibrations that reach surrounding structures. Particle velocity limit measured at the existing structure shall not be greater than previously specified herein.
  3. The Contractor shall insure that qualified personnel perform blast monitoring using properly calibrated and positioned seismographs for each blast, a copy of which will be maintained in the Owner's project office. Data must include seismograph location, distance away from blast, peak particle velocities, frequencies, overpressure, and time of reading. This monitoring of blasts by the Contractor will not preclude the Owner from taking their own seismograph records or relieve the Contractor of their insurance responsibility. All costs incurred by the Contractor in taking seismographs of their blasting or other investigations shall be borne by the Contractor.
  4. Owing to the close proximity of existing structures to the excavations and the necessity of keeping blasting vibration and overpressure to a minimum, the Contractor shall, prior to the start of excavation work, obtain the service of a blasting expert to determine hole sizes, hole spacing, the amount and distribution of explosive charges within the holes, stemming needs, and matting requirements. Trial blasts shall be made to determine the most satisfactory blasting pattern.
  5. The Contractor shall provide and use approved blasting mats.
  6. Millisecond delay firing shall be used in all blasting operations except presplitting.
  7. No blasting shall be allowed between 6:00 PM and 7:00 AM.
- H. Blasting Warning – The Contractor, at their own expense, shall erect proper signboards of adequate size stating that blasting operations are taking place in the area, and such signs shall be clearly visible to all pedestrian and vehicular traffic entering the area. A check of the area entirely surrounding the blast site must be performed by the Contractor, to include areas not necessarily visible from the immediate blast site (over ridges, behind areas of heavy tree cover, etc.) immediately prior to the blast, for at least the distance that fly rock could be expected to travel in the event of an unusual detonation or unexpected hole conditions, or to a matting failure. The Contractor shall establish a reliable warning system, incorporating the standard audible signals adopted for the site, to insure that all personnel in the area are properly warned of the impending detonation of explosives.
- I. Radio Transmitters – Radio transmitters shall not be permitted in the immediate area of blasting operations, unless properly locked and sealed. (Refer to table of minimum distances recommended and published by the Institute of Makers of Explosives, 250 East Forty-Third Street, New York 17, New York).

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- J. A documented post blast inspection must be carried out after each blast, immediately following the blast, before any non-blasting related personnel are allowed back into the blast site area. All surface wiring/tubing remaining from the blast is to be removed and disposed of properly. If there are any signs of a misfire or incomplete detonation, immediately begin the required steps to correct the situation according to Standards contained in the applicable regulations, and notify the Owner before the end of the shift.
- K. Measurement and Payment – No separate measurement and payment for drilling, blasting, powder, exploders or caps, including storage and protection of and watchmen for same, shall be made. Compensation for this work and these items will be paid for on a lump sum basis under the appropriate bid item on the Proposal Form.

Payment Limit Lines – For unit price extra work – The payment limit lines for ledge/rock excavation are as follows:

Open Rock Removal:

- Vertical: to the lines/limits as shown on the Project Plans
- Horizontal: to the grades/elevations as shown on the Project Plans

Structural Rock Removal:

- Vertical: 1.0' outside the neat lines as shown on the Project Plans
- Horizontal: 6" below the grades/elevations as shown on the Project Plans

**3.2 PRESPLITTING**

- A. The presplitting technique of controlled blasting may be required along the finished vertical and sloped planes of bedrock excavations, as shown on the Project Plans, or as required by Owner. Test blasting at the site along exterior surfaces to be presplit shall be conducted to determine the hole size or sizes, hole spacing, the amount and distribution of explosive charges within the holes and the amount and locations of stemming that will produce satisfactory bedrock faces with a minimum of drill holes and explosives. Experimentation shall be done initially by the Contractor and may be required by the Owner at any time as the work progress if satisfactory results are not being obtained. Holes for presplitting shall be drilled along the outside neat dimension lines for bedrock excavation. All charges in the presplit hole shall be detonated simultaneously before the rock mass inside the excavation line in the same lift is blasted or otherwise loosened. Presplitting at all times shall be completed 50 feet or more ahead of the loosening of the bedrock mass to be excavated, unless approved by Owner in advance.
- B. The holes shall be drilled to final grade of benches, insofar as possible. Where the vertical faces are too high to drill in a single lift, insets will be permitted, but the inset distance shall be the minimum practicable in each instance. The lowest points of the inset drill holes shall be at the required dimensions of the excavation. The locations



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and amounts of insets for holes for sloping surfaces shall be approved by the Owner for each case before presplitting operations are started. Care shall be exercised at all times to insure that drill holes are in the required finished excavation surface.

- C. Measurement for payment for presplitting will be made of the neat surface areas of bedrock presplit as shown on the Project Plans or as directed by the Owner.
- D. Payment for presplitting will be made at the unit price per square foot bid in the schedule, which payment shall cover all costs of drilling, blasting, and trimming the bedrock faces.

**3.3 DRILLING NOISE AND DUST CONTROL**

- A. Noise from drilling operations shall be minimized as much as possible. Pneumatic drills using a muffled system or hydraulic drills shall be used.
- B. Low noise, sound enclosed, or “whispered” compressors shall be used at all times with pneumatic drilling equipment.
- C. All drilling equipment shall utilize water or a dry filter dust control system to control the dust originating from drilling operations.
- D. Dust from drilling operations shall also be controlled in accordance with the applicable provisions of the Department of Labor; Safety and Health Regulations for Construction.
- E. Sufficient precautions shall be taken to prevent drill dust from entering the neighboring buildings where damage to existing operations might result.

**3.4 SCALING OF ROCK FACES**

- A. The Contractor shall be required to remove individual protruding rock slabs and other semi-detached masses of rock from previously approved excavated vertical faces as directed by the Owner. The actual areas over which such rock slabs and loose rock are to be removed and the depths thereof shall be as directed by Owner.
- B. Nothing contained in this paragraph shall be construed to relieve the Contractor of full responsibility for the safety of persons or damage to property in any operations under these specifications. Nothing in this paragraph shall prevent the Contractor from taking any suitable steps to protect life or property or from removing material in addition to that ordered by the Owner. No additional payment will be made for the removal of any material on account of the nature, conditions or position of the material or on account of the number of times the material is handled.
- C. No special payment will be made for scaling of rock faces.

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3.5 ROCK HOLE DRILLING

- A. Access Contractor will test all pole hole locations when performing pad construction. They'll provide a weekly report to the Line Contractor of their findings.
- B. Drilling Contractor is responsible for the drilling of Rock. All Rock holes will be drilled at 30" diameter unless otherwise specified by the Project Plans or VT Transco Engineering or Field Coordinator
- C. To facilitate the timeliness of the drilling the Access Contractor may install culverts on the overburden above rock ONLY as need – The Culvert SHALL NOT extend between grade and 12" below grade after poles are set.
- D. A VT Transco **Digging Foundation Asbuilt Form** must be filled out by the Contractor and submitted to the Field Coordinator and Engineer.

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**PART 4 – ENVIRONMENTAL CONSIDERATIONS**

This section provides best management practices associated with the removal of rock developed by the State of Vermont. Nothing in the section below shall relieve the Contractor of the full responsibility of following project permits or adherence to Section 1-3 above. It is the Contractor's responsibility to contact Owner with any questions.

**4.1 EXPLOSIVES OR INITIATORS CONTAINING PERCHLORATE SHALL NOT BE USED FOR ANY PROJECT**

**4.2 DRILLING AND LOADING PRACTICES**

The blasting contractor shall use the following drilling and loading practices to minimize environmental effects.

- A. Blasthole boring logs shall be maintained by the driller and communicated directly to the blaster. The logs shall indicate depths and lengths of voids, cavities, and fault zones or other weak zones encountered as well as any groundwater conditions the driller notes (this is not a formal assessment of groundwater).
- B. Blastholes shall be within five (5) degrees of the intended orientation.
- C. Blastholes shall be drilled within one foot of the intended blast pattern.
- D. Explosive products shall be managed on-site so that they are either used in the borehole, returned to the delivery vehicle, or placed in secure containers for off-site disposal.
- E. Unpackaged/unsleeved ANFO and emulsions shall not be used if artesian or water flowing conditions are encountered.
- F. Loaded explosives shall be detonated as soon as possible and shall not be left in the blastholes overnight unless weather or other safety concerns reasonably dictate that detonation should be postponed.
- G. Loading equipment shall be cleaned in an area where wastewater can be properly contained and handled in a manner that prevents release of contaminants to the environment.

**4.3 EXPLOSIVE SELECTION.**

The following shall be used to reduce the potential for groundwater contamination when explosives are used:

- A. Explosive products shall be selected that are appropriate for site conditions and safe

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blast execution.

- B. Explosive products shall be selected that have the appropriate water resistance for the site conditions present to minimize the potential for hazardous effect of the product upon groundwater.

**4.4 AMMONIUM NITRATE AND FUEL OIL (ANFO)**

The following shall apply to reduce nitrate or other impacts when ANFO is used:

- A. Identify blastholes containing water and remove water prior to loading with ANFO.
- B. Water resistant ANFO (ANFO-WR) shall be used in blastholes that recharge with groundwater and remain wet even after pumping.
- C. ANFO should be handled in a manner to avoid spills.
- D. If spills of ANFO or other blasting agents occur at the ground surface around the blasthole collars, these shall be cleaned up promptly and the ANFO either reused or taken off site for appropriate handling or disposal.
- E. Adequate unloaded collar lengths shall be established to reduce both "blowback" when loading pneumatically and blasthole proximity effects.
- F. Proper "standoff" distance and loading vessel pressure shall be maintained to reduce "blowback" during pneumatically loading ANFO.
- G. Partially used bags of ANFO shall be resealed and returned to the explosive magazine.
- H. Loading equipment shall be cleaned in an area where the water can be properly contained and handled in a proper manner.

**4.5 BULK EMULSIONS AND SLURRY/WATERGEL EXPLOSIVES**

The following shall be applied to reduce nitrate or other impacts when bulk emulsions or slurry/watergel explosives are used:

- A. Spills of the product shall be removed from the spillage area, and either reused or taken off site for disposal.
- B. Proper loading techniques shall be followed when loading a bulk product into a wet blasthole. The bulk liquid product should be extruded into itself from the bottom of the blasthole and not into the standing water above the product.

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- C. If groundwater conditions are severe, e.g., artesian/flowing conditions, packaged explosives (emulsions, watergels, slurries, blends, cartridged, etc.) shall be used instead of bulk products or as required by the Blasting Engineer.

**4.6 BLASTHOLE STEMMING**

The following BMP's shall be followed when placing stemming in blastholes:

- A. Blastholes shall be cleaned out thoroughly using the compressed air stream from the drill when available, to remove the drill cuttings. If compressed air from the drill is not available another similar method will be used to remove drill cuttings.
- B. Drill cuttings shall not be used as stemming.
- C. Stemming shall be placed to prevent bridging, and shall be appropriately sized for the blasthole diameter.
- D. Blastholes shall be completely stemmed to prevent incomplete detonation.
- E. Weak zones, voids, and cavities shall be stemmed as decks to prevent the loss of explosive products into the bedrock.

**4.7 MISFIRES**

One or more of the following can be used to help prevent misfires:

- A. Redundant surface delays to connect blastholes if shifting mats, uneven terrain or other conditions could cause cut-offs shall be used.
- B. Double or triple priming of the blast holes shall be done as applicable depending on the depth of the hole.
- C. Using electric detonating systems shall be considered.
- D. Using programmable electronic detonating systems shall be considered.

**4.8 MUCK PILE MANAGEMENT.**

Muck piles (the blasted pieces of rock) and rock piles shall be managed in a manner to reduce the potential for contamination by implementing the following measures:

- A. Remove the muck pile from the blast area as soon as reasonably possible.

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- B. Manage the interaction of blasted rock piles and storm water to prevent contamination of water supply wells or surface water.

**END OF SECTION 22153**