Controlled Blast Plan
Middlebury Bridge Job
Project # RS 0174(8)

Date: February 13, 2014

Prepared For:
T Buck Construction

Prepared By:

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Table of Contents

General

Pre-Blast Surveys / Notifications

Blast Monitoring

Sequence of Blasting

Vertical Over-Break Control

Test Blast Program

Blasting Procedures

Blasting Mats

Blast Site Security and Warning Whistles

Explosives

Blaster Qualifications

Blasting Personnel

Licenses and Permits

Blast Vibration

Blast Reports

General

This project is for the replacement of the Rt 125 Bridge over the East Middlebury River. The project is located south of the intersection of Rt 125 and North Branch Road. The majority of the blasting will be located at the Southern Side of the bridge for Bridge Abutment #1.

The challenge of this project is designing a practical blasting plan that affords the degree of control necessary for the setting. The design must be appropriate for the close proximity to the existing buildings, roadways, utilities, pedestrian areas that will be influenced by the project. The blast design must also support the 1:6 slope required for wall stability. Special consideration is given to producing a blast design that will achieve wall stability, adequate fragmentation as well as cast suppression to prevent rock from entering the East Middlebury River. Maine Drilling & Blasting has also given consideration to project schedule to provide for maximum production while maintaining adherence to safety. The design must also consider the human response and the neighboring structural response affected by the ledge excavation. It should utilize the best available drilling and blasting technology and be flexible enough to best marginalize the naturally invasive nature of the work.

The blasting schedule proposed in this document reflects approximately 5 drill days performed in advance of blasting. All line drilling/pre-split drilling will be completed in advance of blast day. Maine Drilling and Blasting anticipates one day of blasting to execute the blast plan as written. Any additional ledge removal will be performed using a hydraulic hammer.

Our Design will offer the following controls:

- **Perforation Drilling/Pre-Split-** Drilling a series of 3” holes around the perimeter 6” on center. Geological conditions may require adjustments to prevent holes intersecting. Every 4th hole will be loaded with 7/8” pre-split explosives. This Hybrid drilling/blasting method will allow for a neat line of breakage at the proposed 1:6 slope and also prevent rock breakage from extending beyond intended blast area.

- ***Conservative Mass Rock Removal Plan-*** Maine Drilling and Blasting recommends a conservative approach to the mass rock removal inside of blasting perimeter. Blast design will feature a light charge weight strategically placed just above finish grade of proposed bottom of footer elevation. This will allow for fragmentation and sheering of rock without excessive casting or rock displacement. This will also reduce the potential for over-blast below bridge abutment.

- ***Neighborhood Communication Plan***- Maine Drilling and Blasting will partner with T Buck Construction to develop a comprehensive neighborhood communication plan aimed at informing concerned neighbors about the blasting activities at the bridge project. This plan will include public meetings, distributing Blasting Leaflets detailing effects of blasting, generating a Call List to notify neighbors of blast times. Plan will be coordinated by the Blaster-In Charge who will act as liaison from the Blasting Contractor to concerned stakeholders.

Maine Drilling & Blasting, Inc. considers safety to be the priority during all phases of blasting operations. We are knowledgeable of, and will follow all local, state, and federal regulations related to transportation and use of explosives. The current project documents and existing conditions have been reviewed. Details of procedures for pre-blast surveys, explosives use, blast area security, monitoring and documentation are enclosed.

Pre-Blast Surveys / Notifications

Pre-blast and Post-Blast surveys of all structures within 750' of the blasting operations will be completed. Results of those surveys will be documented through video and still photographs and the appropriate narration or written reports. (Report included)

Blast Monitoring

All blasts will be monitored by a representative of Continental Placer. See qualification statement for Continental Placer included in this report.At least two seismographs will be in use at all times.

At a minimum the placement of monitoring equipment will

- Unit #1-Nearest occupied residence North of Project @intersection of Rt125 & N.Branch Road.
- Unit #2-Nearest occupied residence South of Project @ Rt 125.
- Unit #3- To be set up at Historic Inn if needed.

Maine Drilling & Blasting, Inc. monitoring equipment will consist of Instantel and White Industrial seismographs (calibration certificates will be supplied prior to start of blasting). These seismographs will monitor ground vibration, noise and air blast. Results of blast monitoring will typically be available before the next blast, usually immediately following a blast. Results can be reviewed and modifications can be made to the blast design for the next blast if necessary.

Sequence of Blasting

All blasting operations will be strictly coordinated with local and state authorities, and the site management personnel. On this project, emphasis will be on the safe and efficient removal of the rock without impact to surrounding structures. Blasts will be developed to create adequate relief which will minimize ground vibrations and offer the greatest protection possible to the surrounding structures. We propose to develop blasting operations away from surrounding structures and refine the design as we approach the existing houses. The approximate location of the blasts will enable us to determine ground transmission characteristics in a centrally remote area affording opportunity to fine tune design as we approach the existing structures. Experience has shown advantage to incorporating the following elements into our design strategy:

1. Linear energy dissipation over a long working face (spatial distribution)
2. Relief encouraged by shallow depth to width ratio design
3. Air response and shot cast suppression by “left in place” surface overburden and deliberate muck pile confinement of face
4. Face confinement compensated by lateral and, if necessary, vertical delay sequencing
5. Matting access enhanced by limiting shot depth to excavator reach. Reach is maximized for mat placement from muck pile of previous shot.
6. Removing ledge cut in shallow benches.

Vertical Over-Break Control

Control of over break is a complex and often challenging issue. Technology at present doesn’t afford us the ability to laser cut a uniform and undisturbed bearing surface with explosives. It has always been assumed over break is solely a function of over drilling and over blasting, however consideration must be given as to the nature of the geology presented at the proposed bearing surface. Parting seams near or below sub grade design elevation and variation in strata layering and competence will influence depth of excavation. These variations may be difficult to map. To achieve final grade, minimum sub-drilling will be performed. All drill depths will be to 1’ above proposed final grade. Modification direction must be based on an evaluation of the elevation and condition of the bearing surface presented at the bottom of excavation. Test excavations should be conducted regularly if rock excavation significantly trails

operations to provide relevant data. In all cases, blast dynamics minimally require a borehole to be of adequate depth to safely accommodate both the charge and confinement medium.

Blast Program

The Perforation Drilling/Pre-Split Drilling along the perimeter of the blast area will be performed prior to any blasting taking place.

A test blast is typically performed to provide data to support the overall blast program. This project does not support using a test blast program to refine the overall blast program. This project features a relatively small scope of blasting along with the inability to excavate the blast area for evaluation. Maine Drilling & Blasting will use past experience along with a conservative blast design to achieve project specifications.

Blast #1 will combine the hybrid perforation drilling/pre-split blasting with mass rock removal. This blast will be located on the south side of bridge for Bridge Abutment #2. We estimate the blast area perimeter to reflect approximately 72'-90' of line control/pre-split. The holes will be drilled 8" on center at an average depth of 26' with 11' of overburden. Every fourth hole along the perimeter will be loaded with Dyno Split Right Pre-Split Explosive. Each Pre-Split Hole will have a column load featuring 14' of Dyno Split weighing .33 lbs per foot along with 1 stick of 2" Dynamite weighing 2.5 lbs per stick for a total column weight of 7.12 lbs per hole. The Pre-Split holes will be blasted 3 holes per delay.

The mass rock in the interior of line control perimeter will be drilled on a 5'spacing x 4' burden drill pattern. The holes will be drilled at an average depth of 26' with 11' of overburden. The mass rock holes will be loaded with 1 stick of 2" packaged emulsion initiated by a ½ lb cast booster for a total column weight of 2.72 lbs per hole. The Mass Rock will be blasted 1 hole per delay.

Designing for charge weights referenced in this section and using the following formulas, the approximate particle velocity anticipated is estimated below.

W = Pounds per Delay
D = Distance to Structure
SD = Scaled Distance
PPPV = Predicted Peak Particle Velocity (IPS)

$$SD = \frac{D}{W^{1/2}}$$

Average PPPV = $160(SD)^{-1.6}$
Upper Bound PPPV = $242(SD)^{-1.6}$

Blast Program:

W	Loc D	SD	Average	Upper Bound
21.36	140	30.29	0.68	1.03
21.36	410	88.71	0.12	0.18

Locations are as follows: Nearest House North of Project @ North Branch Road, Nearest House South of project @ Rt 125.

Blasting Procedures

1. Blasting operations shall occur during typical work hours, Monday through Sunday. Blast events shall be scheduled between the hours of 9:00 am and 5:00 pm unless specified otherwise.

2. Blasting cannot be conducted at times different from those announced in the blasting schedule except in emergency situations, such as electrical storms or public safety required unscheduled detonation.

3. Warning and all-clear signals of different character shall be clearly audible at the most distant point in the blast area and shall be given from the point of the blast. All persons within the permit area shall be notified of the meaning of the signals through appropriate instructions and signs posted.

4. Access to blasting area shall be regulated to protect the public from the effects of blasting. Access to the blasting shall be controlled to prevent unauthorized entry before each blast and until the perimeter's authorized representative has determined that no unusual circumstances exist after the blast. Access to and travel in or through the area can then safely resume.

5. Areas in which charged holes are awaiting firing shall be guarded, barricaded and posted, or flagged against unauthorized entry.

6. All blasts shall be made in the direction of the stress relieved face previously marked out or previously blasted.

7. All stemming shall be the minimum as specified, clean, 3/8" crushed stone.

8. Blasting mats shall be used to cover blasts as necessary..

Blasting Mats

Blasting mats will be required to supplement design measures and insure cast control of vented fragments. Placement and density of mats are based on existing and designed relief and proximity to protected structure. Placement and density based on these metrics are determined by the blaster. Mats will be placed so as to protect all people and structures on, or surrounding the blast site and property. Rubber tire type blasting mats will be utilized on this project and will be approximately 12' x 24' in size; Rubber mat @ 12' x 24' 38 lbs. / sqft = 10,944 lbs.

Blast Site Security and Warning Whistles

The Blaster in Charge along with site management will develop a written Site Security Plan identifying as a minimum the blast area, equipment requiring removal, blast area access points, sentry locations and designated “safe area(s)” (see Sample Blast Security Plan attached). Each blast will be preceded by a security check of the affected area and then a series of warning whistles. Communications will be made with job site management, local authority and neighbors as required to ensure the safest possible Blast Operations. All personnel in the vicinity closest to the blast area will be warned. The warning signal sequence will be:

3 Long Audible Signal Pulses - 5 Minutes to Blast

2 Short Audible Signal Pulses - 1 Minute to Blast

1 Long (30 sec) Audible Signal pulse - All Clear

No blast will be fired until the area has been secured and determined safe.

The blast site will be examined by the blaster prior to the all clear signal to determine that it is safe to resume work.

Scheduling

By law, the blaster must limit his blast site access to personnel necessary to the drilling and blasting operation. He will need cooperation from other entities competing for the same footprint. Cost effective site management has recognized a value in dollars and overall schedule by planning and executing required blasting in advance of other competing construction activities. The need to minimize the disruption of onsite or offsite activities by blast events must be balanced with the need to minimize the overall duration of disruption caused by the blast project. Safety must always take precedence over convenience. Between one and four blast events per day should be anticipated.

Explosives

All explosives will be delivered to the job site on a daily basis. There will be no overnight storage. Only the amount of explosives required to perform the day's work will be brought to the site. All explosives will be stored in approved magazines when not in use. Technical Data and MSDS sheets for the explosive products proposed for use on this project are enclosed and will be available on site.

Blaster Qualifications

All Maine Drilling & Blasting, Inc. blasters on this job will be licensed in the Vermont and have received extensive training in the safe use and handling of explosives. Additionally, Maine Drilling & Blasting, Inc. blasters are familiar with all OSHA Regulations, VOSHA & VT State Regulations, and Federal Regulations regarding construction site safety, including transportation, use, and handling of explosive materials. Daily safety meetings are to be held on site by the Maine Drilling & Blasting, Inc. job foreman, with a record of that meeting returned to the Maine Drilling & Blasting, Inc. office. The Lead Blasters selected for this project will have supervised numerous blasting projects in close proximity to highways and occupied existing structure in vibration sensitive environments. We believe their experience will be an asset to this project. Copies of Blasting Certificates of Competency for blasters proposed for this project will be provided prior to commencement of blasting operations.

Blasting Personnel

All blasting operations shall be conducted by experienced, trained and competent persons who understand the hazards involved. Persons working with explosive materials shall:

1. Have demonstrated knowledge of, and a willingness to comply with, safety and security requirements.

2. Be capable of using mature judgment in all situations.

3. Be of good physical condition and not addicted to intoxicants, narcotics, or other similar types of drugs.

4. The person(s) responsible for the explosives shall possess current knowledge of the local, State and Federal Law and regulations applicable to his work.

5. The person(s) responsible for the explosives shall have obtained a Certificate of Competency or a License as required by State law.

Licenses and Permits

MD Drilling & Blasting, Inc. is fully licensed and insured for the transportation, use, and handling of explosives. Insurance certificates as required will be provided.

Blast Vibration

Our experience includes a significant history blasting within urban environments along major highways as well work in close proximity sensitive research. Blast vibration will be monitored at locations described in the blast monitoring section. Modification to monitoring location may be made based on data collected and later identified concerns. Vibration will be limited to levels specified and State Regulation and depicted the attached compliance graph (USBM RI 8507 Appendix “B”).

Given the demanding nature of the limit, there is a critical need for accuracy with regard to

monitoring. Especially with regard to geophone coupling, of which even a minor loss could generate significant erroneous data. We have included for reference:

- Excerpts from the "1998" 17th edition of the "Blaster's Handbook", dealing with poor seismometer coupling, its cause and effects and remedy.

- From the same publication, comment on "The reporting of Anomalous Data".

- The ISEE Field Practice Guidelines for Blasting Seismographs (2009 Edition)

Poor Seismometer Coupling

The usual purpose of routine vibration monitoring in residential areas is to obtain measurements of ground vibrations which represent those transmitted to building foundations in the area. It is important that there be good coupling between the vibration sensor (seismometer) and the ground. The most common result of poor coupling is to amplify (exaggerate) the true motion of the ground. Examples of improper placement of seismometers would be placing them within grass roots or other plant roots, or on the surface of loose fill soil, even when an anchoring spike is used. It is not unusual for such monitoring to register motions which are from 1.5 to 3 times that of the true ground motion. In a recent case, the writer observed that a seismometer spiked into a planter area registered a particle velocity 3.7 times that measured on the adjacent building foundation. When such locations cannot be avoided, a hole can be dug to the bottom of the loose area so that the seismometer can be placed in the firm, underlying soil and held firmly with packed backfill. If the seismometer is equipped with a spike, that can be used also. If available, a firmly packed dirt road will provide a suitable surface, as will most paved surfaces. However, loose slabs or those over hollows can give inaccurate readings, such as resonant responses to high frequencies. If the surface is very smooth, the seismometer should be prevented from slipping sideways, as well as from rocking or "jumping" from the surface. These tendencies are dependent on the size, shape and mass of the seismometer as well as the supporting surface. Sand bags can prevent movement at moderate levels, but should be large enough to contact the ground all around a seismometer to prevent its movement. A small bag that does not touch the ground is not useful. It merely adds to the weight of the seismometer. Ground spikes can also prevent slippage or wobbling at moderate levels. At high levels, positive anchoring is recommended. For paved surfaces, or other smooth surfaces, bolting or various chemical substances may be used to provide that anchoring. In soils, burial and firm backfilling may be needed. Burial is most effective when the density of the seismometer package matches that of the soil, often around 120 lbs/ft^3 (kg/m^3)

Further comment can be found in other publications. Several Bureau of Mines Reports of Investigation offer reviews of seismometer experiments conducted by the Bureau from 1961 to recent years. Duvall (1961) provides some insights into the question. Additional

information is provided in later Bureau reports, as well as lists of previously published information on the subject. Stagg and Engler (1980) offer recommendations that some type of anchoring should generally be provided for seismometer packages if acceleration levels over 0.2 g are expected. Ground spikes or large sand bags (that contact the ground) are usually effective to fairly high levels for small seismometers. Above 1 g, burial is recommended in soils, or bolting or gluing on smooth surfaces.

YOUR TRUSTED BREED
making it happen
together

The Reporting of Anomalous Data

Once the explosives user becomes aware of the manner in which various factors affect the vibration intensity, especially for close-in blasting, he recognizes the need for caution in the manner in which he reports his data. It may happen that the manner of reporting data can be quite misleading to readers and have an adverse effect on the way they evaluate future project conditions.

In general terms, the simplest suggestion that can be offered is to recommend that reports of data include an explanation of why certain results are anomalous, or, at the minimum to point out that the data are unusual and/or questionable, and to be treated with caution. We might illustrate this point with an example from urban blasting. In one case, there was a long row of charges adjacent to the wall of a building. Although many holes detonated simultaneously, their effect was not additive at any given point along the wall. The charge per delay was large, but the vibration intensity was low. This arrangement constituted a line of charges, not a point charge. If conventional procedures had been followed for reporting the data or plotting a graph, the results would have been seriously misleading to readers. The data was treated separately and explained for readers. For more discussion of line sources, see Oriard (1991, 1994).

Readers should be very cautious about accepting anomalous data, such as those indicating unusually high intensities for very small charges, or very low intensities for very large charges, or reports of damage at very low vibration intensities. Unless the reader can verify authenticity, these data should be rejected because of the failure of the authors to describe details which might reveal that they are products of incomplete data gathering, such as timing scatter, sequence overlap, inadequate inspection, unverified damage reports, or other forms of inaccurate or incomplete descriptions.

VIBRATIONS FROM BLASTING

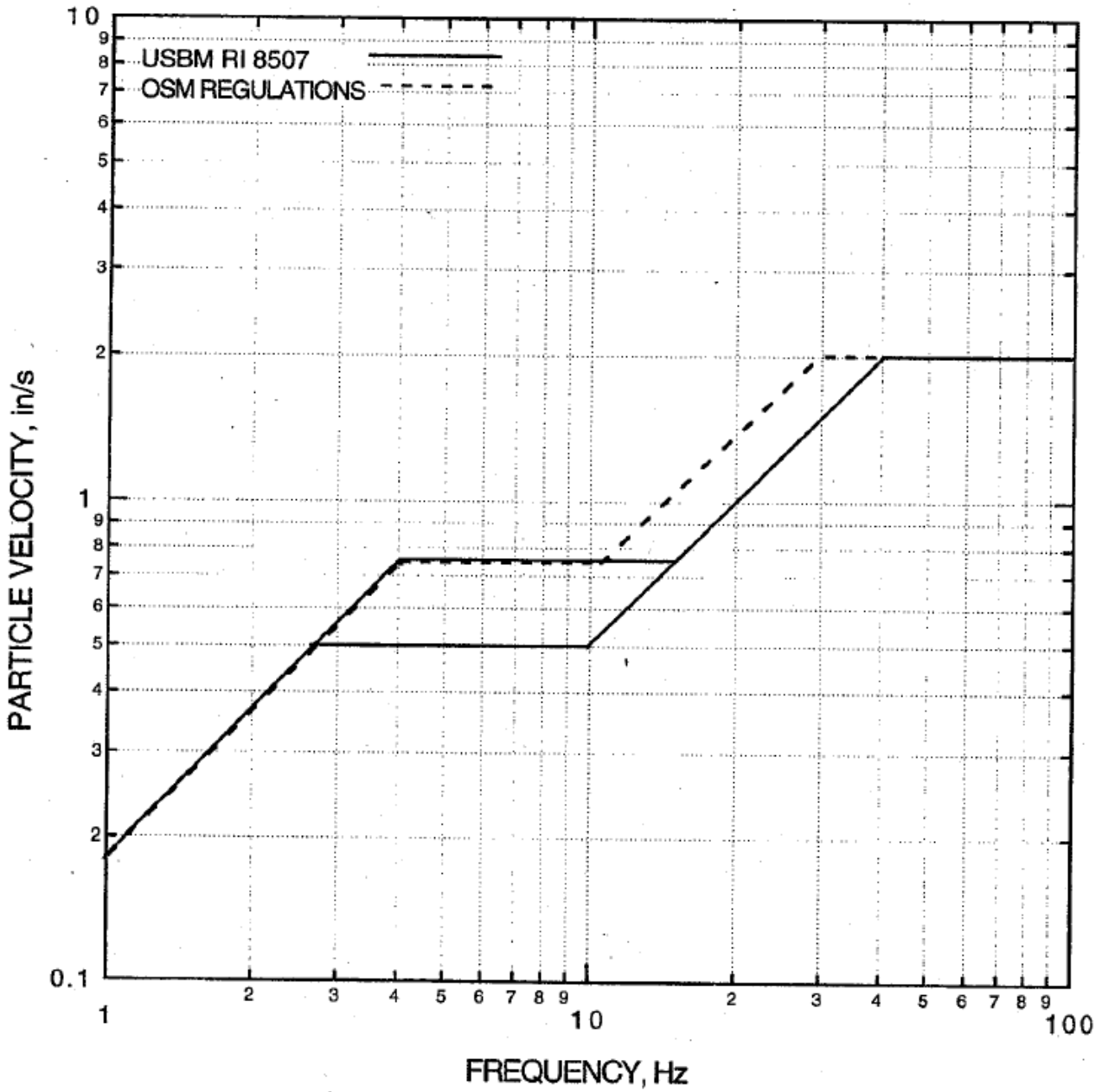


FIGURE 44. Safe level blasting criteria from USBM RI 8507, Appendix B (Siskind et al., 1980b) and the derivative version, the Chart Option from the OSM surface coal mine regulations (OSM, 1983).

Blast Reports

This report will be filled out for each blast and copies will be supplied Daily.

Blast Report

Job # _____ Customer Name: _____ Customer Supt. : _____

Date: _____ Job Address: _____ Pick Ticket(s) # : _____

Shot #:				
Shot Time:				
Operation: (Trench, Open)				
# Holes:				
Depth of Water:				
Hole Diameter:				
Burden:				
Spacing:				
Total Square Feet:				
Stemming:				
Sub Drill:				
Avg. Drill Depth:				
Total Drill Footage:				
Total Pay Yards:				
Total Yards Shot:				
Bulk _____				
ANFO				
ANFO WR				
Exp. 1 _____				
Exp. 2 _____				
Exp. 3 _____				
Exp. 4 _____				
Cast Booster _____				
Cast Booster _____				
Total Pounds Shot:				
Powder Factor (Lbs / Cyd):				
Det 1 _____				
Det 2 _____				
Det 3 _____				
Det 4 _____				
Det 5 _____				
Det 6 _____				
Lead Line _____				
Type of Cover (Dirt, Mats):				
# of Mats Used:				
Seis #: PPV:				
Operator: dB:				
Location:				
Seis #: PPV:				
Operator: dB:				
Location:				
Seis #: PPV:				
Operator: dB:				
Location:				
Seis #: PPV:				
Operator: dB:				
Location:				

Fire Detail Hours: _____
Type of Rock: _____
Type of Terrain: _____
Weather Conditions: _____
Wind Direction/Speed _____
Identify Hazards: _____

_____

Precautions Taken: _____

_____

Calculations:

Notes:

Blaster Name: _____

Lic. # _____

Signature: _____

THIS REPORT MUST BE FILLED OUT COMPLETELY

Rev. 5-5-08

Blast Design Plan

Show Timing for Each Shot

Job Number: **Date:**

Typical Columns

FORMULAS:

$SD = D / W^{.5}$

$PPV = K \times (SD)^{-1.6}$

$K = PPV \times SD^{1.6}$

Shot #:	_____	_____	_____	_____
Distance to Closest Structure:				
Location of Structure:				
Max Holes Per Delay:				
Max Pounds Per Delay:				
Scale Distance:				
Predicted PPV: K Factor _____				

THIS REPORT MUST BE FILLED OUT COMPLETELY

Rev. 5-5-08

Blasting Personnel Licenses

DEPARTMENT OF PUBLIC SAFETY
FIRE MARSHAL'S OFFICE
DATE ISSUED: 2/22/2011
EXPIRES: 12/31/2013

VERMONT EXPLOSIVE LICENSE
NUMBER: 1170

TYPE: A
INDIVIDUAL (BLASTER)

POSSESS	PURCHASE	SELL
STORE	TRANSFER	TRANSPORT

NAME: MARK C. BILLINGS
ADDRESS: 825 QUARTERLINE ROAD
CENTER RUTLAND, VT 05736

SIGNATURE OF LICENSEE
NOT VALID UNLESS SIGNED

COMMISSIONER
NOT VALID WITHOUT OFFICIAL SEAL

DPS 133B
REV 11/88

Maine Drilling & Blasting

Blaster Profile

Mark C Billings – Blasting Superintendent
Western Division
9 Park St, Proctor, VT 05765
mbillings@mdandb.com

Work History

Maine Drilling and Blasting – Blasting Superintendent - May 2000 to Current

Training and Education

Maine Drilling and Blasting

- MSHA Part 46 Refresher – 03/2014
- Explosive Operating Procedures Training – 12/05/2006
  Mike Bell, Operations Manager
- Hazmat In Depth Security Training – 11/20/2011
  Bruce Lawler, Compliance Supervisor
- Hazmat Transportation & Security – 04/01/2011
  Bruce Lawler, Compliance Supervisor
- Hazmat General Awareness Training – 03/13/2009
  Bruce Lawler, Compliance Supervisor

Notable Projects

- Lowell Wind Farm Project – 2011 – 2012
- Proctor, VT Hydro Dam Up Grade - 2013
- Morristown, VT By Pass - 2013
- Warren, VT State Route 100 – 2013 - 2014

Explosive Product Type Experience

- **Initiation Systems**: Electric, Non-Electric, and Electronic
- **Packaged Products**: Emulsions, Dynamite nitroglycerin based product
- **Bulk**: Emulsions

Maine Drilling & Blasting

Additional Information/Licenses/Certifications

- OSHA-10 Construction
- Blasting License NH #1260 Exp. 3/16/2016
- ATF Employee Possessor Clearance
- Current First Aid Certification
- VT CDL C with Hazmat endorsement

Maine Drilling & Blasting

Management Profile

Patrick P Paquette – Regional Superintendent
Western Division
372 Town Hill Rd., New Haven, VT 05472
ppaquette@mdandb.com

Work History

Maine Drilling and Blasting – January 2012 – Current

- Regional Superintendent – Feb. 2014 – Current
- Sales Technical Representative – Jan. 2012 – Feb. 2014

Dyno Nobel – May 1986 to January 2012

- Blaster – 1986 – 1988
- Site Manager / Lead Blaster – 1988 - 2010
- Northern New England Region Area Manager – 2010 – 2012

Training and Education

Maine Drilling and Blasting

- MSHA Part 46 Refresher – 03/2014
- Explosive Operating Procedures Training – 01/11/2012
  Mike Bell, Operations Manager
- Hazmat In Depth Security Training – 01/11/2012
  Bruce Lawler, Compliance Supervisor
- Hazmat Transportation & Security – 01/11/2012
  Bruce Lawler, Compliance Supervisor
- Hazmat General Awareness Training – 01/11/2012
  Bruce Lawler, Compliance Supervisor
- Driller I & II – 03/26/2014

Dyno Nobel, Inc.

- Open Pit Blasting I, II, III – 2002
- Explosive Materials Specialist 29CFR 1910. 120 Refresher – 01/14/2010
- Hazardous Materials Training CFR 49 – 2011
- Health and Safety, Regulatory Compliance OSHA/MSHA Refresher -2011
- Defensive Driving Course Professional Truck Driver Training – 06/27/2008
- Blaster Technical & Safety Education – 2007
- Supervisor Reasonable Suspicion Training – 03/03/1998

Maine Drilling & Blasting

Notable Projects

- Morristown, VT By Pass - 2013
- Montpelier, VT I-89 Exit 8 – 2013
- Proctor, VT Hydro Dam Up Grade - 2013
- Warren, VT State Route 100 – 2013 - 2014

Explosive Product Type Experience

- **Initiation Systems**: Electric, Non-Electric, and Electronic
- **Packaged Products**: Emulsions, Dynamite nitroglycerin based product
- **Bulk**: Emulsions and Ammonium Nitrate

Additional Information/Licenses/Certifications

- ATF Employee Possessor Clearance
- VT CDL A with Hazmat and Tanker endorsements
- Vermont Explosive License Number: 246 Type: A

Maine Drilling & Blasting

Driller Profile

Morris R. Putvain – Lead Drill Operator
Western Division
10 Boulder Dr., Hyde Park, VT 05655

Work History

Maine Drilling and Blasting – Lead Drill Operator – August 2000 to Current

Training and Education

Maine Drilling and Blasting

- MSHA Part 46 Refresher – 03/2014
- Driller I & II – 01/30/2009
  Dave Bijolle – Driller Superintendent

Notable Projects

- Morristown, VT By Pass - 2013
- Montpelier, VT I-89 Exit 8 - 2013
- Warren, VT State Route 100 – 2013 - 2014

Additional Information/Licenses/Certifications

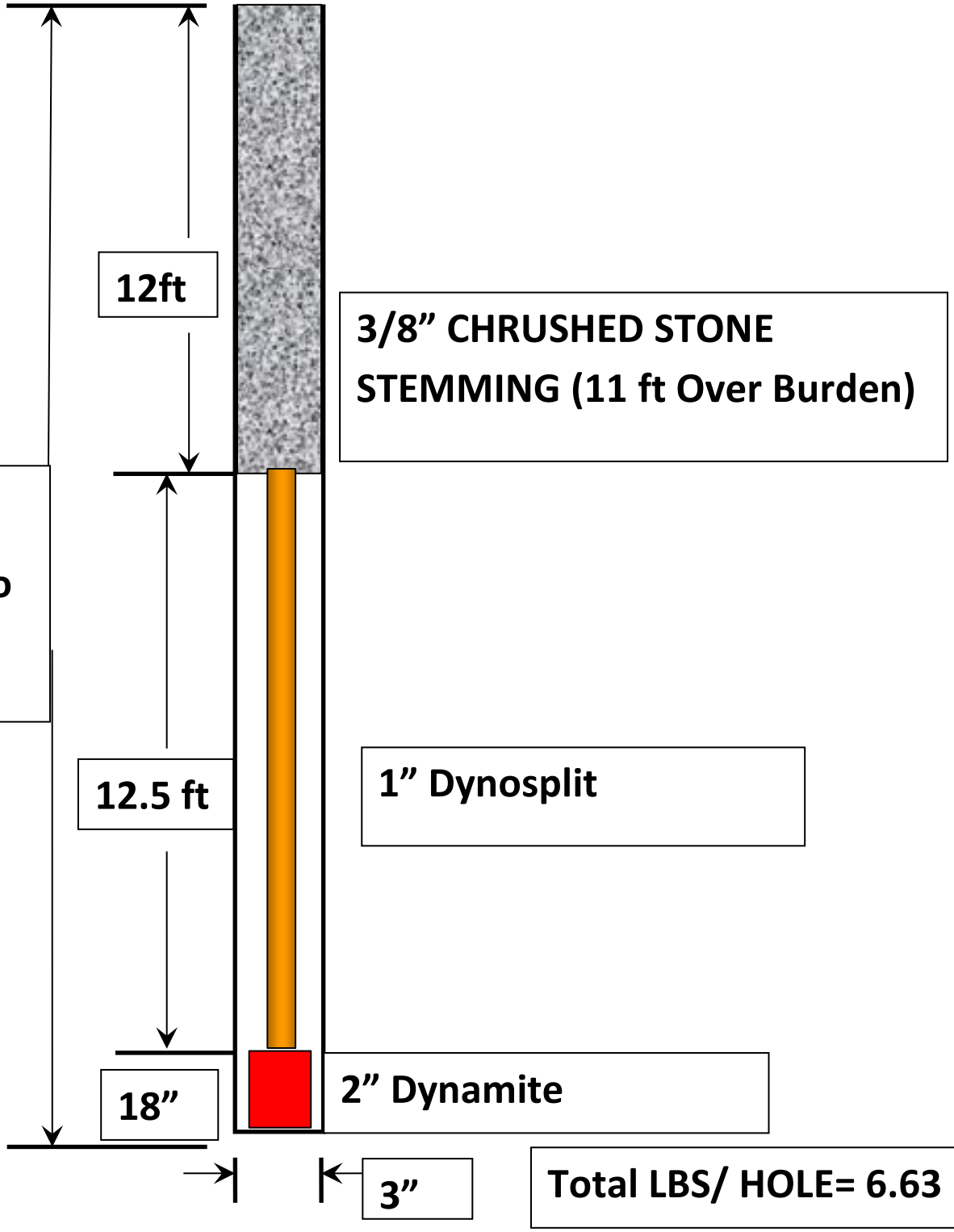
- OSHA-10 Construction
- ATF Employee Possessor Clearance

Typical Blast Design

Maine Drilling & Blasting TECHNICAL SERVICES GROUP

PRESPLIT LOADED HOLE

Total LBS/DELAY = 19.89

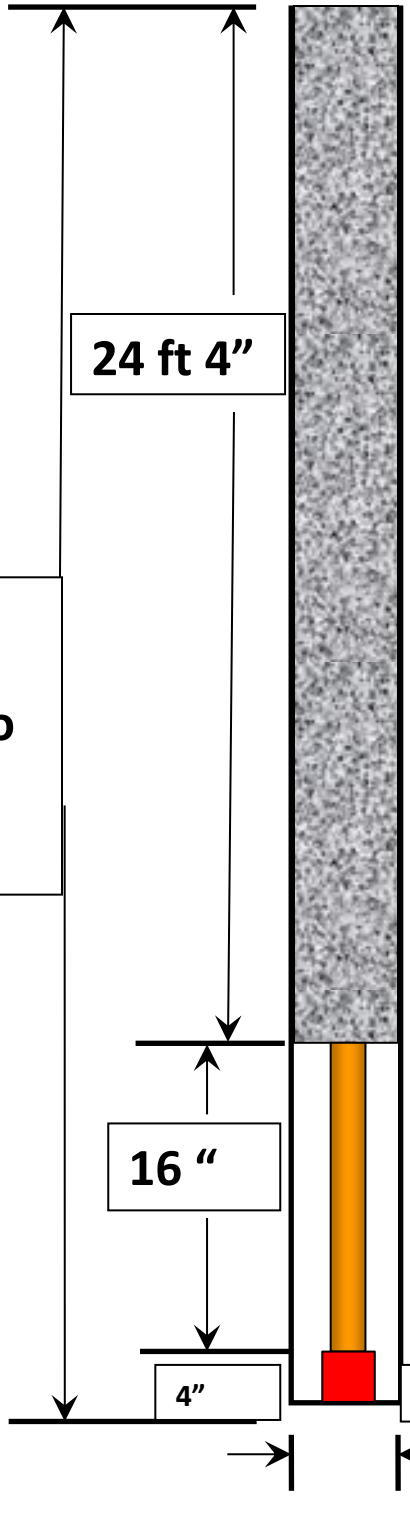


Total LBS/ HOLE= 6.63

Maine Drilling & Blasting TECHNICAL SERVICES GROUP

PRODUCTION LOADED HOLE

Total LBS/DELAY = 2.72



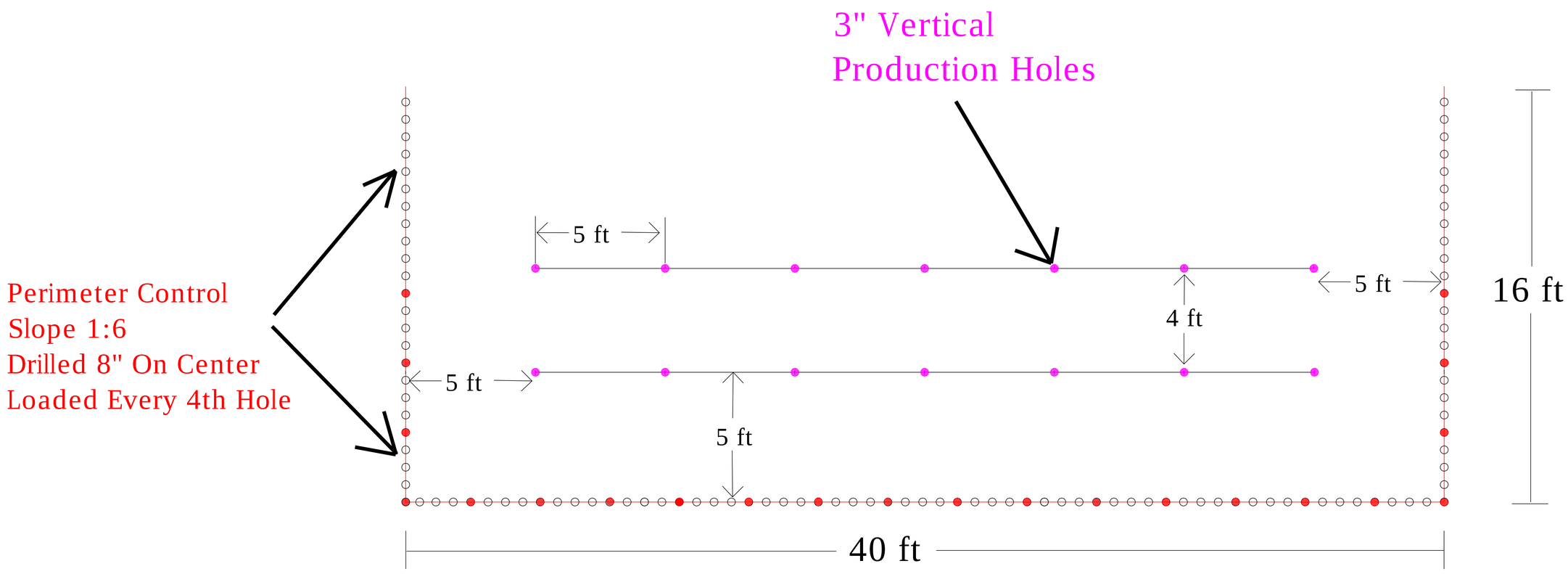
3/8” CHRUSHED STONE STEMMING (11 ft Over Burden)

26 ft hole includes no sub-drilling

2” Blastex

½ LB Cast Booster

Total LBS/ HOLE= 2.72



REV	DATE	DESCRIPTION

Middlebury Bridge- Blast Hole Layout

VT Route 125
Middlebury, VT

MaineDrilling &Blasting

DRAWN: DLT

DATE: 2/13/14

SCALE: 1" = 2'

Material Safety Data Sheets

UNIMAX®

Technical Information

Extra Gelatin Nitroglycerin Dynamite

Product Description

UNIMAX is an extra gelatin dynamite formulated to consistently deliver high detonation velocity and excellent water resistance. UNIMAX is designed to satisfy the vast majority of explosive applications in hard rock and may be used as the main explosive charge where high density and energy is required or as a primer for ANFO.

Application Recommendations

- UNIMAX is an excellent primer for Dynomix (ANFO), Dynomix-WR (WR ANFO) or other detonator sensitive packaged product and can be used as a secondary primer in hard seams or at the top of the explosive column.
- Minimum diameter is 25 mm (1 in).
- Minimum detonator is No. 8 strength.
- Storage at elevated temperatures and/or high humidity for 1 to 6 months can reduce the performance of Unimax depending on the diameter. Consult your Dyno Nobel representative for specific recommendations.
- Dynamites are susceptible to sympathetic detonation when applied in very wet conditions where boreholes are closely spaced and/or where geological conditions promote this effect. Consult your Dyno Nobel representative for recommendations where these conditions exist.

Properties

MSDS #1019

Density	(g/cc) Avg	1.51
Energy[a]	(cal/g)	1,055
	(cal/cc)	1,510
Relative Weight Strength[a]		1.20
Relative Bulk Strength[a,b]		2.10
Velocity[c]	(m/s)	5,300
	(ft/s)	17,400
Detonation Pressure[c]	(Kbars)	106
Gas Volume[a]	(moles/kg)	32
Water Resistance		Excellent
Fume Class		IME1 & NRCan1[d]

[a] All Dyno Nobel Inc. energy and gas volume values are calculated using PRODET™ the computer code developed by Dyno Nobel Inc. for its exclusive use. Other computer codes may give different values.
[b] ANFO = 1.00 @ 0.82 g/cc
[c] Unconfined @ 50 mm (2 in) diameter.
[d] Approved by Natural Resources Canada as Fume Class 1.

Hazardous Shipping Description
Explosive, Blasting, Type A, 1.1D, UN 0081 II

See Product Disclaimer on page 2

DYNO Dyno Nobel
Groundbreaking Performance™

UNIMAX®

Technical Information

Transportation, Storage and Handling

- UNIMAX must be transported, stored, handled and used in conformity with all applicable federal, state, provincial and local laws and regulations.
- For maximum shelf-life, dynamite must be stored in cool, dry and well-ventilated magazines. Dynamite inventory should always be rotated by using the oldest materials first. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives.

Diameter x Length		Quantity / Case	Case Type	Nominal Case Weight	
mm	in			kg	lbs
25 x 200	1 x 8	140	DA	20.4	44.8
32 x 200	1 1/4 x 8	88	DA	20.0	44.0
32 x 400	1 1/4 x 16	44	DA	20.0	44.0
40 x 200	1 1/2 x 8	60	DA	19.4	42.6
40 x 400	1 1/2 x 16	30	DA	20.5	45.0
50 x 200	2 x 8	34	DB	19.3	42.5
50 x 400[a]	2 x 16[a]	17	DB	19.3	42.5
60 x 400[a]	2 1/4 x 16[a]	13	DA	18.1	39.8
65 x 400[a]	2 1/2 x 16[a]	10	DB	18.6	41.0
75 x 200	3 x 8	16	DE	19.9	43.7
75 x 400[a]	3 x 16[a]	8	DE	20.4	44.8

[a] Avaliable in spiral tube shell with tapered end.

- Note: all weights are approximate.
- Product density is 1.50 g/cc for package diameters less than 50 mm (2 in). Use cartridge count to determine actual explosive charge weight.
- UNIMAX is available in a wide variety of sizes. Custom sizes are subject to surcharge and may require longer than usual lead times.

**Available upon request. Check with your Dyno Nobel representative should you have any questions.

Case Dimensions

DA	45 x 34 x 17 cm	17¾ x 13⅜ x 6⅜ in
DB	45 x 34 x 15 cm	17⅞ x 13⅜ x 5⅞ in
DE	45 X 34 X 17 cm	17⅝ x 13 5/16 x 6¾ in

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Material Safety Data Sheet

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CANUTEC (CANADA) 613-996-6666

MSDS # 1063
Date 01/20/11

Supercedes
MSDS # 1063 09/16/10

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):

BLASTEX®	DYNO® 1.5 SB
BLASTEX® PLUS	DYNO® 1.5 SBC
BLASTEX® PLUS HD	DYNO® 1.5 SB30
BLASTEX® TX	DYNO® 900
BLASTEX® PLUS TX	DYNO® 1300
BLASTGEL® 1000	DYNO® 1500
BLASTGEL® 1070	DYNO® 1520
SUPER BLASTEX®	DYNO® 1540
SUPER BLASTEX® TX	DYNOTEX
SUPER BLASTEX® TX	DX-2011
	DX-2012

Product Class: Emulsion Explosives, Packaged

Product Appearance & Odor: White or pink opaque semi-solid, which will appear gray if product contains aluminum. Little or no odor. Packaged in cylindrical cartridges of paper or plastic film.

DOT Hazard Shipping Description: **UN0332** Explosive, blasting, type E 1.5D II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

			Occupational Exposure Limits	
Ingredients:	**CAS#**	**% (Range)**	**ACGIH TLV-TWA**	**OSHA PEL-TWA**
Ammonium Nitrate	6484-52-2	60-85	None	None
Sodium Nitrate	7631-99-4	0-12	None	None
Methylamine Nitrate*	22133-87-7	0-3	None	None
Aluminum	7429-90-5	0-10	10 mg/m^3 (dust)	15 mg/m^3 (total)
Mineral Oil	64742-35-4	0-6	5 mg/m^3 (mist)	None
Kerosene	8008-20-6	0-6	None	None

* This ingredient may be used only in products produced at the Paige Plant.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

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Material Safety Data Sheet

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: (Air = 1) Not Applicable
Percent Volatile by Volume: <20 (water)

Evaporation Rate (Butyl Acetate = 1): <1

Vapor Pressure: Not Applicable
Density: 1.15-1.35 g/cc
Solubility in Water: Product partially dissolves very slowly in water.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: >100°C **Flammable Limits:** Not Applicable
Extinguishing Media: (See Special Fire Fighting Procedures section.)
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: May cause irritation, redness and tearing.
Skin: Prolonged contact may cause irritation.
Ingestion: Large amounts may be harmful if swallowed.
Inhalation: Not a likely route of exposure.
Systemic or Other Effects: None known.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least 15 minutes. If irritation persists seek medical attention.
Skin: Remove contaminated clothing. Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: If irritation occurs, remove to fresh air.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.
Conditions to Avoid: Keep away from heat, flame, ignition sources and strong shock.
Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis).
Hazardous Decomposition Products: Nitrogen Oxides (NO_X), Carbon Monoxide (CO)
Hazardous Polymerization: Will not occur

Material Safety Data Sheet

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.
Respiratory Protection: None normally required.
Protective Clothing: Gloves and work clothing that reduce skin contact are suggested.
Eye Protection: Safety glasses are recommended.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State and local regulations. Keep away from heat, flame, ignition sources and strong shock.
Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.
Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

The reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372 may become applicable if the physical state of this product is changed to an aqueous solution. If an aqueous solution of this product is manufactured, processed, or otherwise used, the nitrate compounds category and ammonia listing of the previously referenced regulation should be reviewed.

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BLASTEX®

Technical Information

PACKAGED EXPLOSIVES

Small & Large Diameter Cast Booster Sensitive Emulsion

Product Description

BLASTEX is a booster sensitive, water resistant, packaged emulsion explosive designed to satisfy a majority of medium diameter explosive applications for quarry and construction blasting. It is a cost effective alternative to most detonator sensitive, water resistant, packaged emulsion explosives. BLASTEX is available in two grades with increasing energy level for each.

Application Recommendations

- Package diameter and type affect product density. Use cartridge count to determine actual explosive charge weight.
- Ensure continuous column loading. For column lengths in excess of 6 m (20 ft) or whenever column separation is suspected, multiple priming is recommended.
- Emulsion explosives are susceptible to "dynamic shock" and may detonate at low order or fail completely when applied in very wet conditions, where explosive charges or decks are closely spaced and/or where geological conditions promote this effect. Consult your Dyno Nobel representative for alternate product recommendations when these conditions exist.
- **ALWAYS** use a cast booster as a primer for BLASTEX to ensure maximum performance.
- **ALWAYS** use a 340 g (12 oz) or larger cast booster at internal product temperatures higher than -18° C (0° F). At internal product temperatures below -18° C (0° F) and higher than -34° C (-30° F) use a 454 g (16 oz) or larger cast booster.
- **NEVER** use BLASTEX at internal product temperatures below -34° C (-30° F). At internal product temperatures below -34° C (-30° F), adequate product warm-up time must be allowed after loading into boreholes and before initiation.
- Use with detonating cord is not recommended.

Properties

MSDS #1063

		BLASTEX	BLASTEX PLUS
Density	(g/cc) Avg	1.26	1.26
Energy[a]	(cal/g)	740	800
	(cal/cc)	930	1,010
Relative Weight Strength[a]		0.84	0.91
Relative Bulk Strength[a,b]		1.29	1.40
Velocity[c]	(m/s)	5,000	4,900
	(ft/s)	16,400	16,100
Detonation Pressure[c]	(Kbars)	79	76
Gas Volume[a]	(moles/kg)	44	39
Fume Class		IME1 & NRCan[d]	IME1
Shelf Life Maximum		1 year (from date of production)	
Maximum Water Depth		45 m (150 ft)	
Water Resistance		Excellent	

[a] All Dyno Nobel Inc. energy and gas volume values are calculated using PRODET™ the computer code developed by Dyno Nobel Inc. for its exclusive use. Other computer codes may give different values.
[b] ANFO = 1.00 @ 0.82 g/cc
[c] Unconfined @ 75 mm (3 in) diameter
[d] Approved by Natural Resources Canada as Fume Class 1 in valeron chub package in all diameters greater than 50 mm (2 in) and **only** in diameters greater than 125 mm (5 in) in shot bags.

Hazardous Shipping Description

Explosive, Blasting, Type E, 1.5D, UN 0332 II

See Product Disclaimer on page 2

DYNO Dyno Nobel

Groundbreaking Performance™

BLASTEX®

Technical Information

PACKAGED EXPLOSIVES

Transportation, Storage and Handling

- BLASTEX and BLASTEX PLUS must be transported, stored, handled and used in conformity with all applicable federal, state, provincial and local laws and regulations.
- Packaged emulsions have a shelf life of one (1) year when stored at temperatures between -18º C and 38º C (0º F and 100º F). Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case ad the Safety Library Publications of the Institute of Makers of Explosives.

Packaging Details

- Package diameter and type affect product density. Use cartridge count to determine actual explosive charge weight.
- All weights are approximate.
- BLASTEX and BLASTEX PLUS are available in a wide variety of sizes. Custom sizes are subject to surcharge and may require longer than usual lead times.
- Check with your Dyno Nobel representative should you have any questions.

Packaging = Chub

Diameter x Length		Blastex	Blastex Plus	Case Quantity	Pallet Box Quantity	Case Weight		Net Explosive Weight / Chub	
mm	in					kg	lbs	kg	lbs
50 x 400	2 x 16	■	■	18	N/A	18.0	40	1.00	2.20
57 x 400	2¼ x 16	■	■	14	N/A	17.7	39	1.26	2.78
65 x 400	2½ x 16	■	■	12	N/A	18.1	40	1.51	3.33
65 x 862	2½ x 34	■		N/A	250	909	2,000	3.63	8.00
70 x 400	2¾ x 16	■	■	9	N/A	17.3	38	1.92	4.23
70 x 862	2¾ x 34	■		N/A	222	908	1,998	4.09	9.00
75 x 400	3 x 16	■	■	8	N/A	18.2	40	2.27	5.00
75 x 862	3 x 34	■		N/A	200	909	2,000	4.54	10.00
89 x 400	3½ x 16	■	■	6	N/A	16.7	37	2.77	6.11

Case Dimensions

44 x 35 x 20 cm 17.25 x 13.875 x 7.875 in

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Material Safety Data Sheet

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MSDS # 1108
Date 06/28/11

Supercedes
MSDS # 1108 09/16/10

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):

DYNO® CORD SENSITIVE BOOSTERS - CS35, CS45, CS90, CS135
TROJAN® SPARTAN®
TROJAN® SPARTAN® Slider
TROJAN® Stinger
TROJAN® NB
TROJAN® NB UNIVERSAL
TROJAN® Twinplex
TROJAN® SPARTAN® SR

Product Class: Cast Boosters

Product Appearance & Odor: Tan to brown solid with no odor. May also be silvery gray. Packaged in paper or plastic tube.

DOT Hazard Shipping Description: Booster 1.1D UN0042 II

NFPA Hazard Classification: Not Available (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

			Occupational Exposure Limits	
Ingredients:	**CAS#**	**% (Range)**	**ACGIH TLV-TWA**	**OSHA PEL-TWA**
Pentaerythritol Tetranitrate (PETN)	78-11-5	35-70	None Established	None Established
Trinitrotoluene	118-96-7	30-50	0.1 mg/m^3 (skin)	1.5 mg/m^3 (skin)
RDX	121-82-4	0-25	0.5 mg/m^3 (skin)	1.5 mg/m^3 (skin)
HMX	2691-41-0	0-5	None Established	None Established
Aluminum	7429-90-5	0-15	10 mg/m^3 (dust)	15 mg/m^3 (total)

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

DYNO
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Groundbreaking Performance

Material Safety Data Sheet

SECTION III - PHYSICAL DATA

Melting Point: 176° F (80° C) (TNT)
Vapor Density: Not applicable
Percent Volatile by Volume: Not applicable
Evaporation Rate (Butyl Acetate = 1): Not applicable
Vapor Pressure: 0.042mm Hg at 80° C (TNT)
Density: 1.55 - 1.65 g/cc
Solubility in Water: < 0.01%

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not applicable
Flammable Limits: Not applicable
Extinguishing Media: (See Special Fire Fighting Procedures section).
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: Particulates in the eye may cause irritation, redness, and tearing. Prolonged or repeated contact may cause cataracts, optic neuritis, blurred vision or amblyopia.
Skin: Prolonged contact may cause irritation, severe eczema and sensitization dermatitis. TNT may be absorbed through the skin, which may be indicated by orange staining on exposed skin. See systemic effects below.
Ingestion: Harmful if swallowed. See systemic effects below.
Inhalation: Inhalation of dusts may cause irritation, sneezing or coughing. See systemic effects below.
Systemic or Other Effects: TNT is an irritant, neurotoxin, hepatotoxin, nephrotoxin and bone marrow depressant. Although exposure is unlikely, acute or chronic exposure may cause sensitization dermatitis, headache, dizziness, jaundice, lethargy, or problems with the liver or blood such as toxic nephritis, aplastic anemia, hemolytic anemia or methemoglobin formation. **PETN** is a known coronary vasodilator, and ingestion or inhalation may result in a lowering of blood pressure, headache or faintness, and a decreased tolerance for grain alcohol. Repeated over-exposure may result in chest pains in the absence of exposure.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Remove contaminated clothing. Wash skin thoroughly with soap and water.
Ingestion: Seek medical attention.
Inhalation: In case of irritation, remove to fresh air. Seek medical attention if chronic symptoms occur.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.
Conditions to Avoid: Keep away from heat, flame, friction, impact, ignition sources and strong shock.
Materials to Avoid (Incompatibility): Corrosives (strong acids and bases or alkalis).
Hazardous Decomposition Products: Nitrogen Oxides (NO_X), Carbon Monoxide (CO)
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.
Respiratory Protection: None normally required.
Protective Clothing: Non-permeable gloves and work clothing that reduce skin contact are recommended.
Eye Protection: Safety glasses are recommended.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry location. Store in compliance with all Federal, State and local regulations. Keep away from heat, flame, ignition sources or strong shock.
Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.
Other Precautions: It is recommended that users of explosives material be familiar with the Institute of Makers of Explosives Safety Library publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
None Applicable		

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TROJAN SPARTAN®

Technical Information

BOOSTERS • CORDS

Cast Booster

Product Description
TROJAN SPARTAN cast boosters are detonator sensitive, high density, high energy molecular explosives avaliable in various sizes designed to optimize initiation of all booster sensitive explosives. All TROJAN SPARTAN boosters are manufactured with an internal through-tunnel and detonator well for easy application with either electric, electronic or nonelectric detonators or 10.6 g/m (50 gr/ft) minimum strength detonating cord.

TROJAN SPARTAN boosters are formulated from the highest quality PETN and other high explosive materials ensuring reliability, consistency and durability in all blasting environments. The fluorescent green container and clear printing makes the TROJAN SPARTAN booster more visible on the blast site (as well as in low light situations) and reduces the possibility of misplaced charges. The redesigned Caplock™ holds the detonator in place more securely and makes it more difficult for the detonator to be pulled out of the capwell position while it is being lowered into the borehole.

Application Recommendations
- **NEVER** force the detonator into the through-tunnel, the detonator-well or otherwise attempt to clear these areas if obstructed. If the through-tunnel or detonator-well does not accommodate the detonator, do not use the booster. Notify your Dyno Nobel representative.

Properties

MSDS #1108

Density	(g/cc) Avg	1.65
Velocity	(m/sec)	7,550
	(ft/s)	24,800
Detonation Pressure (Kbars)		235
Water Resistance		6 months with no loss of sensitivity
Shelf Life Maximum		5 years (from date of production)
Maximum Usage Temperature		60°C (150°F)

All Dyno Nobel Inc. energy and gas volume values except Velocity and Detonation Pressure are calculated using PRODET™ the computer code developed by Dyno Nobel Inc. for its exclusive use. Other computer codes may give different values.

Velocity and Detonation Pressure are the result of empirical methods during May 2009.

Hazardous Shipping Description
UN 0042 Boosters, 1.1D PG II

See Product Disclaimer on page 2.

DYNO
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TROJAN® SPARTAN®

Technical Information

Application Recommendations (continued)

- **ALWAYS** use detonating cord with a coreload of 10.6 g/m (50 gr/ft) or higher when initiating the TROJAN SPARTAN booster with detonating cord.
- Minimum detonator is No. 8 strength for temperatures above -40º C (-40º F). A high strength detonator is recommended for temperatures below -40º C (-40º F).
- Extremely low temperatures do not affect the performance of cast boosters with commercial detonators. Low temperatures do affect detonators and detonating cord. Be certain your initiation system is suitable for your application in extremely low temperatures. Cast boosters are more susceptible to breakage during handling in extremely cold temperatures.

Transportation, Storage and Handling

- Dyno Nobel cast boosters must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations.
- For maximum shelf life (5 years), Dyno Nobel cast boosters must be stored in a cool, dry, well ventilated magazine. Explosive inventory should be rotated. Avoid using new materials before the old.

Packaging

Unit Weight		Unit Dimensions				Case Quantity	Gross Weight/ Case	
		Length		Diameter				
g	oz	cm	in	cm	in		kg	lbs
90	3.2	11.9	4.7	2.7	1.1	150	14.0	30.8
150	5.5	11.9	4.7	3.6	1.4	95	16.7	36.7
200	7	11.7	4.6	4.1	1.6	72	16.5	36.4
350	12	11.9	4.7	5.0	2.0	49	17.9	39.5
400	14	11.9	4.7	5.5	2.2	40	17.6	38.8
450	16	11.9	4.7	5.8	2.3	36	17.8	39.2
900	32	12.9	5.1	7.9	3.1	18	17.8	39.2

Note: All weights and dimensions are approximate.

Case Dimensions

42 x 33 x 14 cm 16 ½ x 13 x 5 ½ in

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CANUTEC (CANADA) 613-996-6666

MSDS # 1122
Date 06/13/12

Supercedes
MSDS # 1122 12/15/11

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):

NONEL® MS
NONEL® MS ARCTIC
NONEL® LP
NONEL® SL
NONEL® TD
NONEL® MS CONNECTOR
NONEL® TWINPLEX™
NONEL® STARTER
NONEL® EZ DET®
NONEL® EZTL™
NONEL® EZ DRIFTER ®
NONEL® SUPER

Product Class: NONEL® Non-electric Delay Detonators

Product Appearance & Odor: Aluminum cylindrical shell with varying length and diameter of attached colored plastic tubing. The detonator may be enclosed in a plastic housing, and an assembly may contain two detonators. Odorless.

DOT Hazard Shipping Description: UN0029 Detonators, non-electric 1.1B II
-or- UN0360 Detonator assemblies, non-electric 1.1B II
-or- UN0361 Detonator assemblies, non-electric 1.4B II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

		Occupational Exposure Limits	
Ingredients	**CAS#**	**OSHA PEL-TWA**	**ACGIH TLV-TWA**
Pentaerythritol Tetranitrate (PETN)	78-11-5	None[1]	None[2]
Lead Azide	13424-46-9	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Lead	7439-92-1	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Silicon	7440-21-3	15 mg / m^3 (total dust) 5 mg / m^3 (respirable fraction)	10 mg / m^3
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3
Red Lead (Lead tetroxide)	1314-41-6	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Titanium dioxide	13463-67-7	15 mg/m^3	10 mg/m^3
Barium Chromate	10294-40-3	1 mg (CrO_3)/10m^3 (ceiling) 0.5 mg (Ba)/m^3	0.01 mg (Cr)/m^3 0.5 mg (Ba)/m^3
Lead Chromate	7758-97-6	0.05 mg (Pb)/m^3 1 mg (CrO_3)/10m^3 (ceiling)	0.15 mg (Pb)/m^3 0.012 mg (Cr)/m^3
Barium Sulfate	7727-43-7	0.5 mg (Ba)/m^3	10 mg/m^3
Potassium Perchlorate[3]	7778-74-7	None[1]	None[2]
Silica (crystalline)	61790-53-2	See Note Below	0.05 mg/m^3 (resp frac)

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Molybdenum	7439-98-7	None[1]	None[2]
Tungsten	7440-33-7	None[1]	5 mg/m^3 (TWA) 10 mg/m^3 (STEL)
Aluminum	7429-90-5	15 mg/m^3 (total dust) 5 mg/m^3 (respirable fraction)	5 mg/m^3
Antimony	7440-36-0	0.5 mg/m^3	0.5 mg/m^3
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	None[1]	None[2]
Diazodinitrophenol	4682035	No value established	No value established

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m^3 ; respirable fraction, 5 mg/m^3 .
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m^3 ; respirable part., 3 mg/m^3 .
Note: The OSHA PEL for crystalline silica is calculated as follows:
Quartz, respirable: 10 mg/m^3 [e] / % SiO_2 + 2 Quartz, total dust: 30 mg/m^3 / % SiO_2 + 2
[3] Not all delay periods contain perchlorate. Those that do contain between from about 4 to a maximum of about 60 mg perchlorate per detonator.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: Not Applicable
Percent Volatile by Volume: Not Applicable
Evaporation Rate (Butyl Acetate = 1): Not Applicable
Vapor Pressure: Not Applicable
Density: Not Applicable
Solubility in Water: Not Applicable

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable **Flammable Limits:** Not Applicable
Extinguishing Media: (See Special Fire Fighting Procedures section.)
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe, distant location. Allow fire to burn unless it can be fought remotely or with fixed extinguishing systems (sprinklers).
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

This is a packaged product that will not result in exposure to the explosive material under normal conditions of use. Exposure concerns are primarily with post-detonation reaction products, particularly heavy metal compounds.

Eyes: No exposure to chemical hazards anticipated with normal handling procedures. Particulates in the eye may cause irritation, redness, swelling, itching, pain and tearing.
Skin: No exposure to chemical hazards anticipated with normal handling procedures. Exposure to post-detonation reaction products may cause irritation.

Ingestion: No exposure to chemical hazards anticipated with normal handling procedures. Post-detonation reaction product residue is toxic by ingestion. Symptoms may include gastroenteritis with abdominal pain, nausea, vomiting and diarrhea. See systemic effects below.

Inhalation: Not a likely route of exposure. See systemic effects below.
Systemic or Other Effects: None anticipated with normal handling procedures. Repeated inhalation or ingestion of post-detonation reaction products may lead to systemic effects such as respiratory tract irritation, ringing of the ears, dizziness, elevated blood pressure, blurred vision and tremors. Heavy metal (lead) poisoning can occur.
Carcinogenicity: ACGIH classifies Lead as a "Suspected Human Carcinogen" and insoluble Chromium VI as "Confirmed Human Carcinogen". NTP, OSHA, and IARC consider components contained in this detonator carcinogenic.

Perchlorate: Perchlorate can potentially inhibit iodide uptake by the thyroid and result in a decrease in thyroid hormone. The National Academy of Sciences (NAS) has reviewed the toxicity of perchlorate and has concluded that even the most sensitive populations could ingest up to 0.7 microgram perchlorate per kilogram of body weight per day without adversely affecting health. The USEPA must establish a maximum contaminant level (MCL) for perchlorate in drinking water by 2007, and this study by NAS may result in a recommendation of about 20 ppb for the MCL.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: Not applicable.
Special Considerations: None

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact.
Conditions to Avoid: Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock. Do not attempt to disassemble.
Materials to Avoid (Incompatibility): Corrosives (acids and bases or alkalis).
Hazardous Decomposition Products: Carbon Monoxide (CO), Nitrous Oxides (NO_X), Sulfides, Chromates, Lead (Pb), Antimony (Sb) and various oxides and complex oxides of metals.
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate all personnel to a safe distant area and allow to burn or fight fire remotely. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. If loose explosive powder is spilled, such as from a broken detonator, only properly qualified and authorized personnel should be involved with handling and clean-up activities. Spilled explosive powder is extremely sensitive to initiation and may detonate. Follow applicable Federal, State, and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: None required for normal handling. Provide enhanced ventilation after use if in underground mines or other enclosed areas.

Respiratory Protection: None required for normal handling.

Protective Clothing: Cotton gloves are recommended.

Eye Protection: Safety glasses are recommended.

Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Only properly qualified and authorized personnel should handle and use explosives. Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.

Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.

Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

Material Safety Data Sheet

ECTION X - SPECIAL INFORMATION

These products contain the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	Max. lbs/1000 units
Lead	7439-92-1	39.4
	(Use Toxic Chemical Category Code)	
Lead Compounds	N420	2.0
Barium Compounds	N040	1.8
Chromium Compounds	N090	1.9

Range* of Section 313 Chemicals in each product

Product	lb Pb per 1000 detonators	lb Pb compounds per 1000 detonators	lb Ba compounds per 1000 detonators	lb Cr compounds per 1000 detonators
NONEL® MS	**0 - 27**	**0.3 – 1.5**	**0 – 0.9**	**0 – 0.9**
NONEL® LP	**0 - 30**	**0.3 – 2.0**	**0 - 1.8**	**0 - 1.9**
NONEL® SL	**7 - 27**	**0.3 – 1.5**	**0**	**0**
NONEL® TD	**0 - 18**	**0.3 – 0.7**	**0**	**0**
NONEL® MS Connector	**5 - 16**	**0.3 – 0.4**	**0**	**0**
NONEL® TWINPLEX™	**5 - 15**	**0.3 – 0.7**	**0**	**0**
NONEL® STARTER	**0**	**0.3**	**0**	**0**
NONEL® EZ DET®	**22 - 36**	**2.0**	**0**	**0**
NONEL® EZTL™	**5 - 15**	**0.5 – 0.7**	**0**	**0**
NONEL® EZ DRIFTER	**39.4**	**1.3**	**1.2**	**1.3**
NONEL® SUPER	**019**	**0.35**	**1.1**	**1.4**

*** The exact quantity and weight percent of Section 313 Chemicals in each delay period and tubing length for each product is available upon request.**

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NONEL® EZ DET® 1.4B

Technical Information

Nonelectric Blast Initiation System

Product Description

NONEL® nonelectric delay detonator EZ DET® 1.4B units consist of a length of orange shock tube with a surface detonator attached to one end and a Standard (#8) in-hole detonator on the other. The surface detonator is inside a color-coded plastic EZ™ Connector block to facilitate easy connections to shock tube leads. This block can hold up to 6 shock tube leads. Easy-to-read, color-coded delay tags display the delay number and nominal firing time prominently.

NONEL EZ DET units can be easily connected to one another to satisfy basic blast design requirements in construction, mining, and quarry operations. They can also be used in combination with NONEL MS, NONEL EZTL™ and/or NONEL TD detonators to satisfy complex blast design requirements and minimize inventory of initiation system components.

Application Recommendations

For detailed application recommendations, **ALWAYS** request a copy of Dyno Nobel's *Product Manual: NONEL® and PRIMACORD®* from your Dyno Nobel representative.

- **ALWAYS** select a NONEL EZ DET unit having more than enough tubing length to extend from the planned primer location in the borehole to the collar of the next hole.

Properties

MSDS #1122

Net Explosive Content per 100 units 0.0810 kg
0.1782 lbs

This product is only available in the United States.

Nominal Time (msec)	Nominal Time (msec)	Nominal Time (msec)	Connector Block Color
17 / 350	17 / 500	17 / 700	Yellow
25 / 350	25 / 500	25 / 700	Red
42 / 350	42 / 500	42 / 700	White
25 / 375			Red

Hazardous Shipping Description

Detonator assemblies nonelectric,
1.4B, UN 0361 PG II

See Product Disclaimer on page 2.

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NONEL® EZ DET® 1.4B

Technical Information

Application Recommendations (continued)

- **ALWAYS** protect the plastic EZ Connector block and all shock tube leads from impact or damage during the loading and stemming operations. Use care when placing blasting mats and cover material on top of the blasting circuit. The EZ Connector block contains a detonator and is subject to detonation caused by abuse such as impact. Shock tube which has been cut, ruptured or damaged may cause misfires.
- **ALWAYS** be sure that the shock tube(s) are securely inserted, one at a time, into the EZ Connector block. The head of the EZ Connector block should rise to accept the shock tube and return to a closed position with an audible click.
- **ALWAYS** ensure that individual shock tubes remain aligned side by side in the connector channel and do not cross one over the another on insertion.
- **NEVER** use NONEL EZ DET units with detonating cord. The low strength surface detonator will not initiate detonating cord and may cause misfires.
- **NEVER** attempt to disassemble the delay detonator from the plastic EZ Connector block or use the detonator without the connector.
- **NEVER** place more than 6 shock tube leads into the plastic EZ Connector block. Misfires may result.
- **NEVER** pull, stretch, kink or put tension on shock tube such that the tube could break.
- **NEVER** splice NONEL EZ DET shock tube together to extend between holes.
- **NEVER** connect NONEL EZ DET units together until all holes have been primed, loaded and stemmed and the blast site has been cleared.

Transportation, Storage and Handling

- NONEL EZ DET must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations.
- For maximum shelf life (3 years), NONEL EZ DET must be stored in a cool, dry, well ventilated magazine. Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives

Packaging

Length		Case Type	Quantity / Case	
m	ft		case	subpack
3.5	12	D	180	90
4.5	16	D	120	60
7	24	D	120	60
9	30	D	80	40
12	40	D	60	30
15	50	D	60	30
18	60	D	50	25
24	80	DC	50	--
30	100	DC	40	--
37	120	DC	30	--

- Length rounded to nearest one-half meter.
- Case weight varies by length & delay; see case label for exact weight.

Note: This product is also available with a High Strength cap. For more information, please contact your local Dyno Nobel sales representative.

Case Dimensions

Detpak Case (DC)	48 x 45 x 26 cm	18¾ x 17¾ x 10¼ in
Detpak (D)		
subpack	44 x 22 x 25 cm	17 ½ x 8 ¾ x 10 in
strapped case	44 x 45 x 25 cm	17 ½ x 17 ⅝ x 10 in

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NONEL® EZTL™

Technical Information

Nonelectric Trunkline Delay Detonators

Product Description

NONEL® nonelectric delay detonator EZTL™ units consist of a length of yellow shock tube, with a surface detonator attached to one end and the other end sealed. The detonator is housed in a plastic EZ Connector block which facilitates easy connection to shock tube. A white J-hook is affixed near the sealed end. Easy-to-read, color-coded delay tags display the delay number and nominal firing time prominently.

EZTL detonators are designed for use with NONEL MS and EZ DET® units to provide effective and accurate surface timing between blastholes and/or rows of blastholes in surface and underground blasting designs.

Application Recommendations

For detailed application recommendations, **ALWAYS** request a copy of Dyno Nobel's *Product Manual: NONEL® and PRIMACORD®* from your Dyno Nobel representative.

- **ALWAYS** be sure that the shock tube(s) are securely inserted, one at a time, into the plastic EZ connector. The head of the connector block should rise to accept the tube, and return to a closed position with an audible click.
- **ALWAYS** ensure that the individual shock tubes remain aligned side by side in the EZ connector channel and do not cross over one another during insertion.
- **ALWAYS** protect the plastic EZ connector and all shock tube leads from impact or

Properties

MSDS #1122

Net Explosive Content per 100 units 0.0240 kg
0.0529 lbs

Delay Time (msec)	Connector Block Color
9	Green
17	Yellow
25	Red
33	Green
42	White
67	Blue
100	Black
109	Black

Hazardous Shipping Description

Detonator assemblies nonelectric,
1.4B, UN 0361 PG II

See Product Disclaimer on page 2.

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Technical Information

Application Recommendations (continued)

damage. Use care when placing blasting mats and cover material on top of the blasting circuit. The EZ connector contains a detonator and is subject to detonation caused by abuse such as impact. Shock tube which has been cut, ruptured or damaged may cause misfires.

- **NEVER** use NONEL EZTL detonators with detonating cord. The low strength surface detonator will not initiate detonating cord.
- **NEVER** attempt to disassemble the delay detonator from the EZ connector block or use the detonator without the connector.
- **NEVER** place more than 6 shock tube leads into an EZ connector block. Misfires may result.
- **NEVER** tie-in NONEL EZTL units until all holes have been primed, loaded, stemmed and the blast site has been cleared.

Transportation, Storage and Handling

- NONEL EZTL must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations.
- For maximum shelf life (3 years), NONEL EZTL must be stored in a cool, dry, well ventilated magazine. Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives.

Packaging

Length		Case Type	Quantity / Case	
m	ft		case	subpack
2.5	10	D	180	90
3.5	12	D	180	90
6	20	D	150	75
9	30	D	120	60
12	40	D	100	50
15	50	D	90	45
18	60	D	70	35

- Length rounded to nearest one-half meter.
- Case weight varies by length & delay; see case label for exact weight.

Case Dimensions

Detpak (D)

subpack	44 x 22 x 25 cm	17½ x 8¾ x 10 in
strapped case	44 x 45 x 25 cm	17½ x 17⅝ x 10 in

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Material Safety Data Sheet

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MSDS # 1124
Date 09/16/10

Supercedes
MSDS # 1124 08/13/08

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): NONEL® LEAD LINE

Product Class: Shock Tube

Product Appearance & Odor: Hollow plastic tubing (normally yellow) with dusty inner coating of HMX and aluminum. No detectable odor.

DOT Hazard Shipping Description: **UN0349** Articles, explosive, n.o.s. (HMX) 1.4S II.
For 10,000 ft spools with Wire Lock Terminations only: Not regulated as an explosive, 0000

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

			Occupational Exposure Limits	
Ingredients:	**CAS#**	**% (Range)**	**OSHA PEL-TWA**	**ACGIH TLV-TWA**
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	0.35	None[1]	None[2]
Aluminum (dust)	7429-90-5	0.04	15 mg/m^3 (total) 5 mg/m^3 (respirable)	10 mg/m^3

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m^3 ; respirable fraction, 5 mg/m^3.
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m^3 ; respirable part., 3 mg/m^3.
Note: The above hazardous dust mixture is present at approximately 15 mg per meter of tubing.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: Not Applicable
Melting Point: HMX decomposes violently at melting pt., about 278°C
Evaporation Rate (Butyl Acetate = 1): Not Applicable
Vapor Pressure: Not Applicable
Density: Not Applicable
Solubility in Water: Not Soluble
Percent Volatile by Volume: Not Applicable

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SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flammable Limits: Not Applicable
Extinguishing Media: Water, inert powder, CO_2
Special Fire Fighting Procedures: For shock tube only, consider initial isolation of at least 15 meters (50 feet) in all directions. Fight fire with normal precautions and methods used for plastic fires from a reasonable distance. IF DETONATORS OR OTHER EXPLOSIVES ARE PRESENT, DO NOT FIGHT FIRE.
Unusual Fire and Explosion Hazards: May burn vigorously with localized detonations and projection of fragments, with effects usually confined to the immediate vicinity of packages. Toxic smoke from combustion of the plastic material may be emitted. If product functions, high heat and pressure are released from the end of the tube if not covered or enclosed, typically by a metal device.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

This is a packaged product that will not result in exposure to hazardous ingredients (inner coating materials) under normal conditions of use.
Eyes: Not a likely route of exposure. Dust particles may be irritating.
Skin: Not a likely route of exposure. Dust particles may cause skin irritation.
Ingestion: Not a likely route of exposure. Ingestion of large amounts of the reactive powder (HMX) is poisonous and may cause cardiovascular collapse.
Inhalation: Not a likely route of exposure. Breathing dust can cause respiratory irritation. During manufacture and at processing temperatures, irritating fumes may evolve.
Systemic or Other Effects: None known.
Carcinogenicity: No constituents are listed by NTP, IARC or OSHA.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Wash with soap and water.
Ingestion: Not Applicable
Inhalation: Not Applicable
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable
Conditions to Avoid: Keep away from heat, flame, impact, friction, ignition sources and strong shocks. Also avoid stretching to failure.
Materials to Avoid (Incompatibility): Incompatible with strong oxidizers and acids.
Hazardous Decomposition or Combustion Products: Hazardous carbon monoxide (CO), nitrogen oxide (NO_X) gases and products of plastic decomposition produced.
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 50 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, repackage undamaged devices in original packaging, accounting for every device. If the ends or tube wall have been opened such that powder may have

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been released from the tube, isolate the spill area. Contamination of the HMX/Aluminum powder with sand, grit or dirt will render the material more sensitive to detonation. Carefully wet down and clean "loose" powder spills using a damp sponge or rag, avoid applying friction or pressure to the explosive, and place in a (Velostat) electrically conductive bag. Follow applicable Federal, State, and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: None normally required. Provide enhanced ventilation if used in underground mines, indoors or other enclosed areas.
Respiratory Protection: None normally required. Extended testing of the product indoors or in enclosed areas may necessitate respiratory protection.
Protective Clothing: None normally required. Wear chemical-resistant gloves during post-detonation cleanup or spill cleanup operations.
Eye Protection: Safety glasses or goggles are recommended for handling, testing or cleanup.
Other Precautions Required: None

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Keep away from heat, flame, ignition sources and strong shock. Only properly qualified and authorized personnel should handle and use Shock Tube.
Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.
Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
None		

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NONEL® Lead Line

Technical Information

Nonelectric Shock Tube

Product Description

NONEL LEAD LINE is NONEL shock tube spooled at the factory in 763 meter (2,500 foot) lengths for easy application and deployment. NONEL LEAD LINE shock tube is a small diameter, three-layer plastic tube coated on the innermost wall with a reactive explosive compound. When initiated, NONEL shock tube propagates a low energy signal, similar to a dust explosion, at approximately 2000 m/sec (6,500 ft/sec) along the tube's length with minimal disturbance to the outside of the tube. The signal is transmitted from one NONEL shock tube to another through field-assembled splices.

NONEL LEAD LINE provides maximum flexibility to the blaster in choosing a position of safety from which to initiate nonelectric blast rounds in either underground or surface applications. NONEL LEAD LINE is the only NONEL product that can be cut and spliced into a NONEL detonator product to construct a custom length nonelectric starter assembly.

Application Recommendations

- **ALWAYS** splice NONEL LEAD LINE to NONEL EZTL™ nonelectric trunkline delay detonators, NONEL EZ DET® nonelectric blast initiation system, NONEL TD or NONEL Starter detonators to make-up the nonelectric starter assembly when using

Properties

MSDS #1124

Net Explosive Content per 100 units 0.0044 kg
0.0097 lbs

Length		Spools / Case
m	ft	
762	2500	2

- Length rounded to nearest one-half meter.
- See case label for exact case weight.

Hazardous Shipping Description

Articles, Explosives, N.O.S. (HMX, Aluminum), 1.4S, UN 0349, PG II

See Product Disclaimer on page 2.

DYNO Dyno Nobel

Groundbreaking Performance™

NONEL® Lead Line

Technical Information

Application Recommendations (continued)

NONEL LEAD LINE as the primary initiator for NONEL blast rounds.

- **ALWAYS** trim at least 3 m [10 ft] of tubing before inserting into a nonelectric shock tube starting device or whenever dirt and/or moisture may have compromised the open tube ends before making a splice connection.
- **ALWAYS** replace the plastic tube closure over the open end of any NONEL LEAD LINE that remains on the spool and is intended to be used to make up another nonelectric starter assembly.
- **ALWAYS** make the final hook-up of the nonelectric starter assembly to the blast round only after all equipment and non-essential personnel are clear of the blast area.
- **ALWAYS** unspool NONEL LEAD LINE by hand if the starter assembly has been spliced to it and is attached to the blast round.
- **ALWAYS** keep any NONEL LEAD LINE tube ends sealed and free from dirt and moisture since dirt or moisture in the shock tube may cause a misfire.
- **NEVER** use NONEL LEAD LINE for in-hole use. NONEL LEAD LINE is for use outside the borehole only.
- **NEVER** attempt to knot different lengths of shock tube together. Shock tube will not initiate itself through knot connections. It must be spliced.
- **NEVER** remove the plastic tube closure from the NONEL LEAD LINE shock tube until just before splicing.
- **NEVER** attach the starter assembly to the blast round until after the LEAD LINE deployment is complete whenever NONEL LEAD LINE is to be unspooled by any method other than by hand,

Application Recommendations (continued)

- **NEVER** run over NONEL LEAD LINE with equipment. This may damage the shock tube and may cause a misfire. **ALWAYS** replace the NONEL LEAD LINE if it is damaged.
- When making a nonelectric starter assembly using NONEL LEAD LINE, **ALWAYS** remove the plastic tube closure and save for later use. Splice two freshly-cut ends of NONEL shock tube together (one from the NONEL LEAD LINE and the other from the NONEL detonator) by inserting them into opposite ends of the plastic connector sleeve and pushing them toward one another until they are both at least ½ cm (¼ in) in the splice.

Transportation, Storage and Handling

- NONEL LEAD LINE must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations.
- For maximum shelf life (3 years), NONEL LEAD LINE must be stored in a cool, dry, well ventilated magazine. Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet “Prevention of Accidents in the Use of Explosive Materials” packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives.

Case Dimensions

51 x 25 x 28 cm 20 x 9 ⅞ x 10 ⅞ in

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Phone 800-732-7534 Fax 801-328-6452 Web www.dynonobel.com

Maine Drilling & Blasting

MATERIAL SAFETY DATA SHEET

Setting Earth Shattering Standards
Since 1966

Product Name: MDB BLEND 1966

SECTION I

Issued by the Safety Department

MAINE DRILLING AND BLASTING
88 Gold Ledge Ave.
Auburn, NH 03032

EMERGENCY PHONE
DAY 603-647-0299
Chemtrec 1-800-424-9300

TRADE NAME AND SYNONYMS:

MDB Blend 1966

SECTION II HAZARDOUS INGREDIENTS

Ammonium Nitrate: NH_4NO_3,	CAS No. 6484-52-2	(65 - 90%)
Fuel Oil/ Mineral Oil Blend,	CAS No. 68476-30-2	(3 - 9%)
Aluminum: Al,	CAS No. 7429-90-5,	(0 - 10%)
Polymeric Surfactant	Not Applicable for Mixtures	(0.5 – 2%)

An emulsified mixture of ammonium nitrate solution, fuel oil, mineral oil and polymeric surfactant (emulsifier). May also contain ammonium nitrate prills (granules) and/or aluminum.

SECTION III PHYSICAL DATA

BOILING POINT: N/A VAPOR PRESSURE (mm Hg) N/A
SPECIFIC GRAVITY (H_2O = 1): 1.20 to 1.30 VAPOR DENSITY (Air=1) N/A
PERCENT VOLATILE BY VOL. (%): N/A EVAPORATION RATE: N/A
SOLUBILITY IN WATER: Although in excess of 80% of the materials are readily soluble in water; the product has excellent water resistance.
APPEARANCE AND ODOR: White to tan colored thick cream. If aluminum is present, gray metal particles will be visible. If ammonium nitrate prill is present, white to tan colored granules will be visible. Slight odor of fuel oil.

SECTION IV FIRE AND EXPLOSION DATA

FLASH POINT:	165^0 F (74^0 C) (PMCC)
FLAMMABLE LIMITS:	Not available
EXTINGUISHING MEDIA:	See below.
SPECIAL FIRE FIGHTING PROCEDURES:	Do not fight fires. Withdraw personnel immediately. Allow fire to burn Itself out.
UNUSUAL FIRE AND EXPLOSION HAZARDS:	May explode when subjected to fire or shock, especially when confined and in large quantities.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: ACGIH: Oil mist, mineral, 5 MG/M^3, Aluminum metal dust, 10 MG/M^3
OSHA: Oil mist, mineral, 5 MG/M^3, Aluminum metal dust, 15 MG/M^3
EFFECTS OF OVEREXPOSURE: Acute: Ingestion of large amounts may cause cyanosis, nausea, collapse, vomiting, abdominal pain, rapid heartbeat and breathing, coma, convulsions, and death may occur.
EMERGENCY AND FIRST AID PROCEDURES:
Eyes: Slight irritant. Flush with large amounts of water for at least 15 minutes and consult a physician.
Skin: Slight irritant. Wash with mild soap and water.

Maine Drilling & Blasting

MATERIAL SAFETY DATA SHEET

Setting Earth Shattering Standards
Since 1966

Product Name: MDB BLEND 1966

SECTION VI REACTIVITY DATA **Issued by the Safety and Compliance Dept.**

STABILITY: Stable under normal conditions. May explode when subjected to fire or shock, especially when confined and in large quantities. Avoid temperatures above 212^0F, (100^0C).
INCOMPATIBILITY (MATERIALS TO AVOID): Avoid all contamination, especially peroxides and chlorates. Alkaline contamination may liberate ammonia fumes.
HAZARDOUS DECOMPOSITION PRODUCTS: Gaseous nitrogen oxides and carbon oxides: Toxic decomposition products including carbon monoxide (CO) may migrate to off blast-site areas.

HAZARDOUS POLYMERIZATION WILL NOT OCCUR.

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Pick up and dispose of all spilled material immediately. Do not permit smoking or open flames near spill site.

WASTE DISPOSAL METHOD: Uncontaminated and contaminated material may be placed in large diameter boreholes and detonated so that the explosive energy is utilized as originally intended. Dispose of under direct supervision of a qualified person according to local, state and federal regulations. Call Maine Drilling & Blasting Safety and Compliance Department for recommendations and assistance.

TRANSPORTATION EMERGENCIES involving spills, leaks, fires or exposures in the United States:
CALL: CHEMTREC for emergencies only: 1-800-424-9300

SECTION VIII SPECIAL PROTECTION INFORMATION:

RESPIRATORY PROTECTION:	Not required under normal conditions.
VENTILATION:	Not required under normal conditions.
PROTECTIVE GLOVES:	Slight skin irritant.
EYE PROTECTION:	Slight eye irritant.

SECTION IX SPECIAL PRECAUTIONS

COMPLY WITH THE SAFETY LIBRARY PUBLICATION NO. 4 “WARNINGS AND INSTRUCTIONS” AS ADOPTED BY THE INSTITUTE OF MAKERS OF EXPLOSIVES.
TRANSPORTATION, STORAGE AND USE MUST COMPLY WITH OSHA SAFETY AND HEALTH STANDARDS 29CFR1910.109, APPLICABLE MSHA REGULATIONS, THE DOT AND HAZARDOUS MATERIALS REGULATIONS, BATF REQUIREMENTS AND STATE AND LOCAL TRANSPORTATION, STORAGE AND USE REGULATIONS AND ORDINANCES.

DOT or IMDG proper shipping description: Explosive, Blasting, Type E, 1.5D, UN0332, PG II

This material may become a hazardous waste under certain conditions and must be collected, labeled and disposed of per state and federal hazardous waste regulations.

None of the components are listed in the 1987 IARC Monographs, Group 1, 2A or 2B as known, probable, or possible carcinogens, nor are they listed in the NTP annual report on carcinogens.

DYNOSPLIT® RIGHT™

Technical Information

PACKAGED EXPLOSIVES

Small Diameter Detonator Sensitive Continuous Packaged Emulsion

Product Description

DYNOSPLIT RiGHT is a detonator sensitive, perchlorate free, packaged emulsion explosive product produced in a continuous cartridge form specifically for both surface and underground perimeter control applications such as presplit and trim blasting. DYNOSPLIT RiGHT is crimped every 400 mm (16 in) and externally traced the entire length with 8.5 g/m (40 gr/ft) detonating cord. The continuous explosive column provides consistent borehole pressure along the entire loaded borehole zone resulting in a uniform tensile shearing effect. DYNOSPLIT RiGHT can be cut to fit the desired load length or spliced to increase the load length.

Application Recommendations

- DYNOSPLIT RIGHT is recommended for use with miniumum #8 strength electric, electronic or nonelectric detonators or the appropriate core load detonating cord.
- When initiating with a detonator, **ALWAYS** attach the detonator directly to the extrernal, trace detonating cord on the DYNOSPLIT RIGHT packaged emulsion.
- When initiating with detonating cord, **ALWAYS** use 5.3 g/m (25 gr/ft) detonating cord when internal product temperatures are higher than 0° C (32°F) or 8.5 g/m (40 gr/ft) detonating cord when internal product temperatures are -20º C to 0° C (-4° to 32° F) for both downlines and trunklines.

Properties

MSDS #1157

Density	(g/cc) Avg	1.10 - 1.12
Energy[a]	(cal/g)	775
	(cal/cc)	860
Relative Weight Strength[a]		0.88
Relative Bulk Strength[a,b]		1.19
Velocity[c]	(m/s)	4,900
	(ft/s)	16,100
Detonation Pressure[c]	(kbars)	66
Gas Volume[a]	(moles/kg)	38
Water Resistance		Excellent
Fume Class[d]		IME1 & NRCan1

a All Dyno Nobel Inc. energy and gas volume values are calculated using PRODET™, the computer code developed by Dyno Nobel Inc. for its exclusive use. Other computer codes may give different values.

b ANFO = 1.00 @ 0.82 g/cc

c Unconfined @ 32 mm (1¼ in) diameter; emulsion only. Actual VOD of DYNOSPLIT RIGHT is dependent on VOD of detonating cord (~7,000 m/sec).

Hazardous Shipping Description

Explosive, Blasting, Type E 1.1D UN 0241 II

See Product Disclaimer on page 2

DYNO Dyno Nobel

Groundbreaking Performance™

DYNOSPLIT® RIGHT™

Technical Information

PACKAGED EXPLOSIVES

Applications Recommandations (continued)

- DYNOSPLIT RIGHT will perform in temperatures from -20º to +50º C (-4º to 122ºF).
- At internal product temperatures below -20ºC (-4ºF), **ALWAYS** allow adequate product warm-up time after loading into boreholes and before initiation. Consult the Warm-Up Time Chart to determine adequate borehole residence time after loading.

Transportation, Storage and Handling

- DYNOSPLIT RIGHT must be transported, stored, handled and used in conformity with all applicable federal, state, provincial and local laws and regulations.
- Packaged emulsions have a shelf life of one (1) year when stored at temperatures between -18ºC and 38º C (0ºF and 100ºF). Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives.

Warm-Up Time Chart
Borehole Residence Time (Hours at 7°C / 45°F)

Internal Product Temperature Before Loading		25-32 mm (1 - 11/4 in) Diameter		38-50 mm (1½ - 2 in) Diameter	
°C	°F	Wet	Dry	Wet	Dry
-30	-22	0.5	1.0	1.0	3.0
-40	-40	1.0	3.0	2.0	5.0

Packaging

Diameter		Weight / Length		Length		Chubs per Case	Case Weight	
mm x 400	po x 16	kg/m	lbs/ft	m	ft		kg	lb
25	1	.49	.33	36.5	120	84	17	37
32	1¼	.83	.56	26.1	86	60	20.4	45
38	1½	1.21	.81	15.7	51	36	17.6	39
50	2	2.37	1.59	8.7	28.5	20	19	42

Note: All weights and dimensions are approximate.

Case Dimensions

44.5 x 36.3 x 20.3 cm 17.5 x 14.3 x 8.0 in

Pallet Information

42 Cases / Pallet

91 x 109 cm 36 x 43 in

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DYNO
Dyno Nobel
Groundbreaking Performance™

Material Safety Data Sheet

Dyno Nobel Inc.
2795 East Cottonwood Parkway, Suite 500
Salt Lake City, Utah 84121
Phone: 801-364-4800 Fax: 801-321-6703
E-Mail: dnna.hse@am.dynonobel.com
FOR 24 HOUR EMERGENCY, CALL CHEMTREC (USA) 800-424-9300
CANUTEC (CANADA) 613-996-6666

MSDS # 1157
Date 12/20/12

Supercedes 02/04/12

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): DYNOSPLIT® Right

Product Class: Pre-split Explosives, Emulsion with Detonating Cord

Product Appearance & Odor: Light pink waxy/greasy material packaged in a continuous string of plastic film cartridges traced externally with detonating cord.

DOT Hazard Shipping Description: Explosive, Blasting, Type E 1.1D UN0241 II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	ACGIH TLV-TWA
Ammonium Nitrate	6484-52-2	62 - 70	No Value Established
Sodium Nitrate	7631-99-4	14 - 18	No Value Established
Pentaerythritol tetranitrate (PETN)	78-11-5	0.5 – 3	No Value Established

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: Not Applicable
Percent Volatile by Volume: <10 (water)

Evaporation Rate (Ether = 1): Not Applicable

Vapor Pressure: Not Applicable
Density: 1.10 - 1.15 g/cc
Solubility in Water: Product mostly dissolves very slowly over time.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flammable Limits: Not Applicable
Extinguishing Media: See Special Fire Fighting Procedures Section.
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

DYNO
Dyno Nobel
Groundbreaking Performance

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: May cause irritation, redness and tearing.
Skin: Prolonged contact may cause irritation.
Ingestion: Not a likely route of exposure. Swallowing large quantities may cause toxicity characterized by dizziness, bluish skin coloration, methemoglobinemia and unconsciousness, abdominal spasms, nausea, and pain. PETN is moderately toxic if ingested. See systemic effects below.
Inhalation: Not a likely route of exposure.
Systemic or Other Effects: PETN is a known coronary vasodilator, and ingestion or inhalation may result in a lowering of blood pressure, headache or faintness, and a decreased tolerance for grain alcohol. Repeated over-exposure may result in chest pains in the absence of exposure. Systemic effects by ingestion include dermatitis.
Carcinogenicity: No constituents are listed by NTP, IARC or OSHA.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Remove contaminated clothing. Wash skin thoroughly with soap and water.
Ingestion: Seek medical attention.
Inhalation: Remove to fresh air. If irritation persists, seek medical attention.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.
Conditions to Avoid: Keep away from heat, flame, impact, friction, ignition sources, electrostatic discharge and strong shock.
Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis). Reacts with strong alkalis to liberate ammonia.
Hazardous Decomposition Products: Nitrogen Oxides (NO_X), Carbon Monoxide (CO)
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.
Respiratory Protection: None normally required.
Protective Clothing: Gloves and work clothing which reduce skin contact are recommended.
Eye Protection: Safety glasses are recommended.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State and local regulations. Only properly qualified and authorized personnel should handle and use explosives. Keep away from heat, flame, impact, friction, ignition sources, electrostatic discharge and strong shock.
Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.
Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library publications.

SECTION X - SPECIAL INFORMATION

The reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372 may become applicable if the physical state of this product is changed to an aqueous solution. If an aqueous solution of this product is manufactured, processed, or otherwise used, the nitrate compounds category and ammonia listings of the previously referenced regulation should be reviewed.

Disclaimer

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Site Security Template

Blast Site Security Plan

Job Name: _____

Job Number: _____

B-I-C: _____

Maine Drilling & Blasting

Site Diagram:

Identify roads, structures, storage areas, "safe areas" and the secure areas

Secure Area A: List responsible people and mode of communication

_____

_____

_____

Secure Area B: List responsible people and mode of communication

_____

_____

_____

Secure Area C: List responsible people and mode of communication

_____

_____

_____

Secure Area List responsible people and mode of communication

_____

_____

_____

Special Site Requirements:

Site Security Checklist

_____ Plan well communicated

_____ Signs Posted

_____ Blast area as large as possible

_____ Equipment moved

_____ Personnel Moved

_____ Other Movables Moved

_____ Hold Harmless in place

_____ Notifications Made

_____ Communication System in Place

_____ Warning signals sufficient volume

_____ Crow's Nest Identified

_____ Buildings cleared

_____ Traffic stopped

_____ Lookouts alert

_____ Adequate Shelter for Blaster

_____ Adequate shelter for others

_____ No one in front of the blast

_____ People out of vehicles/equipment

_____ Everything Double Checked

_____ Post Blast inspection

Review Sign-Off:

Name:	Signature:	Name:	Signature:

Blasting Location Plan

REMOVAL AND DISPOSAL OF GUARDRAIL
STA 137+65 - STA 139+10, RT
STA 138+79 - STA 139+10, LT
STA 139+61 - STA 140+46, RT
STA 139+61 - STA 140+52, LT

BOX BEAM GUARDRAIL (COATED BLACK)
STA 137+68 - STA 138+41, RT
STA 138+80, 45.6' LT - STA 138+89, 54.1' LT
STA 140+28 - STA 140+42, RT
STA 140+30 - STA 140+60, LT

COLD PLANING, BITUMINOUS PAVEMENT
STA 135+90 - STA 136+00, LT & RT

PORTLAND CEMENT CONCRETE SIDEWALK, 5 INCH
STA 136+50 - STA 139+06.75, RT
STA 139+72.75 - STA 140+47.55, RT

CAST-IN-PLACE CONCRETE CURB, TYPE B
STA 136+50 - STA 139+06.75, RT
STA 139+72.75 - STA 140+47.55, RT

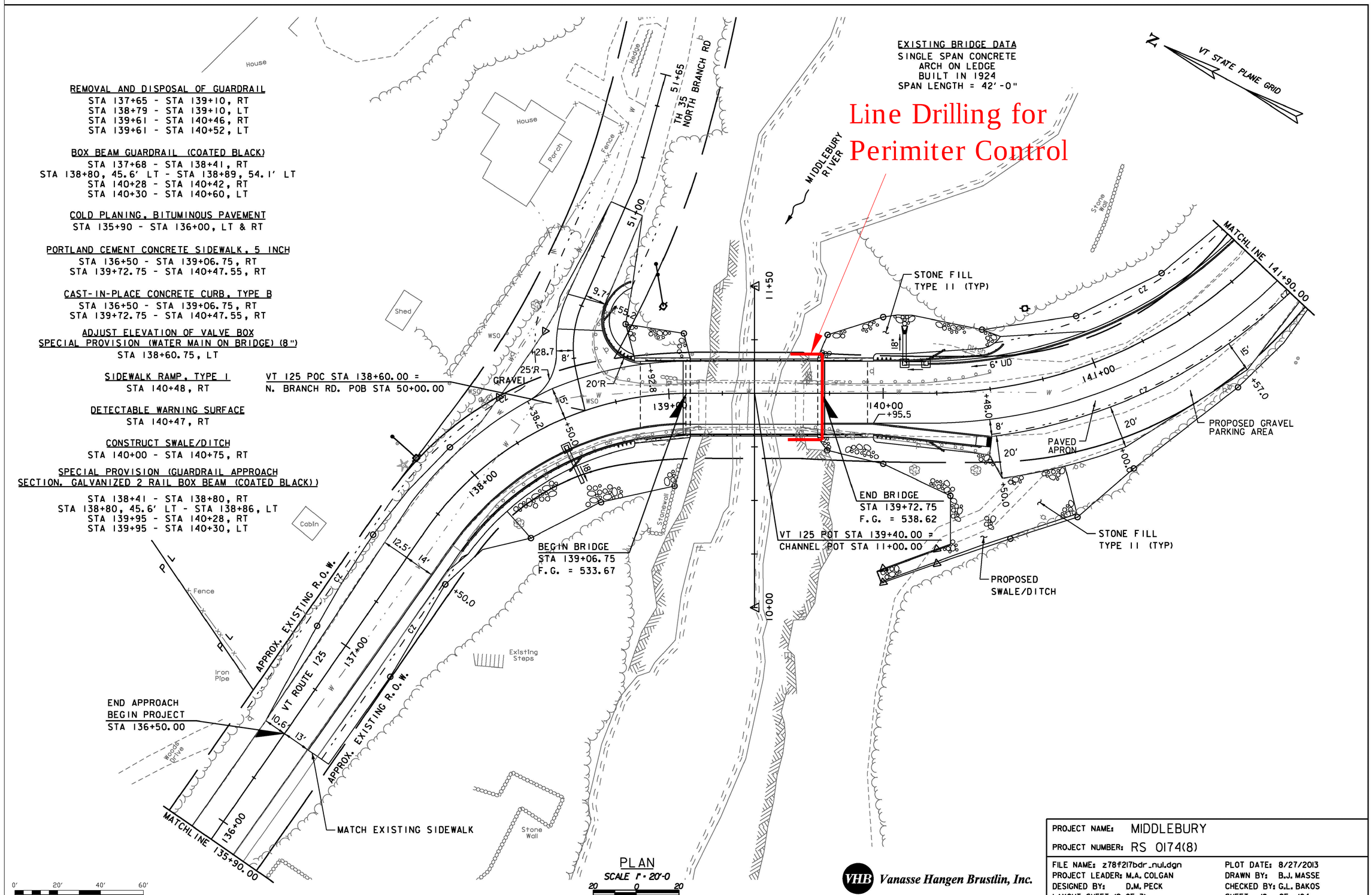
ADJUST ELEVATION OF VALVE BOX
SPECIAL PROVISION (WATER MAIN ON BRIDGE) (8")
STA 138+60.75, LT

SIDEWALK RAMP, TYPE I
STA 140+48, RT

DETECTABLE WARNING SURFACE
STA 140+47, RT

CONSTRUCT SWALE/DITCH
STA 140+00 - STA 140+75, RT

SPECIAL PROVISION (GUARDRAIL APPROACH SECTION, GALVANIZED 2 RAIL BOX BEAM (COATED BLACK))
STA 138+41 - STA 138+80, RT
STA 138+80, 45.6' LT - STA 138+86, LT
STA 139+95 - STA 140+28, RT
STA 139+95 - STA 140+30, LT



PLAN
SCALE 1" = 20'-0"
20 0 20

Vanasse Hangen Brustlin, Inc.

PROJECT NAME: MIDDLEBURY	
PROJECT NUMBER: RS 0174(8)	
FILE NAME: z78f217bdr_nul.dgn	PLOT DATE: 8/27/2013
PROJECT LEADER: M.A. COLGAN	DRAWN BY: B.J. MASSE
DESIGNED BY: D.M. PECK	CHECKED BY: G.L. BAKOS
LAYOUT SHEET (2 OF 3)	SHEET 18 OF 104

VHB 57438

REV	DATE	DESCRIPTION

Middlebury Bride Work Area
VT Route 125
Middlebury, VT

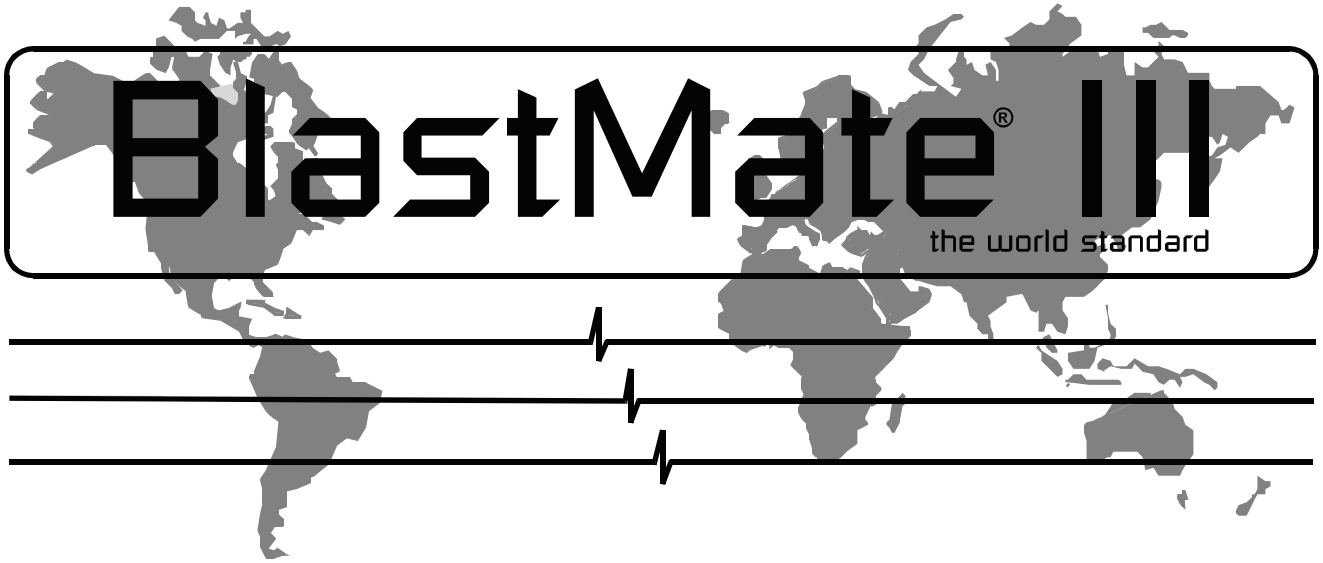
MaineDrilling &Blasting

DRAWN: DLT

DATE: 2/12/14

SCALE: 1" = 20'

Seismograph Information

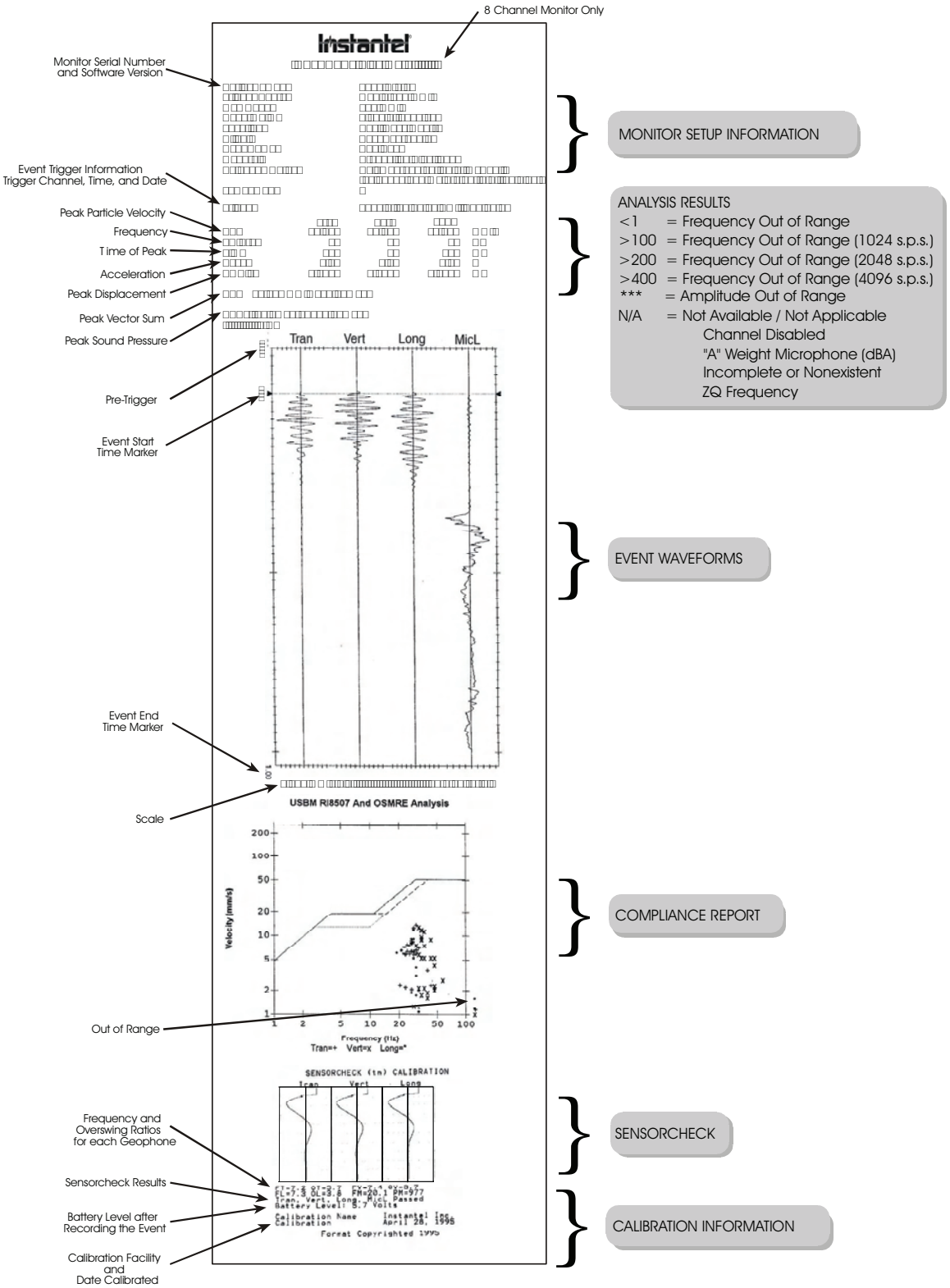


BlastMate III Operator Manual

Software Version 4.3

Instantel is certified to the ISO 9001 Quality Standard

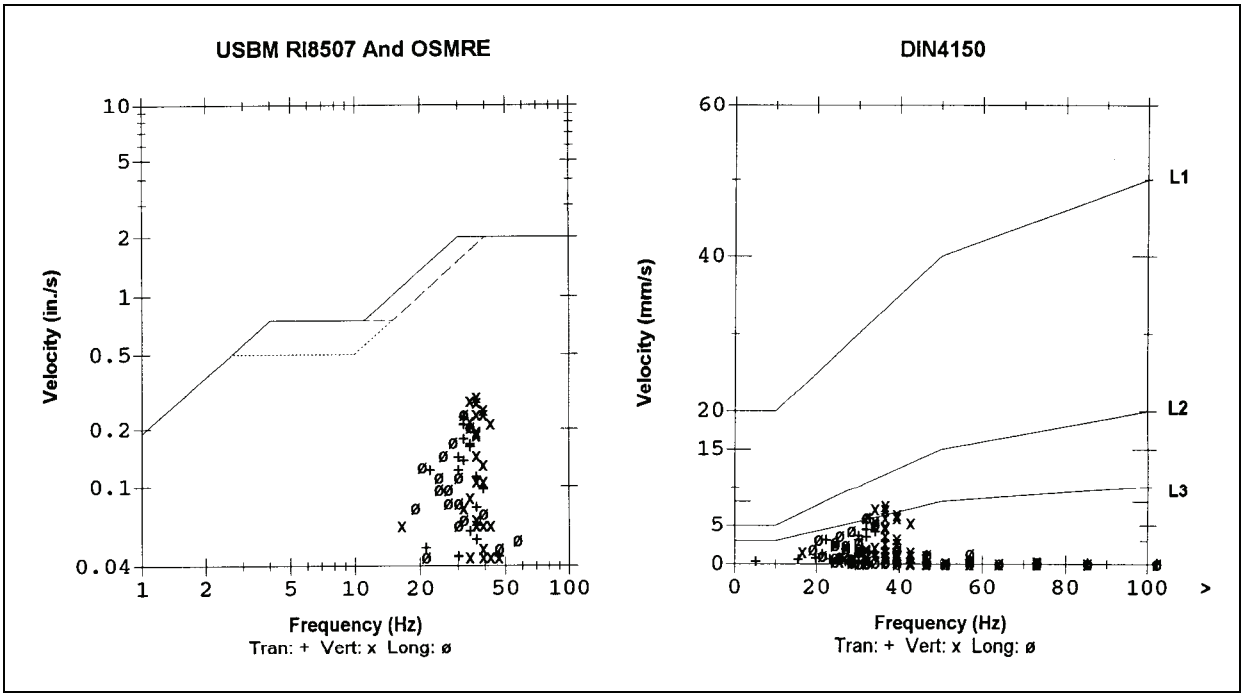
Instantel®


8 Channel Monitor Only
Instantel
Monitor Serial Number and Software Version
Event Trigger Information Trigger Channel, Time, and Date
Peak Particle Velocity
Frequency
Time of Peak
Acceleration
Peak Displacement
Peak Vector Sum
Peak Sound Pressure
Tran
Vert
Long
MicL
Pre-Trigger
Event Start Time Marker
Event End Time Marker
Scale
USBM RI8507 And OSMRE Analysis
Velocity (mm/s)
Frequency (Hz)
Tran=+ Vert=x Long=*
Out of Range
SENSORCHECK (tm) CALIBRATION
Frequency and Overswing Ratios for each Geophone
Sensorcheck Results
Battery Level after Recording the Event
Calibration Facility and Date Calibrated
MONITOR SETUP INFORMATION
ANALYSIS RESULTS
<1 = Frequency Out of Range
>100 = Frequency Out of Range (1024 s.p.s.)
>200 = Frequency Out of Range (2048 s.p.s.)
>400 = Frequency Out of Range (4096 s.p.s.)
*** = Amplitude Out of Range
N/A = Not Available / Not Applicable
Channel Disabled
"A" Weight Microphone (dBA)
Incomplete or Nonexistent
ZQ Frequency
EVENT WAVEFORMS
COMPLIANCE REPORT
SENSORCHECK
CALIBRATION INFORMATION

[illegible]

Instantel reserves the right to change specifications without notice.

[illegible]



REV	DATE	DESCRIPTION

Middlebury Bridge- Seismic Monitoring Plan

VT Route 125
Middlebury, VT

MaineDrilling &Blasting

DRAWN: DLT

DATE: 2/17/14

SCALE: 1" = 30'

Pre-Blast Survey Report

PRE BLAST SURVEY

TO: Guy Keefe
FROM: Jeff Immonen
DATE: 3/25 /2014
RE: JN# 104-04-02550 , E. Middlebury, VT-Bridge rebuilding/T Buck Construction

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The table presented below is a log of the structures that were notified by a representative of Maine Drilling & Blasting in accordance with pre-blast specifications. These structures were within 750 ft. of the anticipated Blasting area of the subject project.

ADDRESS	MAP LOT	OWNER/TENANT NAME	Pre-Blast Survey	NOTES
1 North Branch Rd CALL LIST		Roy Vestridge & Dawn Saunders	Completed	802-388-1250, 1st notice left 3/6/2014, appt 3/24/2014 @ 10:45AM
3 North Branch Rd CALL LIST		Carla Schley	Contact/ declined	802-388-2344, 1st notice left 3/6/2014
4 No Branch Rd CALL LIST		Amy Sheldon	Completed	802-388-9278, 1st notice left 3/6/2014, appt. 3/24/2014@10AM
7 No Branch Rd		Cornelia & Raymond Grant	Completed	802-388-2213, 1st notice left 3/6/2014, appt 3/18/2014 @11:15AM
E. Main St		Town water tank 275,000 gallons	Completed	802-465-4864, Fire Dept District 1 Eli, ok exterior on 3/18/2014, snow covered 75% of concrete wall footing
503 E. Main St		Burke Ratchford	Completed	802-388-8985, 1st notice left 3/6/2014 appt. 3/18/2014 @12:45PM
464 E Main St CALL LIST		Katherine Nichols	Completed	802-377-1942, 1st notice 3/6/2014app0t. 3/18/2014

				@10:30AM
466 E Main St CALL LIST		Simon & Ruth Barenbaum	Completed	802-388-2651, 1st notice left 3/6/2014, appt 3/18/2014 @2:30PM
469 E Main St CALL LIST		Jan Becker	Completed	802-388-9871/802-382-9343, 1st notice left 3/6/2014, appt. 3/18/2014 @Noon
468 E Main St		Francis Schlesinger	No response	Not listed, 1st notice left 3/6/2014, final notice mailed 3/10/2014
472 E Main St		Tom Mulhala Jr	Contact	802-279-4177 or 802-388-3945, Not listed, 1st notice left 3/6/2014, final notice mailed 3/10/2014, disc w/ Mulhalla on 3/25/14 advised if we get a chance will try to do PBS. Deadline was 12 days ago.
475 E. Main St		Jessica Rehuame	No response	Not listed, 1st notice left 3/6/2014, final notice mailed 3/10/2014
474 E Main St CALL LIST		Lynn Liilhammer	Contact/ no response	802-388-0085/802-385-8254, 1st notice left 3/6/2014
478 E Main St		Katie Sampson	No response	Not listed, 1st notice left 3/6/2014, final notice mailed 3/10/2014

Independent Monitoring Qualifications

STATEMENT OF QUALIFICATIONS

CONTINENTAL PLACER INC.
GEOLOGIC AND ENVIRONMENTAL SERVICES

Albany, New York • Wheaton, Illinois • Mechanicsburg, Pennsylvania • Laconia, New Hampshire
www.continentalplacer.com

CONTINENTAL PLACER INC.

A comprehensive team with a diverse range of expertise within the fields of earth science.

Continental Placer Inc. is a multi-disciplinary consulting firm providing interrelated geologic and environmental services to a wide range of clients. Since 1988, Continental Placer Inc.'s professional geologists, senior technicians, and environmental specialists have worked together providing innovative, cost-effective solutions, earning our reputation as a client-focused consulting firm.

Originally formed with the mining industry as its primary focus, our original objective has greatly expanded to offer services within the fields of blasting and construction vibration monitoring, hydrogeology water supply, environmental investigation, slope stability, soil and water remediation, and regulatory compliance. Our professionals are recognized nationally for such specialties as:

- Construction Vibration and Blasting Monitoring
- Blasting Design and Planning
- Environmental Site Assessments
- Environmental Impact Studies
- Geological Services
- Hydrogeologic Services
- Industrial Compliance
- Soil and Ground Remediation
- Expert Testimony
- Real Estate Transaction Assessments Market Studies
- Economic and Financial Feasibility Services

Continental Placer Inc.'s clients range in size from major international corporations to small, privately owned operations. We take pride in our ability to provide quality consulting services. As a professional consulting firm the most important key to our success is the relationship we develop with our clients. We strive to listen and understand each client's distinctive needs and requirements, each client's unique operations. Continental Placer Inc. works closely with our clients to develop realistic and profitable solutions that meet their immediate and long-term project goals. Our clients depend on our ability to form effective relationships with the financial, legal and regulatory communities involved within many industries.

Our client's success is our success. This idea is evident in our many loyal and repeat clients. It is our commitment to quality and improved practices which gives our clients the confidence and the satisfaction to use our services again and again.

OUR CORE SERVICES

Our client's success is our success.
Offering a full range of construction and mining services for over 25 years.

Construction and Industrial Services

- Pre-Blast Surveys
- Post-Blast Investigations
- Blast Vibration Monitoring
- Market Studies
- Acquisition Due Diligence
- Computerized Mapping and Modeling

Water Resources

- Groundwater Supply Exploration and Development
- Production Well Safe Yield Determination
- Wellhead Delineation and Aquifer Protection Zone Determination
- Well Field Management
- Well Redevelopment/Rehabilitation
- Assessment of Surface Water-Groundwater Interactions
- Water Budget Preparation
- Groundwater Flow Modeling

Environmental Services

- Environmental Site Assessments and Compliance Audits
- Environmental Impact Statements
- Permitting (Air, Wetlands, Stormwater, Surface Discharges, etc.)
- Spill Plans (SPCC)
- Subsurface Contamination Investigations
  (Phase II, RI, Landfills, UST's)
- Water Quality Delineation
- Contaminant Fate and Transport Modeling
- Turnkey Soil and Groundwater Remediation
- Landfill Siting and Closures
- Brownfields Redevelopment
- Building Asbestos Inspection and Sampling

BLASTING AND VIBRATION SERVICES

Monitoring and analysis of this kind must be conducted by professionals. Continental Placer Inc. has the ability to conduct blasting programs, investigation of blasting claims, review of seismograph data for clients throughout the United States.

Using knowledge gained from many years of experience to promote the timely and cost effective completion of any blast types. Continental Placer can provide both the required technical assistance and proven project management necessary for the progress and completion of any project. Continental Placer applies its blasting knowledge and experience We can provide:

- Public Relations
- Pre-Blast Surveys
- Blast Design
- Vibration Monitoring
- Alleged damages investigations
- Wave Form Interpretation
- Post Blast Inspection
- Expert Testimony
- Interpretation of Seismograms

Pre-Blast Surveys: Continental Placer Inc. (CPI) researches all properties within a specified radius of the blast area to gather names and addresses of property owners. Typically, owners are notified of the impending blasting project by certified mail/return receipt requested. The letter also includes our offer to conduct a pre-blast of their property. Surveys are conducted using a video camera with audio capabilities and are done to document the existing condition of structures on the property. The videotapes are kept on file at CPI unless other arrangements are made. In addition to completing the survey, CPI personnel discuss the aspects of blasting with the property owners. This is in an effort to make the owner more aware of blasting, hopefully reducing the potential for blast damage claims.

Third Party Blast Monitoring: CPI can assist in strategically locating and proper set-up of seismographs to monitor each detonation. Recorded blast induced ground vibrations and air overpressures can be interpreted in the field and immediately reported to the blaster in charge.

Post-Blast Surveys: At the request of the blasting company or their insurance company, CPI can conduct a thorough investigation of any blast. Through field investigations, interviews with property owners, analyses of seismic and/or blast records, and review of any existing pre-blast surveys, CPI personnel can determine what effect blasting had on a structure.

INTRODUCTION TO KEY PERSONNEL

Many of our professional and geologists have worked in the blasting and construction industries for a variant of projects, these projects range from Department of Transportation blasting to monitoring sensitive laboratory equipment while the construction of a 90-milion dollar building happens next door.. Continental's expertise is based on knowledge that can only be attained by years of experience. An introduction to key personnel is listed below followed by their respective resumes.

Brent J. Tardif, PG, President/Senior Geologist and Project Manager. Mr. Tardif has provided blast consultation and vibration control services for a major highway construction project for U.S. Fish and Wildlife Service in area of endangered species habitat. He has also prepared blasting and vibration control studies for numerous road construction projects as well as many other site construction projects. A sample of some of the more unique projects completed by Tardif include a vent shaft raise for underground mine and several projects that included blasting adjacent to a fully charged natural gas transmission line. Mr. Tardif has provided blasting consultation for a taking of a 6 million ton per year quarry. Tasks included a blast design within of 150 feet of inhabited dwellings and a multi-deck blasting for faces 140 feet in height. Mr. Tardif assisted in the preparation of the New England Governor's Conference Study on "The Supply and Demand for Construction Aggregates throughout New England". Mr. Tardif has expertise in blast consultation and vibration control services for major highway construction and related projects.

Paul (Dutch) Kretschmer, Blasting and Vibration Team Lead. Mr. Kretschmer has been involved in the construction industry for well over three decades, his career includes working in every aspect of building construction from laborer to Site Superintendent to Project Manager for projects up to $20 million. His work with a major drilling and blasting contractor in New England, involves all aspects of the industry, from blast design and vibration calculations, to assist in obtaining blasting permits. Mr. Kretschmer's proficiency with the use of a seismograph and the interpretation of seismograms, shot design and construction industry vibration monitoring is recognized by the industry as one of the experts. Mr. Kretschmer has provided over 10,000 pre-blast and pre-construction surveys. Mr. Kretschmer utilizes all of his experience to document the alleged damages, review all pertinent information, analyze the vibrations and render an expert opinion based upon the data compiled. He has conducted thousands of these investigations for numerous insurance companies throughout the United States.

Jeffrey A. Slade, Senior Geologist. For over 28 years Mr. Slade has provided blast consultation and vibration monitoring services for clients in the mining and construction industries. Typical project work included blasting impact and mitigation studies for new mine and quarry permits, blast vibration monitoring and control programs for major highway, municipal utility lines and gas transmission pipelines, as well as supervision and monitoring of blasting at other construction projects. Acting as a blasting consultant, Mr. Slade has provided expert testimony at public hearings concerning blasting issues. Special or unique project work included blast monitoring for a major gas pipeline within an existing major utility corridor and blast consultation for construction project at the Iron Mountain

underground document storage facility in Rosendale, New York.

W. Kyle Crossett, Geologist. Mr. Crossett has the know how to effectively implement surveys and subsequent mapping of any given site, both surficially, and geologically. Mr. Crossett has the experience of surveying multiple sites using various tools that include GPS mapping grade equipment and Electronic Distance Measurement (EDM) transit surveys. This has ensured that site maps produced are of the utmost detail with the highest level of accuracy and consistency possible.

BRENT J. TARDIF, PG, PRESIDENT/SENIOR GEOLOGIST

(518) 458-9203 ext. 308

AREAS OF EXPERTISE

Blasting Consulting and Vibration Control: Mr. Tardif has provided expert expertise in blast consultation and vibration control services for major highway construction and related projects, including a vent shaft raise for an underground mine and several projects that included blasting adjacent to a fully charged natural gas transmission line. Throughout his career Mr. Tardif has conducted several hundred pre-blast surveys and post-blast inspections throughout New England and the northeast.

Permit Preparation and Regulatory Compliance: Mr. Tardif has prepared numerous federal, state and local permits for aggregate quarry projects including comprehensive Title V, Clean Air Act Amendment compliance review inventories and testing throughout New England and the northeast. Other permits for such clients have included stormwater permits, spill prevention plans and wetland permits. Mr. Tardif has designed reclamation plans for secondary uses to maximize profit and concurrent reclamation schemes to lessen restoration costs.

Reserves Valuations: Many acquisitions require that a valuation be made of the business to be purchased. Mr. Tardif has conducted many valuations on properties throughout the U.S. of several large aggregate material producers in New England, the Mid-Atlantic States and the Midwest. Responsibilities included certification of reserves, market analyses, environmental assessments and net present value/discounted cash flow calculations. Tardif has also performed numerous sand and gravel evaluations throughout New England and the northeast. Prepared a study for the New England Governor's Conference on the Supply and Demand for Construction Aggregates throughout New England.

Exploration and Development: For over 28 years Tardif has been involved in the search for, evaluation and development of sand, gravel and bedrock deposits. These projects have been throughout the eastern and New England portions of the United States. Such projects involve expertise not only in geology but also involve an assessment of the business economics, marketing strategies, permitting and processing. Mr. Tardif has conducted numerous core-drilling programs to quantify reserves; he has developed material testing programs and planned sequencing and mine layouts. These projects have been done for large international corporations as well as individuals on scopes that have varied from regional programs to site specific.

Education	BA – Geology, State University of New York at Buffalo
Years Experience	29
Professional Registrations	New Hampshire PG #431
Professional Membership	International Society of Explosive Engineers New England Society of Explosive Engineers NHDOT Approved Seismologist Associated General Contractors- Committee Chair (past), Director (past)
Employment History	Continental Placer Inc., President/Senior Geologist Dunn Geoscience Corp. (New England), Dir. of Mining Division/Sr. Geologist Pike Industries, Inc., Field Technician

PAUL (DUTCH) KRETSCHMER, BLASTING AND VIBRATION TEAM LEAD

(603) 540-0626

AREAS OF EXPERTISE

Blasting and Construction Vibration Services. With over four decades of experience beginning with small home improvement projects, Mr. Kretschmer's career includes working in every aspect of building construction from laborer to Site Superintendent to Project Manager for projects up to $20 million. For the past 18 years his focus has been on the blasting industry. Working with a major drilling and blasting contractor in New England, Mr. Kretschmer was able to become involved in all aspects of the industry. By learning blast design and vibration calculations he was able to assist in obtaining blasting permits. The job required proficiency with the use of a seismograph and the interpretation of seismograms in order to adjust shot design and to defend blast damage claims. Mr. Kretschmer has taken this blasting knowledge and applied it to the construction industry, conducting vibration-monitoring projects for all types of vibration causing construction projects. These projects range from close-in blasting and large quarry operations, to site or road compaction and pile driving for heavy construction projects.

Pre-Blast and Pre-Construction Surveys. Surveys of structures in the area of vibration producing activities are essential to establish a baseline of the conditions of buildings and to provide public relations for high profile projects. Mr. Kretschmer has used his experience in the building trades to provide over 10,000 pre-blast and pre-construction surveys. As this is sometimes the only contact homeowners have with the construction project, Mr. Kretschmer's knowledge of the project and effects of vibration on the home have established a better understanding of the project by the people directly affected.

Post-Blast and Post-Construction Investigations. Allegations of vibration damage are inevitable. Mr. Kretschmer utilizes his experience to document the alleged damages, review all pertinent information, analyze the vibrations and render an expert opinion based upon the data compiled. He has conducted thousands of these investigations for numerous insurance companies throughout the United States.

Expert Testimony. Mr. Kretschmer has provided expert testimony for projects throughout the Northeast during hearings for planning, permitting or defense of damage claims.

Education:	BA – Communications, Ohio University
Years Experience:	40
Professional Registrations:	OSHA 40 Hour Training MSHA Certified Instructor HUD Certified Housing Rehabilitation Specialist
Professional Memberships:	International Society of Explosive Engineers New England Society of Explosive Engineers
Employment History:	Continental Placer Inc., Senior Blast/Vibration Consultant PreSeis Inc., Blast/Vibration Consultant Maine Drilling & Blasting, Safety Engineer

JEFFERY A. SLADE, SENIOR GEOLOGIST

(518) 458-9203 ext. 304

AREAS OF EXPERTISE

Drilling and Blasting. For over 28 years Mr. Slade has provided blast consultation and vibration monitoring services for clients in the mining and construction industries. Typical project work included blasting impact and mitigation studies for new mine and quarry permits, blast vibration monitoring and control programs for major highway, municipal utility lines and gas transmission pipelines, as well as supervision and monitoring of blasting at other construction projects. Acting as a blasting consultant, Mr. Slade has provided expert testimony at public hearings concerning blasting issues. Special or unique project work included blast monitoring for a major gas pipeline within an existing major utility corridor and blast consultation for construction project at the Iron Mountain underground document storage facility in Rosendale, New York.

Computer Simulations and Modeling. The use of computer technology has made it possible to model or simulate all types of conditions encountered in mining operations. Mr. Slade has been highly successful in utilizing computer based simulations and modeling to solve complex mining related problems. A sample of some of the projects completed utilizing this technology include numerous mine sequencing and reserve plans, three dimensional models of karst features involved with a flooded quarry, and several computer simulations of visual impacts from surface mines. Mr. Slade is experienced with the use of both HydroCAD and Autodesk's Land Development Desktop software for use in modeling stormwater events. This HydroCAD based project work has focused on relocation and design of settling ponds, sizing and location of stormwater retention structures, stormwater effects on quarry discharge rates, and development of stormwater plans for surface mines.

Site Development. In his position as senior geologist, he has extensive experience involving field supervision and project management of exploration drilling and mapping projects. Such projects were often conducted to delineate and quantify ore reserves for construction aggregate and industrial minerals. In order to determine the material characteristic and quality of mineral reserves, Mr. Slade has developed various chemical and physical testing programs for a wide range of commodities.

Environmental Permitting and Regulatory Compliance. Mr. Slade has prepared numerous mining permits for mining operations in New York, Vermont, and Connecticut. These have included the actual state or local mine permit and associated permits such as stormwater permits, stream crossing permits, spill prevention plans and wetland permits. In addition, Mr. Slade has completed permits and managed regulatory compliance issues with the Adirondack Park Agency (APA) of New York, for several regional mining companies.

Education	BS – Geology, University of Vermont
Years of Experience	28
Professional Membership	Society of Mining Engineers Adirondack Association of Mining Engineers
Professional Registration	Visible Emissions Evaluator – Federal Reference Method Visible Emissions Evaluator Refresher Course
Employment History	Continental Placer Inc., Senior Geologist Rust Environment & Infrastructure (Formerly Dunn Corp.), Geologist Southern Vermont College, Adjunct Professor of Computer Science

W. KYLE CROSSETT, GEOLOGIST

(518) 458-9203 ext 311

AREAS OF EXPERTISE

Pre-Blast and Blast Monitoring. Quarry blasting, for the purposes of moving and crushing material is by far the most cost-effective and widely used method of liberating aggregate from parent rock. As one can imagine, residential and commercial neighbors of quarries are often concerned about blasting and its perceived negative effects, which include ground vibration, noise and air quality. Through the use of pre-blast surveys, and concurrent blast monitoring, Mr. Crossett has ensured that blasting at multiple quarries, does not have a negative impact on respective neighbors, as well as working out site specific blasting effect mitigation techniques.

Mine Permitting and Regulatory Compliance. In today's climate of strictly enforced state and federal environmental laws, the most important investment a mine operator can make is the creation of a thorough mine plan. The planning process must be viewed as an all encompassing and detailed look at the entire life of mine, from initial property purchase, to final reclamation, taking into account multiple aspects such as market potential, local zoning laws and ordinances, site specific geologic attributes and potential environmental concerns in addition to state and federal regulations. Mr. Crossett's mine planning and regulatory acumen has ensured that many material producers have continued to operate and remain profitable regardless of various economic, geologic and regulatory obstacles.

Geologic Source Reports. As per the requirements of the State of New York's Department of Transportation specs, aggregate needed for use in blacktop and concrete must be sampled and tested periodically to ensure material soundness and quality. Mr. Crossett has conducted both field mapping and data collection, as well as map preparation and report drafting for numerous material sources throughout New York State. This information, along with test results, is used to create and submit a source report to gain, or confirm material soundness approval from the Department of Transportation.

Geologic Surveying and Field Mapping. In order to create cogent and detailed Mine Plans and Source Reports, one must know how to effectively implement surveys and subsequent mapping of any given site, both surficially, and geologically. Mr. Crossett has the experience of surveying multiple sites using various tools that include GPS mapping grade equipment and Electronic Distance Measurement (EDM) transit surveys. This has ensured that site maps produced are of the utmost detail with the highest level of accuracy and consistency possible.

Computer Aided Design and GIS Applications. To effectively combine and synergize relevant data gathered from field reconnaissance, surveys, aerial photography, and GIS data, knowledge of computerized applications and their potential for cost-benefit maximization is a must. Mr. Crossett, is well versed in the use of Computer Aided Design software, as well as available GIS databases to deliver accurate and detailed maps and other visual expressions of information. This helps insure site specific awareness, and implementation of plans in an effective manner.

Education	BA – Geology and History, State University of New York at Potsdam MBA – Concentration in environment management, Clarkson University
Employment History	Continental Placer Inc., Geologist Griggs-Lang Consulting Geologists, Project Geologist Dean Herrick Consulting, Geologist

RELEVANT PROJECT EXPERINCE

Whether for site construction or quarrying, understanding the science of blasting and the economic value of explosives is paramount to the success of today's blasting projects. Continental Placer applies its blasting knowledge and experience to promote the timely and cost effective completion of blasting projects. Below are a sampling of our blasting and construction vibration monitoring projects followed by additional firm experiences. **Specific project references available upon request.**

Groton Wind Farm Blasting Oversight, Groton, NH. Continental Placer was hired to provide oversight of the blasting operations at the Groton Wind Farm project. This project erected 24 Gamesa G87 wind turbines, located along two ridges, whose peak elevation from was 2,300 feet. Continental Placer worked with the blasting contractors on a daily basis to ensure that blasting operations were completed safely on a very busy and congested site.

NYS DOT Route 4 Rehabilitation D262101, Kubricky Construction. Pre Construction survey for all properties along the project route.

Maine Drilling and Blasting, CPI has worked with Maine Drilling & Blasting throughout the North East for the past 20 years. Projects included:

- Middlebury College Library & Atwater Project, Middlebury, VT
- Numerous highway construction projects throughout New England and New York
- Holyoke Water Works - Holyoke - South Hampton, MA
- Salem Water Treatment Plant - Salem, NH
- Wal-Mart Distribution Center - Raymond, NH
- Manchester Airport Runway Expansion Project
- Endicott College - Beverly, MA
- Libby Hill Ind. Park - Weymouth, MA
- Marriot Hotel - Quincy, MA
- Oxford Airport - Oxford, Ct
- Academy Homes - Roxbury, MA
- Waterford Commons - Waterford, CT
- Ludlowe Middle School - Fairfield, CT
- UCONN - Storrs, CT
- RIDOT Waterline Replacement - Lincoln, RI

Dartmouth College, Hanover, NH, Projects Included:

- Construction of Moore Psychology Building
- Construction of Haldeman Center and Kemeny Hall
- Construction of Class of 1978 Life Sciences Center

Liberty Mutual Insurance, Weston, MA; Dover, NH; Natick, MA; Lynbrook, NY. Continental has conducted almost 300 blast damage claims throughout New England for Liberty Mutual clients.

Acadia Insurance, Westbrook, ME, CPI has conducted in excess of 250 blast damage claims throughout the northeast for Acadia Insurance clients.

CORPORATE CONTACT PAGE

Continental Placer is a licensed and insured corporation with offices in the states of New Hampshire, New York, Pennsylvania, and Illinois.

www.continentalplacer.com

Contact:
Brent J. Tardif, PG, President/Senior Geologist btardif@continentalplacer.com

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5010 Lenker Street • Mechanicsburg, PA 07050-2440
(717) 975-2862 • Fax (717) 975-2637

Continental Placer Inc. has geologists registered with the American Institute of Professional Geology (AIPG) and in many state throughout the United States. We are proud to be members of many trade and professional associations, on local, state and national levels. These include:

- American Institute of Professional Geologists
- Association of Engineering Geologists
- National Asphalt Producers Association
- National Stone, Sand and Gravel Association
- Society of Mining, Metallurgy and Exploration
- National Stone, Sand and Gravel Association
- International Society of Explosive Engineers
- Association of Groundwater Scientists and Engineers
- American Water Works Association
- National Groundwater Association
- Institute of Scrap Recycling Industry
- New Hampshire Geological Society
- New York State Rural Water Association
- Hudson Mohawk Professional Geologists Association
- New York Construction Materials Association
- Pennsylvania Concrete and Aggregate Producers Association