SECTION 02900

BLASTING

PART 1 GENERAL

1.1 BLASTING REGULATIONS, CONTROLS AND RESPONSIBILITIES

1.1.1 General

In general, the Contractor shall assume that no blasting is allowed in association with the New Bedford Marine Commerce Terminal project, that rock removal in association with the Work must take place utilizing non-blasting methods as outlined within Section 02482 DREDGING, and shall bid the Work accordingly; however, should Optional Bid Item No. 0005 be approved by the Owner, blasting will be allowed in association with the Work, subject to the conditions of Section 02900 BLASTING, the USEPA Final Determination (and subsequent amendments, as applicable), the Performance Standards, as well as other conditions of the Plans and Specifications including, but not limited to, conditions within Section 02482 DREDGING, Section 02470 DRILLED ROCK SOCKETS, Section 02458 CONCRETE FILLED STEEL PIPE PILES, Section 02488 STEEL SHEET PILING, and Section 01135 WATER QUALITY MONITORING AND CONTROL.

When the nature of the material to be dredged requires blasting, the Contractor's blasting progress and methods shall be those necessary to accomplish the excavation shown on the Contract Drawings in accordance with the procedures specified herein. The Contractor shall note that an Operational Blasting Plan shall be submitted for review by the Owner, Owner’s Representative, as well as regulatory oversight authorities as noted in Part 3.9 of this Section. The Contractor will be required to make necessary plans, examinations, surveys, and test blasts to determine the quantity of explosives that can be fired without damaging property, and to thereafter control the quantity of explosives fired in any one blast to prevent injuries to persons or damage to structures, homes, utilities, vehicles, vessels moored or underway, or any property. The Contractor's blasting program shall abide by all Federal, State and Local laws and regulations, as well as the applicable permits and requirements of any regulatory authorities, which include, but are not limited to, the following applicable codes and regulations:

- Title 29 Code of Federal Regulations Part 1926, Safety and Health Regulations for Construction.
- Federal Occupation Safety and Health Act of 1970.
- Army Corps of Engineers EM-385-1-1, Safety and Health Requirements Manual.
- Institute of Makers of Explosives (IME); Safety Publications.
- Board of Fire Prevention Regulations, Code of Massachusetts Regulations, Title 527, Section 13
- The Following six letters detailing the input and requirements of the US Environmental Protection Agency:

May 20, 2013 Letter from MassCEC to EPA
June 13, 2013 Letter from EPA to MassCEC
July 24, 2013 Letter from EPA to MassCEC
August 28, 2013 Letter from MassCEC to EPA
September 6, 2013 Letter from EPA to NMFS
September 5, 2013 Letter from the US Army Corps of Engineers to EPA

1.1.2 Liabilities

The Contractor's attention is called to Article 5 of Section 00700 of the General Conditions entitled “Laws to be Observed”, which defines the Contractor's responsibilities relative to the references listed in paragraph 1.1.1. The Contractor shall assume all liability and hold and save the Owner, its representatives, officers, agents, and employees harmless for any and all claims for personal injuries, property damages, or other claims arising out of, or in connection with, the transportation, storage, and use of explosives under the contract.

1.1.3 The Contractor shall, in addition, process any and all claims of private citizens arising out of said use of explosives promptly in an acceptable time period set by the Owner’s Representative; in particular, all property damage claims shall be acknowledged by the Contractor, or his representative, and be submitted immediately as directed by the Owner’s Representative providing name of claimant, location, time and description of alleged damage, and estimated value. The claimed damage shall be inspected by the Blasting Vibration Consultant (see paragraph 3.7.3) within 48 hours following initial notification, and processed to a conclusion (honored, denied, or compromised) within 90 days after cessation of all blasting on the contract; but, in no case shall the claims remain unresolved for a period exceeding 6 months (180 calendar days). The Contractor shall submit inspection results and actions taken to the Owner’s Representative on a weekly basis.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TRANSPORTATION, STORAGE, AND USE OF EXPLOSIVES

The Contractor will be held responsible to perform the work in compliance with all applicable Federal, State, and local codes and regulations, including, but not limited to, those cited above in paragraph 1.1.1. The Contractor shall have available the documents for inspection at all times, which will pertain to the blasting operation. In case of conflict between codes and regulations, the more stringent will apply.

3.1.1 Daily Summary

The Contractor shall keep a daily record of transactions, to be maintained at each storage magazine. The inventory records shall be updated at close

of business each day and furnished to the Owner’s Representative on a weekly basis. Records shall show class and quantities received and issued, and total remaining on hand at end of each day. The remaining stock shall be checked each day, and any discrepancies that would indicate a theft or loss of explosive materials shall be reported immediately. The daily summary shall be done in accordance with the applicable regulations cited in paragraph 1.1.1. Copies of the daily inventory records shall be furnished to the Owner’s Representative.

3.1.2 Report of Loss

Should a loss or theft of explosives occur, all circumstances and details of the loss/theft will be immediately reported to the nearest office of the Alcohol, Tobacco, Firearms and Explosives (ATF), as well as to the local and State law enforcement authorities and the Owner’s Representative.

ATF Boston Field Office
10 Causeway Street, Room 791
Boston, Massachusetts 02222
Telephone: 617-557-1200

The New Bedford Fire Department should be contacted at the following address:

New Bedford Fire Department
868 Pleasant Street
New Bedford, Massachusetts 02740
Telephone: 508-991-6105, 508-991-6124.

3.2 RESPONSIBILITY

The Contractor shall be responsible for obtaining all licenses, permits, any and all fees, and the keeping of accounts and records, as well as arranging the transportation and protection of all explosives on the contract, and notifying the relevant local, state and federal authorities of its work. Should the Contractor fail to comply with above requirements, the Owner’s Representative may order a suspension of that part of work involved until the deficiencies are corrected. The Contractor's attention is also directed to subparagraph 1.1.2 "Liabilities" for additional specific liability to be assumed by the Contractor. The Contractor must supply to the Owner’s Representative all permits, licenses and approvals which are necessary for this contract as required by the regulations cited in paragraph 1.1.1.

3.3 PREBLAST PUBLIC INFORMATION MEETINGS

3.3.1 The Contractor shall schedule, publicize, coordinate, secure adequate facilities for, and conduct two Preblast Public Information Meetings prior to finalizing his Operational Blasting Plan. The meeting shall be held in New Bedford, Massachusetts. As a minimum, the meetings shall be publicized in advertisements in local newspapers, including the Standard Times, not less than two weeks prior to the scheduled meeting for a period of not less than one week. State and local agencies likely to express an interest in the project shall be contacted in writing directly, including law enforcement, fire prevention, and environmental

authorities. The Owner's Representative will solicit interest from appropriate Federal agencies. In addition, all property owners whose properties border a portion of the contract limits shall be contacted in writing directly. A post test blast public information meeting shall be conducted at the above location, if requested by the Owner's Representative.

3.3.2 The contents of the advertisements shall be approved by the Owner's Representative prior to advertisement. Copies of all correspondence publicizing the meetings shall be furnished to the Owner's Representative.

3.3.3 The purpose of the meetings is to disseminate basic project information to interested members of the public, to solicit comments from the public and evaluate proposed blasting methods in light of any valid concerns, and to identify key representatives of the Contractor and Owner's Representative who may be contacted for current project information or to report complaints. The Contractor, in conjunction with the Owner's Representative, shall prepare an agenda for each meeting to address these purposes. A public question-and-answer period shall be held at the conclusion of the public presentation if required by the Owner's Representative.

3.3.4 The Owner's Representative will participate in each meeting, and will provide reasonable assistance in planning, scheduling, and coordination with the public.

3.3.5 The proceedings of each meeting shall be recorded verbatim by the Contractor, and transcripts thereof shall be provided to the Owner's Representative. The Owner's Representative will review the transcripts, as well as any written comments that may be received, with the Contractor, and may require the Contractor to address specific comments in his Operational Blasting Plan prior to submission.

3.4 PROTECTION FOR ADMINISTRATION OF DRILLING AND BLASTING COMPLAINTS

3.5 PREBLAST SURVEY

The Contractor shall provide one person from his organization and his specialist on vibration control (Seismic specialist, see paragraph 3.7.3) to work as a team with a representative of the Owner's Representative in making a preblast structural survey. A preblast survey of the interior and exterior of all structures shall be made within a one thousand five hundred (1500) foot radius from the production blasting areas. The Contractor must notify the property owners near the blasting areas of the preblast survey as defined below. All structures that may be affected by the blasting, as well as those enumerated in paragraph 3.7.3, will be inspected and their condition documented. Any existing outstanding architectural defects such as broken or fallen plaster or broken windows shall be photographically documented by digital video and with a minimum 7 mega-pixel digital camera with zoom capabilities. The Contractor shall provide methodology to be used in conducting the preblast survey and listing of structures, determined from the survey to be sensitive, with reasons for these structures being sensitive, within 1500 feet from the blasting areas. Photographs will be taken of all the surveyed structures. The Contractor will determine the elevation of all piers and record with photographs all floating vessels that are in the vicinity and that are vulnerable to wave propagation.

The Contractor shall certify that the survey was prepared prior to the start of any blasting under this contract. A copy of the Preblast survey shall be submitted for the Owner's Representative’s approval in conjunction with the Operational Blasting Plan.

3.5.1 Prior to test blast program and Blasting activities, the following actions regarding property owners located within 1,500 feet of proposed blasting locations are required:

A. Newspaper Advertisements-Advertisements in the local newspapers informing the public about the location, date and time of the Public Information Meetings.

B. Public Information Meetings

C. Door hangers providing information about the blasting and the request for pre-blast property inspection surveys to the property owners residing within 1,500 ft from the blast site.

D. Requests by first class mail to all property owners for pre-blast property inspections within the 1,500 foot radius of blasting

E. Where there has been no response to first requests, second requests by certified letter for pre-blast property inspections.

F. Where there has been no response to second requests, the Contractor shall inform the property owner by certified mail that he has not responded to both requests for inspections and will provide the date and time that blasting will be commencing.

3.5.2 During blasting activities, the process for addressing citizens complaints will be as follows:

A. Citizen complaints will be received through the Contractor.

B. The caller's name, address, phone number, and pertinent information will be recorded in a master complaint log to be maintained by the Contractor.

C. Contractor shall schedule and perform an inspection of the complainant's property within five calendar days of the date of the complaint.

D. The Contractor shall issue an acknowledgement letter not later than seven days from the inspection date as a follow up to the inspection and update the complainant as to the status of the final determination of the inspection results.

E. The Contractor shall provide to the complainant a final determination letter honoring, denying the claim within 90 days after cessation of all blasting on the contract. In no case shall the claims remain unresolved for a period exceeding 180 calendar days.

F. Inspection results, actions taken and all correspondence regarding the complaints shall be furnished to the Owner’s Representative.

3.6 SAFETY

3.6.1 Drill Boat or Barge Safety

3.6.1.1 All onboard magazines shall be permanently secured to the deck as required by the Coast Guard.

3.6.1.2 No high explosives shall be stored on the boat or barge deck in the open except for the one case that is to be loaded immediately into the bore holes. Any explosives remaining on deck shall be returned to the day magazine prior to the firing of any blast.

3.6.1.3 The firing line reel or spool shall be mounted on the rig in a manner that it cannot be lost overboard. An approved blasting machine shall be used for detonation regardless of the number of caps used. An electric blasting system shall not be used.

3.6.1.4 The amount of explosives permitted aboard the drill boat at any one time will be subject to the approval of the ’Owner's Representative, but in no case shall such amount exceed the amount permitted by appropriate codes and regulations.

3.6.1.5 The Contractor shall make necessary arrangements to prevent damage to any vessel, moored or underway, building or structure and preserve the crew or occupants thereon from exposure to injury as a result of the Contractor's operations. The Owner’s Representative may require additional arrangements.

3.6.1.6 The Contractor shall have a certified marine survey of all floating plant proposed for underwater blasting work on this contract performed prior to starting any work, and shall provide the results to the Owner’s Representative.

3.6.1.7 Automatic fire extinguishers of an appropriate type shall be installed on air compressors and in all engine compartments aboard vessels (drill boats, barges) where explosives are stored, handled, and used.

3.6.1.8 Remote fuel shut-offs and fire signaling devices shall be provided aboard the drill boats.

3.6.1.9 Loading of tubes and casings of dissimilar metals shall not be used because of possible transient electric currents from galvanic action of the metals and water.

3.6.1.10 Only water resistant blasting caps and detonating cords shall be used for all marine blasting. Loading shall be done through a non-sparking metal loading tube when a tube is necessary.

3.6.1.11 No blast shall be fired while any vessel under way is closer than 1,500 feet from the blast area. Those on board vessels or craft moored or anchored within 1,500 feet shall be notified before a blast is fired.

3.6.1.12 No blast shall be fired while any swimming or diving operations are in progress in the vicinity of the blasting area. If such operations are in progress, signals and arrangements shall be agreed upon to assure that no blast shall be fired while any person is in the water.

3.6.1.13 A red blasting flag, 18 inches by 30 inches with the word “EXPLOSIVES” thereon in white letters, at least six inches in height, shall be readily visible in all directions.

3.6.1.14 The storage of explosive material shall be in accordance with 527 CMR 13.05(4).

3.6.1.15 When more than one charge is placed in under water, a float device shall be attached to an element of each charge in such a manner that it will b released by firing. Misfires shall be handled in accordance with 527 CMR 13.09(5).

3.6.2 Lightning

The Contractor shall furnish, maintain, and operate lightning-detection equipment during the entire period of blasting operations and during the periods that explosives are stored at the site. The equipment shall be installed where approved by the Owner’s Representative. A lightning detector shall be operated at all times to detect lightning within a 50 mile radius. When the lightning-detection device indicates a blasting hazard potential, the Contractor shall perform the following:

A. Notify the Coast Guard and the Owner’s Representative of the potential hazard.

B. Clear the buoyed area of all vessels and personnel.

C. Terminate all loading of holes and return unused explosives to the day storage area/day magazine.

D. Monitor the blast area to prevent any boat or vessels from inadvertently entering the blasting area during the lightning hazard.

E. Remove the lightning detector from the drill barge with the last evacuation vessel and continuously monitor the potential hazard until the danger has passed.

F. After sounding the All Clear Signal, notify the Coast guard and the Owner’s Representative that the potential hazard has passed.

G. Resume operations only after all potential of hazard has passed.

3.6.3 All other applicable safety requirements shall be implemented in addition to that required above.

3.6.4 Navigation Control during Drilling, Loading, and Blasting Operations

3.6.4.1 The Contractor shall buoy the area with warning signs. The warning signs shall be legible from a distance of 200 feet and shall contain

the message "DANGER - EXPLOSIVES IN USE" visible on either side of the sign. The Contractor shall operate two or more patrol boats during blasting operations equipped with a visible yellow flashing light, audible horn, and radio with a hailer, whose sole function shall be to monitor and maintain security in the blast area. Patrol boats shall be stationed at the drill barge and remain in the blasting area during all blasting operations. Land oriented access control and visual observation locations should be determined and approved by the Owner's Representative. The Contractor shall inspect and ensure there is no boat traffic within the buoyed work area prior to the firing of the blasting caps and until such time as the Contractor has sounded the "All Clear Signal". The Contractor shall establish and maintain a warning system as required by the Corps of Engineers Safety Manual. The Contractor shall equip and maintain his floating plant with radio equipment capable of communications with the Coast Guard. The Contractor, after each blast, upon inspecting the area, shall immediately notify the Coast Guard and the Owner's Representative if all clear or misfire is noted.

3.6.4.2 Coordination with the U.S. Coast Guard.

The Contractor shall notify the Coast Guard 24 hours prior to a scheduled shot and 2 hours prior to the actual shot. The channel must be kept open to vessel traffic at all times except as permitted by the Coast Guard and the Owner's Representative. Contact should be made with:

US Coast Guard New Bedford Marine Safety Unit
New Bedford, Massachusetts
Telephone: 508-999-0072

3.6.5 Contingency Plan in Case of Misfire, Inadvertent Initiator Extraction, or Accidental Loss of Down Lines

All loading of blasting holes shall be done early enough each day to allow time, in case of a misfire, inadvertent initiator extraction, or accidental loss of down lines, to implement a contingency plan for removing or detonating the explosives before dark. The Contractor shall submit a contingency plan to the Coast Guard and Owner's Representative prior to initiation of any blasting and shall notify both parties in the event of a misfire, inadvertent initiator extraction, or accidental loss of down lines. All undetonated explosives due to misfire, inadvertent initiator extraction, or accidental loss of down lines must be detonated. The Contractor shall immediately notify the Coast Guard upon giving the "All Clear Signal" after correcting the misfire, inadvertent initiator extraction, or accidental loss of down lines.

3.6.6 The Contractor shall notify the public at least 24 hours prior to any scheduled blast, and at least 2 hours prior to an actual blast. As a minimum, the following shall be notified:

New Bedford Police Department
871 Rockdale Avenue
New Bedford, Massachusetts 02740
Tel. (508) 991-6300

New Bedford Fire Department
868 Pleasant Street

New Bedford, Massachusetts 02740
Tel. (508) 991-6124

Fairhaven Police Department
1 Bryant Lane
Fairhaven, Massachusetts 02719
Tel. (508) 997-7421

Fairhaven Fire Department
146 Washington Street
Fairhaven, Massachusetts 02719
Tel: (508) 994-1428

3.6.7 Bulk Product Specifications

A. Bulk blasting agents or explosives delivered to the work area shall be weighed by a certified weigh master at the transfer location nearest the work area to determine the actual quantity of explosives delivered each day.

B. Bulk storage tanks or vessels on barges shall be permanently attached to the barge and electrically grounded. A containment dike shall be erected to contain the maximum rated capacity of the storage vessel and all associated pumps and hoses for transfer operations. Pumps, hoses and valves containing bulk product after transfer operations shall be stored in a locked magazine.

C. All access ports, valves, vents and drains shall be secured to prevent vandalism or theft of the explosive product.

A flow metering device capable of measuring the quantity of explosives to within 0.5% of the actual quantity in pounds shall be utilized for all bulk transfer to or from the bulk storage vessel.

D. The delivery system to load holes on each drill frame shall be designed to load each hole to within 0.5% of the design quantity required for each drill hole.

E. Each drill frame shall measure the quantity of explosives loaded in all holes with weigh scales or flow metering devices to within 0.5% of the design quantity for each hole. The total of all loaded holes shall be checked with the total quantity delivered prior to subsequent bulk deliveries. Should the bulk quantity delivered vary from the recorded quantity loaded and detonated, all measuring devices and or meters shall be recalibrated to within the specified accuracy.

F. Each hole loaded with emulsions or slurry shall be initiated with two separate downlines, caps, boosters and starters. At least one booster shall be secured in the hole with a mechanical lock-in system or spider to prevent extraction of the booster or priming charge.

G. As a minimum the top elevation of the emulsion or slurry product shall be measured to check for voids and actual quantity loaded.

H. The blast plan shall include manufacturer's catalog cuts, data sheets and detailed plans and specifications for the bulk storage vessel and transfer system, drill frame delivery system associated loading tubes and reel systems and measuring devices.

I. All loading tubes or hoses shall be equipped to be retracted from the bottom of the hole to the top of the product as the emulsion or slurry is loaded in the hole. The system shall in effect place the product in each hole in a tremie method.

3.6.8 Surface Blasting

Doby, or Surface Blasting, will not be allowed for the fragmentation of bedrock.

3.7 BLASTING CONTROL

3.7.1 General

The blasting program and methods shall be those developed by the test blasting program and procedure to accomplish the excavation shown on the contract drawings in accordance with the procedures specified herein.

3.7.2 Blasting

3.7.2.1 **Blasting shall be confined to daylight hours during the period from 2 hours after sunrise to 1 hour before sunset, but shall not be conducted before 9:00 A.M. or after 4:00 P.M. on the day of blasting**. Blasting shall not be conducted when temperature inversions or heavy, low-level cloud cover exists. **Blasting will be prohibited on Saturdays, Sundays and Federal holidays. The Contractor may request a waiver to perform Blasting on Saturdays or Sundays. The waiver must be in the form of a written request that details the Contractor's need to blast on Saturdays or Sundays, any benefits to the project, and additional safety measures (if any) that would be taken as part of the Saturday or Sunday Blasting Program. The Owner reserves the right to approve or deny this request and to revoke any previously granted approval of Saturday or Sunday Blasting (or both), at the Owner's sole discretion.**

3.7.2.2 TIME OF YEAR

Blasting shall only be conducted in the southern most area of the three locations depicted on page 4 of the Commonwealth's May 20, 2013 letter to EPA between September 15 and January 15. Blasting at the other two locations shall occur between November 15 and January 15, and earlier with written approval by U.S. Environmental Protection Agency.

3.7.3 Vibration Control

Where blasting is necessary, the Contractor shall employ a specialist qualified in vibration control methods capable of analyzing results obtained from seismograph readings. A minimum of 30 days prior to commencement of blasting operations, the Contractor shall provide the Owner's Representative such bona fides of the seismic specialist to

include, but not limited to, past experience, training, and education, and have working a knowledge of State and local laws and regulations which pertain to blasting. The acceptability of the specialist is subject to the approval of the Owner's Representative. The Contractor's seismic specialist shall place vibration monitors on any identified historic structures and shall determine the placement of at least 8 additional vibration monitoring machines per blast area (minimum 4 per shore) with approval of the Owner's Representative and shall be retained for loss control should contract blasting operations result in claims or complaints. The vibration monitoring plan shall identify the type of anchoring devices to be employed at various monitoring sites. Structures that should have monitoring machines include, at least, bulkheads, hazardous materials storage areas and buried utilities. At least one vibration monitoring machine must be placed between the blast and the nearest structure on a natural ground surface. This may require utilizing underwater locations. The other machines must be secured in the ground near identified sensitive structures. Blasting shall be controlled in such a manner that the maximum vibration level at any vessel or structure which is vulnerable to damage should not exceed the peak particle velocity of the appropriate municipality and geographical jurisdictions, or be subject to an unacceptable vibration frequency. A written and a telephone report on vibration intensity shall be submitted within 24 hours when specifically requested by the Owner's Representative or, without request, when such intensity exceeds a peak particle velocity of 2.0 inches per second for any one of the 3 perpendicular planes of motion or when the PPV at the Palmer's Island Lighthouse exceeds a peak particle velocity of 0.5 inches per second. Peak Particle Velocity of 2.0 inches per second should not become the basis of design. Refer to 527 CMR 13.09 chart (a) for assistance. The Contractor will perform a test blast (paragraph 4) which will determine a safe peak particle velocity (PPV) for all structures within the blast area. If historic structures are to be monitored, they shall be evaluated for sensitivity to vibration and monitored during blasting operations. The Contractor shall follow the following vibration limits for the structures listed below:

Historic Structures PPV<0.5 in/sec
Residential Structures in Massachusetts PPV<0.8 in/sec
Other Structures PPV<2.0 in/sec

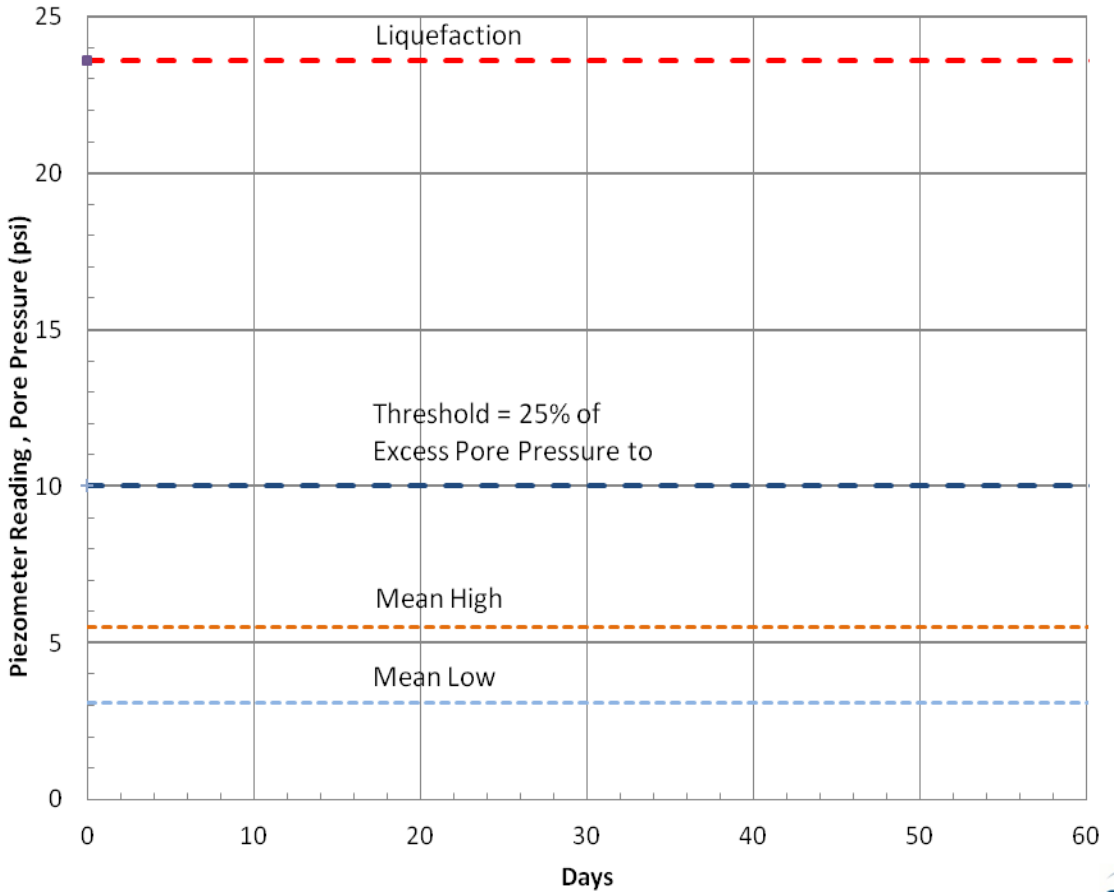
The Contractor shall submit a copy of the record in tabular form for each blast to the Owner's Representative no later than 24 hours after each blast, with a written report on velocity and vibration effects. This should also include location of blast, size, spacing, number, top and bottom elevations of holes, type of explosives, amount of explosives and stemming per hole and delay, type of delays, sequence and pattern, distance from the blast to the vibration monitoring machine, and any other pertinent information.

3.7.3.1 The Contractor is advised to evaluate the vibration and airblast factors affecting structures and vessels in the vicinity of the blast area as determined in the preblast survey. It is recommended that the Contractor use a blast design that produces the maximum amount of relief practicable. The amount of explosives to be used will be determined during the test blast operation to meet all proper safety and environmental requirements. The Contractor is responsible that the fragmentation resulting from the blasting

operation is of suitable size to allow for easy excavation by the Contractor's equipment. The Contractor shall also check water wave propagation to insure that shoreline structures and moored vessels within the blasting area will not be affected during blasting.

3.7.4 All blasting shall be monitored by the Contractor to determine air blast effects using an instrument approved by the Owner’s Representative, operated by an experienced person with a minimum of 3 years of related experience with the type of equipment to be used throughout the project construction and all data furnished to the Owner’s Representative. The instrumentation will be located at seismic station locations as determined in paragraph 3.7.3 and other locations as directed by the Owner’s Representative with at least three (3) monitors located in the area closest to the blast site. Airblast equipment shall record waveform data. Recorded airblast data shall be submitted in conjunction with vibration intensity data as specified in paragraph 3.7.3, within 24 hours of each blast. The maximum allowable airblast shall not exceed 129 decibels.

3.7.5 The Contractor is advised that the owner will be monitoring pore pressure within the core material of the US Army Corps of Engineers New Bedford Hurricane Barrier (or Hurricane Protection Structure) in two locations. Given the unknown nature of the material in the structure the owner has set a limit associated with the buildup of excess pore pressure of 25% of the liquefaction limit as displayed below:



If excess pore water pressures are recorded during blasting that are greater than the threshold level shown in the above Figure , the Contractor shall suspend blasting operations and modify their blasting program to reduce the charge weights in order to minimize the impact to pore water pressure within the Hurricane Protection Structure.

3.7.6 If the Government decides to have a supplemental blasting monitoring program, under no circumstances will this relieve the Contractor of monitoring and controlling the blasting as specified in this Section or any other requirements.

3.8 TEST BLAST PROGRAM

3.8.1 Purpose

The purpose of the test program is to allow the Contractor to establish safe limits of vibration and airblast overpressure, demonstrate the satisfactory performance of the drill boats and develop an operational blasting plan. The type of explosives and firing systems shall adhere to all applicable codes and regulations including, but not limited to, those cited in paragraph 1.1.1.

3.8.2 Test Blast Plan

3.8.2.1 The Contractor shall submit fifteen (15) copies of the Test Blast Plan for review. The Owner’s Representative shall have 35 days for review after receipt. The Contractor may be required to revise and resubmit the plan. The ’Owner's Representative shall have 21 days review of the revised plan. Concurrence with the revised plan will not relieve the Contractor of his responsibility to produce safe and satisfactory results as set forth by these specifications. The test plan shall include as a minimum all pertinent information listed in paragraphs 3.8.4, 3.9.2 and 3.9.4.

3.8.2.2 Test blast programs shall be conducted by the Contractor for each area of rock such as discontinuity of rock contours and areas and as directed by the Owner’s Representative. An optional test blast program for the glacial till shall be planned if determined by the Owner’s Representative to be necessary. Each blast program shall involve all drill boats that will be used for any portion of the contract. No drill boat shall be used for the contract that has not participated in a test blast program.

3.8.2.3 The Contractor shall notify the Owner’s Representative sufficiently in advance of each test blast in order for the Owner’s Representative to be present during the test blasts. The Contractor shall also invite representatives of the Fire Departments from New Bedford and Fairhaven to the test blasts. The test blasts shall begin with a small number of charges and extend upward to the maximum yield to be used. The final test event shall simulate as close as practicable the explosives charge type, size, overlying water depth, charge configuration, charge separation, initiation methods, and emplacement conditions anticipated for the operational blasting program. During each blast the Contractor will analyze the effect of wave propagation on structures, vessels, etc., and take the appropriate actions to prevent damages.

3.8.2.4 The Contractor shall note additional conditions of the Test Blast Program as noted within Part 3.11 of this Section.

3.8.3 Post Blast Evaluation

3.8.3.1 After each test blast, the Contractor shall examine the nearest structures observed during the preblast survey that were inspected and documented, which shall include, at a minimum, the Palmer’s Island Lighthouse, the existing South Terminal bulkhead, the Shuster Facility Building, and the New Bedford Hurricane Barrier, to establish whether damage was caused to the structures. All damage resulting from the test blasting shall be reported in detail to the Owner’s Representative, including photographs. The report shall contain the observed peak particle velocity at each monitoring point, any excess pore pressure reported by the Owner’s Representative and percent of the liquefaction threshold within the piezometers installed in the U.S. Army Corps of Engineers Hurricane Protection Structure. The contractor shall suggest any additional mitigation measures to minimize peak particle velocity at all monitoring locations, and excess pore pressure in the U.S. Army Corps of Engineers Hurricane Protection Structure.

3.8.4 Data Recording and Evaluation

The test blast program shall be conducted and reported in strict accordance with procedures outlined in the sections of these specifications covering vibration control and air blast control. The Contractor shall submit the blasting plans showing the location(s) and extent of the blasted areas. The blasting plans shall include the blasting patterns and the locations of patterns shall be drawn on plan sheet(s)(maps) in scale by providing coordinates of at least four (4) corners of the blasted area. Include information as to the number of holes, bottom and top elevations of holes, coordinates of each hole, amount of explosives and stemming per hole, type of delay in holes, sequence and pattern of delays, maximum peak particle velocity from each instrument, and peak overpressure reading in pounds per square inch and decibels from each airblast sensor. Information provided should also include a written analysis of each blast, including the maximum particle velocity in each plane, associated frequency in each plane and peak true vector sum of particle motion. In addition to the submission of an initial test blast plan, the Contractor is required to submit a documentation of each blast prior to proceeding forward the next blast test. The documentation shall include, but not limited to a written analysis of each blast, all observed test blasting data, examination of structures of the preblast surveys that were inspected, and information about excavation of fractured materials. Four copies of the record of each blast performed shall be submitted no later than 24 hours after completion of each test blast until the test blast program is completed. It is expected that the initial test blast will be used to develop knowledge of ground conditions, propagation characteristics, etc. At the conclusion of the test blast program, the Contractor shall examine all reports, surveys, test data, and other pertinent information. Conclusions reached shall be the basis for developing a completely engineered procedure for blasting. Five copies of the Test Blast Plan and results shall be provided to the Owner’s Representative. In no event shall the operational blasting proceed until the review of the developed procedure for blasting has been completed and the procedures approved.

3.9 OPERATIONAL BLASTING PLAN

3.9.1 The Contractor shall submit to the Owner’s Representative ten (10) copies of the Proposed Operational Blasting Plan for review. The Owner’s Representative shall have 35 days for review after receipt. The Contractor may be required to revise and resubmit the plan. The Owner’s Representative shall have 21 days review of the revised plan. Concurrence with the revised plan will not relieve the Contractor of his responsibility to produce safe and satisfactory results as set forth by these specifications.

3.9.2 Environmental Impact of Blasting

3.9.2.1 The Contractor shall follow the following guidelines and incorporate the following measures when preparing its Operational Blasting Plan and shall use the following measures to minimize its impact to the aquatic environment to the extent possible. These measures include:

1. Evaluate the need to use explosives. If practical alternatives are available and not excessively expensive to

remove rock without blasting, the Contractor shall utilize those methods.

2. Plan the blasting program to minimize the total weight of explosive charges per shot and the number of shots for the project.
3. All Blasting shall be conducted with clean parent material (non-contaminated) left in place.
4. The Contractor shall minimize the total weight of explosive charge per shot and the number of shots for the project, and in no case shall the total weight of explosive charges exceed 150 pounds per delay charge, with a minimum time delay of 25 milliseconds between charges.
5. Use angular stemming material of sufficient length in drill holes to reduce energy dispersal to the aquatic environment.
6. Subdivide the charge, using detonating caps with delays or delay connectors with detonating cord, to reduce total pressure. The Contractor shall not use submerged detonation cord unless the Contractor can show that no other method is practicable.
7. The Contractor shall use decking when possible in lengthy drill holes to reduce total pressure.
8. For seismic exploration use non-explosive sources when possible or use linear charges for open water shots or buried charges.
9. Use shaped charges to focus the blast energy when submerged surface charges are necessary, reducing energy released to the aquatic environment during demolition.
10. The Contractor shall enclose blast areas with silt curtains and bubble curtains to keep fish species away from the blast area and minimize the pressure wave and turbidity generated from blasting.
11. An adequate fish deterrent system, comprised of a combination of silt and bubble curtains and fish weirs, shall be put in place by the Contractor and be properly functioning at least 24 hours prior to blasting, and such system shall remain in place for the duration of all blasting activities. Contractor shall enclose blast areas with silt curtains and bubble curtains to keep fish species away from the blast area and minimize the pressure wave and turbidity generated from blasting. The Contractor shall integrate this requirement with the bubble curtains and silt curtains required in association with Item 10, above.
12. Contractor shall use non-explosive noise techniques to move fish and marine mammals from the immediate blast zone.
13. Stemming, in which rock is placed into the top of the borehole to damp the shock wave reaching the water column, thereby reducing fish mortalities from blasting, shall be utilized.
14. All blasting operations shall take place utilizing sonar to identify fish schools and with a fisheries observer (hired by the Contractor) who is approved by the Massachusetts Division of Marine Fisheries (and National Marine Fisheries Services) in attendance.
15. The Contractor shall conduct pre-blast monitoring for the presence of fish in the projected impact zone immediately prior to the initiation of blasting utilizing sonar and

fisheries observer as noted above. If fish are detected within the impact zone, the fish startle system shall be deployed by the Owner's Representative in an attempt to move fish out of the area.

16. After the completion of each blasting event, the fisheries observer shall monitor the area within and near the impact zone, looking for fish that may have been injured or killed. Monitoring shall commence immediately following the completion of each blasting event and continue until no more bodies are recovered. Dead and injured fish shall be enumerated and sorted by species and the information shall be reported to EPA. If excessive mortalities (hundreds of fish/event) occur, then additional technologies shall be considered for use and blasting may be delayed until November 15, 2013.
17. There shall be no blasting during the passage of schools of fish or when a marine mammal is present as determined by the fisheries observer (as required in item 12 above).
18. Blasting shall be conducted with a fish startle system.
19. In accordance with the US EPA requirements (as promulgated in six letters detailing the input and requirements of the US Environmental Protection Agency) referenced in this specification section, Part 1.1.1, all work associated with blasting shall be conducted in accordance with the US EPA requirements noted in the above referenced letters. This includes requirements for impact minimization involving the use of bubble curtains, silt curtains, and a silt curtain to deflect fish from entering the blast zone. Specifically, the US EPA June 13, 2013 letter states that "For any blasting that occurs before November 15, a silt curtain must be erected north of the blast at an angle and length sufficient to deflect juvenile anadromous fish migrating from the Acushnet River to the ocean. The details, location, length and angle of the silt curtain must be identified in the final blasting plan. Additional, the June 13, 2013 letter states, " There must be an adequate fish deterrent system (a combination of silt and bubble curtains and fish weirs) in place and properly functioning at least 24 hours prior to blasting, and such system shall remain in place for the duration of all blasting activities. Also the August 28, 2013 letter from MassCEC to the EPA states that "both silt curtains and bubble curtains" are required to enclose blasting areas. The August 28th, 2013 letter also states "It is MassCEC's understanding that flatfish will not be a high concern as during the conventional implementation of the Fish Deterrent System; therefore fish weirs will not be installed as part of this effort."

3.9.3 No drilling shall be started before the Owner's Representative reviews and concurs with the final blasting plan or any revisions to that plan.

3.9.3.1 Any changes to the Contractor's blasting or monitoring procedures, equipment, plant, products or personnel must be reflected in a revised Operational Blasting Plan or supplement and must be approved by the Owner's Representative prior to implementation.

3.9.4 The Blasting Plan shall include as minimum requirements the following:

1. Proposed method of transportation, storage, and handling of explosives.

2. Plan showing layout of drill hole pattern, timing and sequence, anticipated burden dimensions and depth of subdrilling.

3. Plan for the fragmentation of large boulders and blast rubble.

4. Type of explosives and method of loading and detonating.

5. Type of blasting machine to be used and when last tested.

6. Specific gravity of explosives and manufacturer's technical literature.

7. Initiation system to be used and explosive loading in pounds of explosive per delay.

8. Indication as to whether decking or boosters will be used and the depths of required stemming.

9. Type and number of drilling rigs, including drill hole diameter, and expected production rates/day.

10. Type of instrumentation to be used, manufacturer, and when last calibrated and certified.

11. Procedure for monitoring the blast operations.

12. List of permits and clearances required, when applied for, and date of approval or anticipated approval.

13. A format for maintaining a record of individual blasts throughout the life of the job designed to record pertinent data before, during, and after the blasting operation. Pertinent information shall include, but not limited to, number of holes, bottom and top elevations of holes, coordinates of each hole, amount of explosives and stemming per hole, type of delay in holes, and sequence and pattern of delays.

14. Names and qualifications of specialists for vibration control analysis and airblast over- pressure measurements (refer to paragraph 3.7.3 for exacting requirements).

15. Location plan, manufacturer's literature, and parameters to be used in site selection for seismic instrumentation.

16. Plan showing location of warning signs and signals and the Contractor's land and marine spotters.

17. Name and address of Contractor's representative to which any claims for damage due to blasting should be addressed.

18. The plan, signed off by the Contractor's jobsite authorized representative.

19. The location of monitoring equipment, based on information from the preblast survey.

20. Contingency Plan for Lightning Hazard

21. The 527 CMR 13.00 Uniform Blasting Site Detail Check List – (Attached at the end of this Section).

22. Complete Project Team Organization with duties, responsibilities and authorities clearly defined. This organizational outline shall also include a listing of all personnel authorized to sign for, receive and use explosives on this contract.

23. Complete list of floating plant involved in production blasting operations.

24. Provide analysis and control of potential hazard due to possibility of undetonated Pourvex remaining from previous deepening.

25. If the Contractor elects to perform blasting operations before November 15, the Contractor shall include in the Blasting Plan the details of the location, length and angle of the silt curtain more fully described in Section 3.9.2.1.19 as well as the details of other bubble curtains and silt curtains that will be utilized to fulfill EPA requirements.

The Contractor shall submit the blasting plans showing the location(s) and extent of the blasted areas. The blasting plans shall include the blasting patterns and the locations of patterns shall be drawn on the maps in scale by providing coordinates of at least four (4) corners of blasted areas.

3.9.4 If drilling and blasting is required outside the buoyed areas, the Contractor shall submit a plan to maintain **the previous authorized depth**, as part of the Operational Blast Plan. This plan shall include areas where the buoy cannot be removed.

3.10 DRILL LOG AND BLAST REPORT

The Contractor shall prepare and complete drill logs and report for each blast is completed. Information provided on the logs shall include, at a minimum:

1. Name, signature, and Certificate of Competency Number of the blaster in charge.
2. Blast location, address, city description.
3. Drill rig type, construction of rig, name of driller in charge, location of borehole in Massachusetts State Plane coordinates.

4. Depth of boring in MLLW. Position within borehole of explosives at time of detonation.
5. Date and time of blast.
6. Type of material blasted.
7. Distance in feet, to the nearest inhabited building or structure, neither owned nor leased by holder or holder client of the Explosives User Certificate issued by State Fire Marshall.
8. Scaled distance or alternative option used to determine blast design.
9. Type of matting or cover over blast, if applicable.
10. Weather conditions, including temperature, cloud cover, wind direction.
11. Blast plan and sketch showing blast hole diameter, delay, delay patter, and types of detonators, spacing, depth of blast hole, hole pattern and number of holes.
12. Explosive material type, size, total weights of each explosive by hole.
13. Type of initiation system (Methods of firing and type of circuit).
14. Feet of overburden, depth and type of stemming.
15. Maximum weight of explosives detonated within any eight millisecond period.
16. The seismograph(s) location(s) including distance and direction from the seismograph to the closest borehole and from the seismograph to the closest structure.
17. Seismograph readings including peak particle velocity, frequency and airblast.
18. Type of seismograph, instrument make, model serial number, calibration date and sensitivity settings.
19. Name of person taking the seismograph reading. The name and firm analyzing the seismograph record, if applicable.
20. Complaints or comments following blast.
21. The Contractor shall provide and certify on a daily basis the horizontal location (x,y), the diameter of drilling stem, depth at which drill casing is set, depth at which bedrock is encountered, elevation at which bedrock coring is begun, elevation at which bore hole is terminated, weight of explosive loaded into bore hole, type of stemming used and length of stemming in each bore hole for blasting purposes. All elevations shall be reported in MLLW. “Presumptive refusal” shall be defined in accordance with Dredging Specification Section 02482, subsection 3.2.1 Part H and shall be used to determine payable quantities in association with Specification Section 01025 Measurement and Payment.

3.11 POTENTIAL IMPACT TO HURRICANE BARRIER

A study regarding the potential impacts to the New Bedford Hurricane Barrier was completed in response to requests from the U.S. Army Corps of Engineers, in order to determine the potential impact to the Hurricane Barrier associated with blasting for this project, and was included within the “Data Report – New Bedford Marine Commerce Terminal”, attached to Section 00800 of the Contract Documents. This was revised as noted in the “ASSESSMENT OF BLASTING IMPACTS TO THE NEW BEDFORD-FAIRHAVEN HURRICANE BARRIER NEW BEDFORD

MARINE COMMERCE TERMINAL NEW BEDFORD, MASSACHUSETTS" revised August 2013 as prepared by GZA GeoEnvironmental, LLC.

During completion of the Contractor's Test Blast program, as outlined within Part 3.8 of this Section, the Owner shall measure particle velocity as a function of distance from the Blast. Portable seismographs capable of measuring peak particle velocity in three mutually perpendicular directions and frequency shall be utilized for this work.

The Owner's Representative will generate a site specific graph of scaled distance versus peak particle velocity on a log-log plot. In this context, the scaled distance is the distance in feet from the blast divided by the square root of the weight of the charge per delay in pounds. The data from the test program will be analyzed by fitting a best-fit regression line to provide the site specific values of velocity intercept and slope factor. The frequency of the blast vibrations will also be reviewed and compared to assumed values from the Hurricane Barrier study. The site specific values will be used to determine the final allowable blasting criteria for production blasting at the site. ***If the final allowable blasting criteria are determined to be lower than the values in the table listed below, the Contractor shall use the lower of the two values.***

As a result, the maximum charge weight per delay as a function of distance and frequency from the nearest point of the New Bedford-Fairhaven Hurricane Barrier shall not exceed the lower of either the values calculated by the Owner's Representative during the Test Blast Program (as determined above) or the following tabulated values:

Dist. (ft)	10 Hz	20 Hz	30 Hz	40 Hz	50 Hz	60 Hz	70 Hz	80 Hz	90 Hz
	Pounds per Delay	Pounds per Delay	Pounds per Delay	Pounds per Delay	Pounds per Delay	Pounds per Delay	Pounds per Delay	Pounds per Delay	Pounds per Delay
250	198	83	50	35	26	21	17	15	13
300	200	120	72	50	38	30	25	21	18
350	200	163	98	69	52	41	34	29	25
400	200	200	128	89	68	54	44	38	32
450	200	200	162	113	86	68	56	48	41
500	200	200	200	140	106	84	69	59	51
550	200	200	200	169	128	102	84	71	61
600	200	200	200	200	152	121	100	85	73
700	200	200	200	200	200	165	136	115	99
800	200	200	200	200	200	200	178	150	130
900	200	200	200	200	200	200	200	190	164

1000	200	200	200	200	200	200	200	200	200
1100	200	200	200	200	200	200	200	200	200
1200	200	200	200	200	200	200	200	200	200

- End of Section -

527 CMR 13.00 Uniform Blasting Site Detail Check List

Location: _____ Date: ___/___/____

Blaster's Name: _____ Cert. #: _____

Company Name: _____ Time of Blast: __:__

Check List	Ref. #	Violations?	YES	NO
Two Way Radio/Warning Signs ("Blasting Zone" "Turn off 2-way Radio")	CMR 13.09(1)(p)		☐	☐
Transport Vehicle(s) (Placards, Fire Marshal Magazine Permit, Attended)	CMR 13.06(2), 13.04(3)		☐	☐
Site Storage (Day Box) (Fire Marshal Magazine Permit, Attended)	CMR 13.04(3)		☐	☐
NO smoking or open flames (within 50ft of explosives)	CMR 13.09(1)(d) 2., 3.		☐	☐
NO unnecessary personnel on the blast site (while boreholes are being loaded or are loaded with explosives)	CMR 13.09(2)(a)		☐	☐
Prior to blasting, excess explosives returned to proper storage	CMR 13.09(2)(f)		☐	☐
Seismograph must be placed between 5&10 ft of nearest inhabited structure	CMR 13.09 (9)(f)		☐	☐
Explosives, persons & equipment must be at a safe distance prior to blast	CMR 13.09(3)(a), (h)		☐	☐
Warning signal (3 long blasts 5 min before blast) Blast Signal (2 blasts 1 min before blast) All Clear Signal (1 prolonged blast)	CMR 13.09(1)(m), (3)(h)(2)		☐	☐
Post Blast Inspection (blaster must inspect site prior to personnel returning)	CMR 13.09(4)		☐	☐
Trash (boxes, bags, non-electric) (shall be picked up and/or destroyed)	CMR 13.09(6)		☐	☐

Seismograph Readings:

PPV: H_____ V_____ R_____ (2.0 in/sec max)
HZ: H_____ V_____ R_____ Airblast: _____Db (133max)

Report any incident involving flyrock, whether or not was an injury or damage, to the Office of the State Fire Marshal at 978-567-3375.
FP-55 (Rev. May '10)