

**SECTION 02318**  
**ROCK EXCAVATION**

**PART 1 GENERAL**

**1.1 REQUIREMENTS, CODES**

- A. All applicable portions of Division 1 - General Requirements shall be considered as included with this section.
- B. The following are minimum requirements and shall govern except that all Federal, Local and/or State Codes and Ordinances shall govern when their requirements are in excess hereof.

**1.2 SECTION INCLUDES**

- A. Removal of identified and discovered rock during excavation.
- B. Use of explosives to assist rock removal.
- C. Incorporating removed rock into fills and embankments.

**1.3 RELATED SECTIONS**

- A. Section 02110 – Clearing and Grubbing
- B. Section 02200 –General Earthwork for Athletic and Baseball Fields
- C. Construction Drawings

**1.4 REFERENCE STANDARDS**

- A. National Fire Protection Association (NFPA)
  - 1. NFPA 495 Code for Manufacturing, Transportation, Storage, And Use of Explosive Material
- B. All work shall be performed in accordance with all pertinent state and local, regulations, and shall conform to the State of Connecticut Department of Transportation “ Standard Specifications, for Roads, Bridges, and Incidental Construction Form 816”, Section 2.02.03-4, and OSHA 29 CFR Ch. XVII .

**1.5 ENVIRONMENTAL REQUIREMENTS**

- A. Determine environmental effects associated with proposed work and safeguard those concerns as regulated by law and local governing agencies by reasonable and practical methods.

**1.6 DEFINITIONS**

- A. “Rock Excavation” is defined as removal of igneous, metamorphic or sedimentary rock or stone, boulders over two (2) cubic yards in volume in open areas and one (1) cubic yard in volume in trenches; masonry or concrete or solid frozen soil; that cannot be removed

by rippers or other mechanical methods and, therefore, requires drilling and blasting. The word “trenches” shall mean excavations having vertical sides whose depths exceed its width, made for storm water drainage, sanitary sewer, water, and gas pipes, electric, communications, and steam conduits, and related uses.

## **1.7 SCOPE**

- A. All work shall be performed in accordance with all pertinent state and local, regulations, and shall conform to the State of Connecticut Department of Transportation “ Standard Specifications, for Roads, Bridges, and Incidental Construction Form 816”, Section 2.02.03-4, and OSHA 29 CFR Ch. XVII.
- B. The Contractor shall examine the site and may make his own subsurface explorations. Test borings have been performed and made available for information only. The Contractor shall assume all responsibility for any interpretations or for reviewing the available information. The test borings do not define top of rock for pay purposes.
- C. This Section includes furnishing all drilling, blasting and protection required to complete the work indicated on the Drawings and as specified herein.
- D. The Contractor shall perform a Preconstruction/Preblast Survey of all existing buildings and other structures located within 250 feet of the limits of all work requiring rock blasting prior to commencement of blasting. This survey is to be conducted in compliance with Section 3.03 E. of these specifications contained herein.
- E. The Contractor shall be responsible for any and all damage and/or injury from the use of explosives. The Contractor shall save and hold harmless the Owner, Architect and Engineer from any and all claims from the use of explosives. Removal of materials of any nature by blasting shall be done in such a manner and at such times as to avoid damage affecting integrity of existing construction and damage to new or existing dwellings, structures and water wells in or adjacent to the area of the work. It shall be the Contractor’s responsibility to determine the method of operation to ensure desired results and integrity of completed work. All damage caused by the Contractor’s blasting operations shall be repaired to the full satisfaction of the Owner at no additional cost to the Owner.

## **1.8 PERMITS AND LICENSES**

- A. Prior to rock excavation, Contractor shall obtain all necessary permits from regulatory agencies. If blasting is required or undertaken, the responsible Subcontractor shall be licensed in the State and shall possess a current blasting license issued by the appropriate regulatory authority and be permitted for the transportation of explosives if required.

## **1.9 SUBMITTAL**

- A. The Contractor shall provide Blasting Plan (prior to any blasting) and Monitoring Reports to the Owner and Governing Agencies for review.

## **1.10 ROCK EXCAVATION LIMITS**

- A. Rock excavation, as defined above, shall be paid for in the contract Lump Sum amount. The Contractor’s bid must include the blasting, crushing or removal, and disposal of all rock required to complete the lines and grades as indicated on the Contract Drawings. Rock excavation will be made for the following items as specified below:

1. Building, structure and wall footings, building slabs and foundation trenches to 18 inches below bottom of footing elevations and to 24 inches outside of the horizontal concrete lines shown on contract drawings for buildings and structures.
2. Open cut excavations including presplitting/line drilling.
3. Pipe trenches to a depth and width as indicated in the Contract Drawings.
4. Lawn areas to a depth of twelve inches (12") below finished grade. Overblasted rock containing significant voids shall be choked with 6-inch size crushed stone and tracked in with a dozer. Tree planting areas to a depth of four feet (4') below finished grade for a minimum width of four feet (4'). Shrub planting areas to a depth of three feet (3') below finished grade for a minimum width of three feet (3').
5. Any rock encountered and required to be removed for the construction of work not currently defined in the plans and specifications and required by the Owner due to additions of utilities and excavation grades shall be paid for at the per cubic yard rate for trench excavation and the per cubic yard rate for open cut excavation by measuring said excavation in its original position to the limit of the clearly defined vertical construction lines and the depth required by the new construction.
6. Pavement excavation to 18 inches below finished pavement surface grade.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Explosives, detonator/delay device, and blast mat materials shall be type recommended by explosive supplier and shall comply with requirements specified herein.

**PART 3 EXECUTION**

**3.1 PERMITS**

- A. Prior to blasting, all necessary permits shall be obtained by the Contractor from all necessary agencies. These permits shall include:
  1. Blasting Permit obtained from the Town of Killingworth's Fire Marshal's office.
  2. Explosives users certificate.
  3. Certificate of competency for blasting employees.
  4. Adherence to the Town of Killingworth's Fire Marshal's office regarding any and all of their specific requirements and all applicable provisions outlined in the State of Connecticut Department of Transportation "Standard Specifications, for Roads, Bridges, and Incidental Construction", Form 816", Section 2.02.03-4.
- B. In addition, the blasting Contractor shall be bonded by the State of Connecticut and shall possess both a current blasting license issued by the State Fire Marshal and permit for the

transportation of explosives. "Call Before You Dig" shall be notified at 1-800-922-4455 at least 4 working days prior to commencement of any explosive activities.

### **3.2 PREPARATION**

- A. Verify site conditions and note subsurface conditions affecting work of this section.
- B. Identify required lines, levels, and elevations that will determine extent of proposed removals.

### **3.3 ROCK EXCAVATION**

- A. Cut rock to form level bearing at bottom of field subgrade and trench excavations. Remove shaled layers to provide sound and unshattered base for footings or foundations. Contractor shall consider reuse of excavated materials on site in accordance with Section 02200. If material cannot be utilized on site, then Contractor shall dispose of material offsite at no additional cost to the Owner.
- B. If placed in embankments, perform rock excavation in manner that will produce material of such size as in accordance with Section 02200. Remove rock to allow for construction and/or installation of the site and building improvements as indicated on Construction Drawings. Remove loose or shattered rock, overhanging ledges and boulders, which might dislodge.

### **3.4 ROCK BLASTING**

- A. General
  - 1. The drilling and blasting methods and programs shall be those necessary to accomplish any and all rock excavation required for completion of the improvements shown on the Construction Drawings in accordance with the procedures specified herein. Do not use explosives as a primary means of transporting material outside the excavated prism.
  - 2. Blasting work shall be performed only with necessary permits from all regulatory authorities and after completion of the preblast survey. Blasting work shall take place only after persons in the vicinity have been notified and have reached positions of safety. Take appropriate precautions to prevent all persons from entering the blasting area. Use methods and programs that will prevent damage to, but not limited to, adjacent dwellings, structures, public domain, natural resources, habitat, existing wells and landscape features and that will minimize the scattering of rock, stumps or other debris. All affected roadways shall be inspected, cleared, and opened to traffic within 1 (one) hour of completed blasting or as required by governing authorities.
  - 3. Complete all blasting with experienced powdermen licensed to use explosives in the State.
  - 4. Conduct blasting at such (9 a.m. to 4 p.m. Monday - Friday) hours so as not to disrupt surrounding residences and businesses, and in accordance with Federal, state and local regulations and/or ordinances with regard to noise.

5. Take all precautions necessary to warn and/or protect any individuals exposed to his operations prior to any blasting. Blasting mats or other approved flyrock protection shall be employed as necessary to protect areas adjacent to blasting.
6. Develop and maintain records covering pertinent data on the location, depth and area of the blast, the diameter, spacing, depth, overdepth, pattern, amount, distribution and powder factor for the explosives used per hole and per blast; the sequence and pattern delays, and description and purpose of special methods. Provide a copy of the records to the Owner upon the Owner's request. Receipt and acceptance by the Owner of blasting data will not relieve the Contractor of his responsibility to produce satisfactory results as set forth in these specifications. Drilling and blasting shall be done only to the depth, amount and at such locations, with explosives of such quantity, distribution, and density that will not produce unsafe or damage rock surfaces or damage rock beyond the prescribed excavation limits. The Contractor shall be responsible for the cost of removal of overblast and also for the cost of placement and compaction of suitable replacement fill where overblast removal is required or occurs.
7. When a drilling and blasting program results in damage to the excavation or unacceptable peak particle velocity or frequency values as specified in Section 3.03.D. below, the Contractor will be required to devise and employ revised methods that will prevent such damage or unacceptable ground motions at no cost to the Owner. The revisions may include special methods such as presplit and zone blasting, shallow lifts, reduction in size of individual blasts, small diameter blast holes, closely spaced blast holes, reduction of explosives, greater distribution of explosives by use of decking and primacord or variation in density of explosives and chemical or mechanical splitting of the rock.

**B. Codes, Permits And Regulations**

1. Comply with all applicable laws, rules, ordinances and regulations of the Federal, State and local regulatory authorities and insurers that govern the licensing, transportation, storage, handling, use, and disposition of explosives.
2. Obtain and pay for all powder and blasting permits and licenses required to complete the work of this Section as defined in the General and Supplementary Conditions.
3. In case of conflict between regulations or between regulations and Specifications, the Contractor shall comply with the strictest applicable codes, regulations or Specifications.

**C. Explosives**

1. Take special precautions for proper use of explosives to prevent harm to human life and damage to surface structures, utility lines, or other subsurface structures.
2. Store, handle, and employ explosives in accordance with Federal, state and local regulations, or, in the absence of such, in accordance with the provisions of the NFPA and OSHA.

**D. Blasting Vibration And Limit Criteria**

1. The amount of vibration, frequency and overpressure generated by blasting shall not exceed regulatory statutes or directives established by State, local or other

authorities. Maximum peak particle velocity should not exceed 1 inch per second, up to 2 hours after blasting; 0.5 inch per second 2 to 24 hours after blasting; 1 inch per second 24 to 72 hours after blasting and 2 inches per second more than 72 hours after blasting.

2. The peak airblast overpressure measured at the location of the nearest occupied, aboveground structure (considering wind direction) shall not exceed 0.014 psi.

### **3.5 PREBLAST SURVEY**

#### **A. General**

1. Conduct a preblast survey prior to initiating any blasting work. The Contractor shall have the preblast survey performed by a registered Professional Engineer or specialized consultant licensed in the State of the work covered under this contract and specialized in conducting preblast surveys.
2. The work to be performed for the preconstruction/preblast survey will consist of documenting conditions of all existing dwellings and structures located within a minimum of 250 feet of the limits of all work requiring rock blasting prior to commencement of blasting or further if required by Federal, state or local regulations.
3. The purpose of the preblast survey is to determine the conditions of existing dwellings, structures and document any pre-existing defects and other physical factors that could reasonably be affected by the blasting. Structures such as pipelines, cables and transmission lines, cisterns, structures of historical significance, and/or structures with unusually costly or vulnerable contents shall be included.

#### **B. Examination of and Preparation for Survey:**

1. The Contractor shall contact the property owners (or their legal representative) of properties within a minimum of 250 feet of the limits of all blasting work in order to obtain permission to conduct a survey of their property. If the property owner does not grant the Contractor permission to conduct the survey, the Contractor shall contact the property owner a second time by registered mail/return receipt requested. The second request for permission to conduct the survey shall include a description of the survey to be performed and the purpose of the survey. At least 72 hours prior to start of blasting work, notify the appropriate local regulatory authority of any property owners who refuse access for the preconstruction survey.
2. Notify the property owners at least 48 hours prior to conducting the preblast survey. After completion of the survey, two copies of the preblast report will be submitted to the appropriate local regulatory authority for their reference if required. Additionally, one copy shall be kept on file at the location of the project and one copy provided to the Owner upon request.

#### **C. Method:**

1. The preblast survey shall include a detailed examination of the interior and exterior of structures located within a minimum of 250 feet of the limits of all blasting work. Color photographs, videotapes, and written descriptions shall be taken as required to document the condition of areas within the limits of the

survey area. Particular note shall be made of evident structural faults or deficiencies, or recent repairs.

D. Survey Report:

1. The Contractor shall prepare a written report summarizing the results of the preblast survey. The final written report shall be signed and sealed by the Contractor's qualified inspector. The report shall contain the following:
  - a. Location and description of each property
  - b. Descriptions of the conditions of the on-site elements
  - c. Summary of the visual inspection
  - d. Color photographs, sketches, and videotape with vocal summary
2. Provide videotapes to include supplemental information, as required. Pictorial documentation shall be of professional quality and shall be provided with a scale, where practicable. Clearly label pictorial documentation with an identification number, name of the project and the Engineer or qualified person conducting the survey, name of the property owner, date the picture or video tape was taken, and sufficient information to determine the location of the area in question.
3. The Contractor's inspector shall immediately report in writing to the Contractor any findings that, in his opinion, indicate that any structure or well will be adversely affected by the required construction and blasting.
4. If, during the course of construction and blasting, the Contractor is requested by an adjacent property owner to view alleged damage to property, the Contractor shall give written notice to the Owner prior to the Contractor's visit to the adjacent owners property.

**3.6 BLAST MONITORING**

- A. Contractor shall perform seismic blast monitoring in accordance with State and local regulations.
- B. Contractor shall provide monitoring of blasting vibrations and over-pressures to allow evaluation of compliance with the specified vibration/over-pressures to criteria. As a minimum, the Contractor will monitor each blast as follows:
  1. Monitor vibrations at the exterior walls of all structures within 250 feet of each blast location.
  2. If no structures are located within 250 feet of the blast location, monitor vibrations at three equally spaced radial points located a minimum of 250 feet from the blast locations and shall not exceed fourteen thousandths (0.014) pounds per square inch.
  3. Monitor over-pressures for all structures within a minimum 250 feet of the blast.
- C. Seismographs proposed for use on the project shall have been calibrated within the previous six (6) months to a standard which is traceable to the National Bureau of Standards. Required characteristics of seismographs are listed below:

- 1. Measure and display three mutually perpendicular components of particle velocity in directions vertical, radial and perpendicular to the vibration source after each blast>
- 2. Furnish a permanent record of a velocity per time waveform on a strip chart.
- D. If requested by the Owner, report vibration/overpressure-monitoring results to the Owner within two hours of blasting. Monitoring performed by the Contractor does not relieve the Contractor of his responsibility for control of vibration and overpressure during blasting operations.
- E. The Contractor shall implement alternative non-explosive methods in the event that the explosive methods complying with the vibration and air blast thresholds are unsuccessful in achieving the requisite rock removal.

**3.7 ROCK CUT FACE EXCAVATION**

- A. The slope of the soil above the top of any permanently exposed rock cut face shall be no steeper than 4(H):1(V) unless otherwise noted on the Construction Drawings. Slope of the rock face shall meet the requirements below and be subject to a field review by the Geotechnical Engineer.

<u>TYPE</u>	<u>SLOPE (Horizontal to Vertical)</u>
Erodable sandstone	1:1
Fractured Gneis or Schist	1:3
Sound Gneis or Schist	1:4

- B. Benches of at least ten (10) feet in width at a maximum of twenty (20) feet in elevation intervals or as noted on the Construction Drawings. The benches are to provide rock traps and divert water from the rock face.

**3.8 ROCK TRAP**

- A. Locate rock traps at the base of permanently exposed rock slopes and construct as indicated in the Construction Documents or Blasting Plan.

**3.9 OVEREXCAVATION AND BACKFILL**

- A. Over excavation, which is required to remove unsuitable natural undisturbed bedrock weakened by weathering or other cause not inflicted by the Contractor shall be immediately reported to the Owner and performed as directed by the Owner, and the theoretical lines and grades will be adjusted accordingly. Material outside the excavation limits which are disturbed due to the fault or negligence of the Contractor or due to his failure to exercise sound construction practices, shall be either replaced by him with suitable materials (earth or concrete), or bolted, or both as directed, at no cost to the Owner.

**END OF SECTION 02318**