

SPECIFICATION SECTION 03150– ROCK BLASTING

TABLE OF CONTENTS

1. DESCRIPTION.....	2
2. CONSTRUCTION REQUIREMENTS	2
2.1 Regulations and Blasting Plan	2
2.2 General Blasting Plan	2
2.3 Site Specific Blasting Plan.....	3
2.4 Preblast Condition Survey and Vibration Monitoring and Control.....	3
2.5 Test Blasting.....	4
2.6 Blasting	4
2.7 After-Blast Reports.....	7
2.8 Acceptance	8
3. MEASUREMENT AND PAYMENT	8

SPECIFICATION SECTION 03150 - ROCK BLASTING

1. DESCRIPTION

This Specification Section prescribes the fracturing rock and constructing of stable final rock cut faces using controlled blasting and production blasting techniques.

Controlled blasting uses explosives to form a shear plane in the rock along a specified back slope. Controlled blasting includes presplitting and cushion blasting.

Production blasting uses explosives to fracture rock.

2. CONSTRUCTION REQUIREMENTS

2.1 Regulations and Blasting Plan

Prior to proceeding with the Rock Blasting work within the Site, the Contractor shall:

- a) Furnish copies or other proof of all applicable permits and licenses and comply with Vietnamese regulations on the purchase, transportation, storage and use of explosive material.
- b) Designate in writing a blaster in charge and submit evidence that the blaster in charge has a valid Vietnam blaster's license or other license acceptable to the Government and Local Authorities for the Works and issued by an equivalent licensing body for the type of blasting required.
- c) Submit for review and approval by the Engineer the general blasting plan duly signed by the blaster in charge for quality control and record keeping purposes. The review and acceptance of the above blasting plan does not relieve the Contractor of the responsibility for using existing drilling and blasting technology and for obtaining the required results.
- d) Not deliver explosives to the Works until the general blasting plan is accepted.

2.2 General Blasting Plan

The general blasting plan shall be subject of review and approval by the Engineer at least 14 days before drilling operations begin. The plan shall include, as a minimum, the following safety and procedural details:

- a) Working procedures and safety precautions for storing, transporting, handling, and detonating explosives.
- b) Proposed product selection for both dry and wet holes. Manufacturer's material safety data sheets for all explosives, primers, initiators, and other blasting devices.

- c) Typical plan and section views for both production and controlled blasting, including maximum length of the shot, burden, hole spacing, hole inclination, hole depth, hole diameter, sub-drill depth, and powder factor.
- d) Proposed initiation and delay methods and delay times.
- e) Proposed format for providing all the required information for the site specific blasting plan.

2.3 Site Specific Blasting Plan

After the general blasting plan has been accepted, the Contractor shall submit site specific blasting plan for acceptance before drilling operations begin, allowing up to three days for review of the plan.

The following shall be provided in the site specific blasting plan:

- a) Contractor's drawings showing a scaled map of the blast area and cross sectional views which indicate beginning and ending stations, free face location, hole spacing, hole diameter, hole depth, burden, hole inclination, and sub-drill depth. The drawings shall show any significant joints or bedding planes within the blast zone and these geological features shall be incorporated into the blast design.
- b) Where blasting may affect nearby structures or utilities, the Contractor shall provide the method of monitoring and controlling blast vibrations according to Subsection 2.4 of this Specification Section.
- c) A loading pattern diagram showing the location and amount of each type of explosive to be used in the holes including primer and initiators and the location, type, and depth of stemming, column heights, and overall powder factor for each type of loading.
- d) A delay and initiation diagram showing the delay pattern, sequence, and delay times.

2.4 Preblast Condition Survey and Vibration Monitoring and Control

- a) When blasting near buildings, structures or utilities that may be subject to damage from ground or air blast vibrations the Contractor shall provide a blast vibration specialist with at least 5 consecutive years experience in vibration monitoring for at least 3 projects. Within 14 days before blasting the Contractor shall submit to the Engineer the name and qualifications of the blast vibration specialist including the following:

Project names, locations and services performed.

Names and phone numbers of owner/agency contacts who can confirm the experience of the specialist.

- b) Before blasting the Contractor shall carry out a preblast condition survey of nearby buildings, structures, or utilities, which could be at risk of damage by

blasting. The survey method shall be acceptable to the Contractor's insurance company. Damage resulting from blasting shall be the Contractor's responsibility. All preblast condition survey records, and the certified acceptance of the Contractor's insurance company shall be submitted to the Engineer. The Contractor shall notify the Engineer and occupants of nearby buildings at least 24 hours before blasting.

- c) Control of vibrations shall be done with properly designed delay sequences and allowable charge weights per delay when blasting near buildings, structures, or utilities that may be subject to damage by blast induced vibrations. Trial blasts and measurement of vibration levels shall be carried out to confirm allowable charge weights per delay.
- d) The Contractor shall conduct test blasts with blast plan modifications that limit ground and air blast vibrations to a level that will not cause damage to nearby buildings, structures or utilities as determined by the blast vibration specialist.
- e) Where there is eventual vibration damage to buildings, structures, or utilities the Contractor shall monitor each blast with approved seismographs and air blast monitoring equipment located at acceptable locations. Seismographs capable of recording particle velocity for three mutually perpendicular components of vibration shall be used. The blast vibration specialist shall interpret the seismograph records and air blast records to ensure that the data is effectively used in the control of the blasting operations.

2.5 Test Blasting

- a) The Contractor shall drill, blast, and excavate one or more test sections as proposed in the blasting plan before full-scale drilling and blasting. Test blasts may be made away from or at the final slope line.
- b) The blast holes for the cushion (trim) method of controlled blasting shall be spaced no more than 1.5 meters apart for the initial test blast. The blast holes for the presplitting method of controlled blasting shall be spaced no more than 750 millimeters apart for the initial test blast. Adjustment on the spacing shall be as approved. The approved spacing shall be used in the full-scale blasting or subsequent test blasts if necessary.
- c) A test blast is unacceptable when it results in; fragmentation beyond the final rock face, fly rock, excessive vibration, air blast, overbreak, damage to the final rock face, or overhang. If a test blast is unacceptable the Contractor shall revise the blasting plan and make an additional test blast.

2.6 Blasting

- (a) General: Drill and blast shall be made in accordance with the approved blasting plan.

The Contractor shall:

Before drilling remove overburden soil and loose rock along the top of the excavation for at least 10 meters beyond the hole drilling limits or to the end of the cut;

- (i) Cap all holes to prevent unwanted backfill; place a stake next to each hole with hole number and total depth drilled;
- (ii) Use the types of explosives and blasting accessories necessary to obtain the required results (a bottom charge may be larger than the line charges if no overbreak results);
- (iii) Free blast holes of obstructions for their entire depth; place charges without caving the blast hole walls; stem the upper portion of all blast holes with dry sand or other granular material passing the 9.5-millimeter sieve; not stem the hole with drill cuttings;
- (iv) Following a blast, stop work in the entire blast area and check for misfires before allowing workers to return to excavate the rock;
- (v) Remove or stabilize all cut face rock that is loose, hanging, or potentially dangerous; scale by hand or machine methods as approved by the Engineer; leave minor irregularities or surface variations in place if they do not create a hazard; drill the next lift only after the cleanup work and stabilization work are completed;
- (vi) If blasting operations cause fracturing of the final rock face, repair or stabilize it in an approved manner at no cost to the Employer (repair or stabilization may include removal, rock bolting, rock dowels, or other stabilization techniques) and
- (vii) Halt blasting operations when any of the following occur and perform additional test blasts:
 - (1) Slopes are unstable;
 - (2) Slopes exceed tolerances or overhangs are created;
 - (3) Back-slope damage occurs;
 - (4) Safety of the public is jeopardized;
 - (5) Property or natural features are endangered;
 - (6) Fly rock is generated or
 - (7) Excessive ground or air blast vibrations occur in an area where damage to; buildings, structures, or utilities is possible.
- (b) Drill logs: The Contractor shall submit drill logs including the following:
 - (i) Blast plan map showing designated hole numbers; and
 - (ii) Individual hole logs completed and signed by the driller showing; total depth drilled, depths and descriptions of significant conditions

encountered during drilling that may affect loading such as water or voids and date drilled.

(c) Controlled blasting:

- (i) When test blasts indicate the need for controlled blasting, the Contractor shall use controlled blasting methods to form the final rock cut faces when the rock height is more than 3 meters above the ditch grade and the staked slope is 2:1 or steeper.
- (ii) Controlled blasting includes only those holes drilled on the row furthest from the free face and that are drilled on the design slope.
- (iii) Down hole angle or fan drill blast holes shall be used for pioneering the tops of rock cuts or preparing a working platform for controlled blasting. The blast hole diameter and hole spacing established shall be used for controlled blasting during the test blasts.
- (iv) Controlled blast holes shall be drilled not greater than 100 millimeters in diameter along the final rock face line. Controlled blast holes shall be drilled within 75 millimeters of the proposed surface location and shall be at least 10 meters beyond the production holes to be detonated or to the end of the cut.
- (v) Drilling equipment with mechanical or electromechanical devices that accurately control the angle the drill enters the rock shall be used. A lift height shall be selected and drilling operations shall be conducted in such a way that the blast hole spacing and down hole alignment does not vary more than 225 millimeters from the proposed spacing and alignment. When more than 5 percent of the holes exceed the variance the lift height shall be reduced and the drilling operations shall be modified until the blast holes are within the allowable variance. Maximum lift height is 15 meters.
- (vi) A 600 millimeter offset is allowed for a working bench at the bottom of each lift for drilling the next lower controlled blasting hole pattern. The drill inclination angle or the initial drill collar location shall be so adjusted that the required ditch cross section is obtained when the bench is used.
- (vii) Drilling 500 millimeters below the ditch bottom is allowed for removing the toe. Bulk ammonium nitrate and fuel oil shall not be used for controlled blasting.
- (viii) In presplitting, the nearest production blast row shall be delayed by at least 25 milliseconds after the presplit line blasting. Presplitting shall be done at a minimum of 10 meters ahead of the production blasting zone.

- (ix) In cushion (trim) blasting, the cushion blast row shall be delayed by 25 to 75 milliseconds after blasting the nearest production row.
- (d) Production blasting: The row of production blast holes closest to the parallel controlled blast line shall be drilled at a distance of not less than 2 meters from the controlled blast line. Production blast holes shall not be drilled to a depth lower than the bottom of the controlled blast holes. Production holes shall be detonated on a delay sequence toward a free face.

2.7 After Blast Reports

Within 3 days after a blast and before the next blast, the Contractor shall submit an after blast report that includes the following:

- (a) Results of the blast and information on whether or not blasting objectives were met. If blasting objectives were not met the Contractor shall submit proposed changes to future site specific blasting plan that will produce acceptable results and proposed repair or stabilization plan for unstable or blast damaged back-slopes.
- (b) Blasting logs that include the following:
 - (i) All actual dimensions of the shot including blast hole depths, hole diameter, burden, spacing, sub-drilling, stemming, powder loads, and timing; and
 - (ii) A drawing or sketch showing the direction of the face, or faces, and the physical shot layout.
- (c) If a seismograph was used, the Contractor shall provide the following:
 - (i) Identification of the instrument used;
 - (ii) Name of qualified observer and interpreter;
 - (iii) Distance and direction of recording station from the blast area;
 - (iv) Type of ground recording station and material on which the instrument is sitting;
 - (v) Maximum particle velocity in each direction;
 - (vi) A dated and signed copy of the seismograph readings and
 - (vii) Postblast condition survey.
- (d) Results of air blast monitoring.
- (e) Results of postblast condition survey.

2.8 Acceptance

- (a) Material for Rock Blasting will be evaluated under the specifications provided by a certified supplier.
- (b) Rock Blasting work and services will be evaluated by the Engineer in accordance with these specifications.

3. MEASUREMENT AND PAYMENT

All costs for the Rock Blasting in accordance with the provisions and construction requirements of this Specification Section shall be deemed to be Indirectly Paid Work, which shall be included in the applicable pay items established in Specification Section 03100 Common Soil Excavation or Specification Section 03200 Structural Excavation as applicable.

Any Rock Blasting Works not specifically indentified in this Specification Section but which are necessary for the performance of the Works shall be deemed to be Indirectly Paid Work, which shall neither be measured nor paid separately and shall be deemed included in the rates and prices for other main items or distributed among all the pay items listed in the Bill of Quantities.