STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

EUGENE A. CONTI, JR.
SECRETARY

November 4, 2011

Addendum No. 1
RE: Contract ID C202585
WBS # 34402.3.7
State Funded
Watauga, Caldwell Counties (R-2237C)
US-321 From South Of SR-1500 To US-221 At Blowing Rock

November 15, 2011 Letting

To Whom It May Concern:

Reference is made to the proposal furnished to you on this project.

The following revisions have been made to the proposal:

On Page Nos. 59, 63 thru 67 and 69 thru 71 some changes have been made to the project special provision entitled "Rock Blasting and Control of Vibration". Please void Page Nos. 59, 63 thru 67 and 69 thru 71 in your proposal and staple the revised Page Nos. 59, 63 thru 67 and 69 thru 71 thereto.

Sincerely,

R. A. Garris, PE
Contract Officer

RAG/jag
Attachments

cc:
Mr. Jon Nance, PE
Mr. Ron Hancock, PE
Mr. M. A. Pettyjohn, PE
Ms. D. M. Barbour, PE
Mr. Art McMillan, PE
Mr. J. V. Barbour, PE
Project File (2)
Mr. R.E. Davenport, PE
Ms. Natalie Roskam, PE
Mr. Njorge Wainaina, PE
Mr. Larry Strickland
Mr. Ronnie Higgins
Ms. Lori Strickland
Ms. Marsha Sample

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
CONTRACT STANDARDS AND DEVELOPMENT UNIT
1591 MAIL SERVICE CENTER
RALEIGH NC 27699-1591

TELEPHONE: 919-707-6900
FAX: 919-250-4119
WEBSITE: WWW.NCDOT.ORG

LOCATION:
CENTURY CENTER COMPLEX
ENTRANCE B-2
1020 BIRCH RIDGE DRIVE
RALEIGH NC 27610

(A) Pre-Construction Condition Surveys

The condition of all buildings, improvements and surface utilities located within 500 feet of all locations where blasting may occur shall be surveyed at least 30 days before any holes are drilled for blasting operations. Condition survey reports and the experience of persons performing the surveys shall conform to standards provided in Submittals Section (D) of these special provisions. Similar surveys, done to the same standards, shall be done at all buildings, improvements and surface utilities located within 100 feet of all locations where heavy equipment is used to construct new roadways, retaining walls, and other structures associated with the work. These reports shall be submitted 30 days before any work occurs within 100 feet of identified survey targets. No heavy construction work shall occur until NCDOT has accepted surveys done in accordance with standards provided in Submittals Section (D) of these special provisions.

(B) Vibration and Air-Overpressure Limitations

All blasting work shall be designed and executed to assure the following vibration and air-overpressure limits are not exceeded.

Vibration Limits at all frequencies of motion:

Location	Warning Level	Not-to-Exceed Level
Historic Structures[1]	0.15 in/s	0.25 in/s
Residential Structures	0.35 in/s	0.5 in/s
Commercial Buildings	0.35 in/s	0.5 in/s
Public Buildings	0.35 in/s	0.5 in/s
Heavy Commercial Structures	0.75 in/s	1.0 in/s
Buried Utilities and Surface Poles	3.0 in/s	4.0 in/s
[1]Green Park Inn near station 457+00 –L-, A.G. Jonas Cottage (Laughter Home) near station 465+00 –L-, Bollinger-Hartley House near station 542+00 –L-		

- Institute of Makers of Explosives (IME) Safety Library Publications (SLPs)

In case of conflict, the more stringent regulation applies.

Submittals

In lieu of a blasting plan in accordance with Article 107-11 of the *Standard Specifications*, the following submittals are required for rock blasting.

- Blasting Contractor Personnel and Experience including Blasting Consultant and Blasting Specialist and Blaster(s)-in-Charge
- General Blast Plan including Vibration Monitoring Consultant
- Pre-construction Condition Surveys
- Drill Logs, Individual Blast Plans and Post-blast Reports as defined in the Blasting Documentation System required for all blasting.
- Blast Damage Report, when necessary

For the Individual Blast Plans, drill logs and post-blast reports, submit two hard copies of each to the Resident Engineer. After completing all blasting for a cut, structure or an excavation, submit electronic copies in PDF format.

Allow 30 calendar days upon receipt by the Department for the review and acceptance of the Blasting Contractor and Support Personnel and Experience and General Blast Plan. Provide these submittals in both electronic and hard copy form in accordance with the following:

Submit one hard copy to the Resident Engineer. At the same time, submit a second hard copy and an electronic copy (PDF on CD or DVD) directly to the Geotechnical Engineering Unit at the following addresses:

Western Regional Geotechnical Manager
North Carolina Department of
Transportation
Geotechnical Engineering Unit
Western Regional Office
5253 Z Max Boulevard
Harrisburg, NC 28075

The Engineer may suspend blasting operations in accordance with Article 108-7 of the *Standard Specifications* if submittals are illegible, incomplete or not provided.

(A) Blasting Contractor and Support Personnel Experience

Obtain acceptance of the Blasting Contractor personnel and experience before submitting a General Blast Plan.

(1) Blasting Contractor

Use a Blasting Contractor prequalified by the NCDOT Contractual Services Unit for rock blasting work (work code 070). Submit documentation that the Blasting Contractor has successfully completed at least 5 blasting projects within the last 3 years with subsurface conditions and blasting of a scope and complexity similar to that anticipated for this project. Documentation should include the General Contractor and Owner's name, descriptions of each past project, and current contact information of a representative of the project owner or construction manager. Contact information shall include at lease one valid phone number.

(2) Blaster-in-Charge

The Blaster-in-Charge has total authority over the handling, use and security of explosives and is responsible for coordinating, planning and supervising explosives use. The Blaster-in-Charge is also responsible for inspecting blast areas and completing check-list activities identified in the blast planning form included in the Blasting Documentation System. Either the Blaster-in-Charge or an alternate Blaster-in-Charge is required to be on-site during blasting. All acting Blasters-in-Charge must be preapproved by NCDOT.

Provide verification of employment with the Blasting Contractor for the Blaster-in-Charge and any alternate Blasters-in-Charge assigned to this project. Submit documentation that each Blaster-in-Charge has a minimum of 5 years experience in blasting with past projects of scope and complexity similar to that anticipated for this project. Documentation should include resumes, references, certifications, project lists, experience descriptions and details, etc. References shall include valid phone numbers for representative of the project owner or construction manager from at least three past projects involving similar close-in blasting. The submittal shall also include a signed statement from the proposed blaster certifying that during the prior five years they: 1) not been involved in flyrock incidents, 2) have not had a blasting license restricted or revoked in any State, and 3) they have not been fined or sanctioned in any way by a regulating authority. If there is a change in the Blaster-in-Charge, discontinue explosives use until qualifications of a new Blaster-in-Charge are submitted and accepted.

(3) Blasting Consultant

A Blasting Consultant is required. Employees of the Contractor, any affiliated companies or product suppliers are not allowed to be independent consultants. Use a Blasting Consultant prequalified by the NCDOT Contractual Services Unit for the rock blasting evaluation & design discipline.

(4) Blasting Specialist

The Contractor shall retain a Blasting Specialist with at least 5 years of direct blasting experience who can assist the blasters with all blasting documentation and submittals including drill logs, blast plans, blast reports, and vibration monitoring records. The blasting specialist must have proven computer skill to use Microsoft WORD®, EXCEL®, vibration reporting software, and other software as needed to prepare all documents and to submit them in PDF format for review by others as required. The Blasting Specialist shall also direct the video taping of blast and submittals in .mpg or better format.

(5) Pre-construction Condition Survey Specialist

The Contractor shall retain a third-party specialist with at least 5 years of experience in surveying structures at a minimum of five projects with similar complexity to the proposed work.

(6) Vibration Monitoring Specialist

The Contractor shall retain a third-party specialist with at least 5 years of experience in vibration monitoring on a minimum of 5 projects with similar complexity to the proposed work. The specialist shall have proven experience in performing PPV curve regression analysis.

(B) Blast Plans

Individual blast plans are required to be signed by the Blaster-in-Charge. The Blasting Consultant must author the General Blast Plan or provide a signed review letter indicating their approval of it. Review and acceptance of blast plans does not relieve the Contractor of responsibility for the blast results or liability in accordance with Articles 107-11 and 107-12 of the *Standard Specifications*.

(1) General Blast Plan

Submit a General Blast Plan before beginning drilling, when revised drilling or blasting methods are proposed or as directed by the Engineer. At a minimum, include the following in the plan:

- Work procedures and safety precautions for the storage, transportation, handling and detonation of explosives
- Explosive products and devices for dry and wet blast holes including explosives, primers and detonators with material safety data sheets
- Drilling equipment and methods for maintaining blast hole alignment
- Typical plan, profile and sectional views for both production and controlled blasting showing hole diameter, depth, inclination and spacing, maximum blast limits, burden, subdrill depth and method of determining maximum charge per delay
- Initiation and delay methods and delay times
- Sample blast monitoring report format and equipment including calibration information
- Blast Monitoring Consultant, if applicable
- Test blast locations when required
- Methods of placing dirt or mat cover where required

Do not deliver explosives to the project site until the General Blast Plan is reviewed and accepted.

(2) Individual Blast Plan

After the General Blast Plan is accepted, submit individual blast plans at least 24 hours in advance of each blast. In addition to information shown on the Blast Planning Forms, the following is required for each individual blast plan:

- Check list activities shall be dated and initialed by the blaster-in-charge and an accepted Contractor management person to assure they have been done.
- A plan sketch of the blast area showing hole locations, free faces and any observed joints, bedding planes, weathered zones, voids or other significant rock structure that may influence the blast. Also include hole-numbers corresponding to numbers used in drill logs and note burden and spacing dimensions.
- Typical diagrams showing charge configurations including the location and amount of each type of explosives, primers, detonators, top-stemming, column heights, inert stemming decks and subdrill.
- Calculations showing maximum charge per delay determinations based on scaled distance calculations to various structures, using appropriate PPV limits
- A delay and initiation diagram showing surface delay connections, in-hole delay times, and actual firing times of all charges.
- Predicted maximum vibration level at the most restrictive point of concern
- Description of methods that will be used to cover blasts
- Description of plans to notify residents of buildings located within 200 feet of blasts.
- Description of methods and trained personnel that will be deployed to block roadways during blasting

Drill Logs and Post Blast Reports shall be submitted within 24 hours after the time of blasting. Drill logs shall include all information shown on the forms and hole numbers shall consistent with numbers used in blast plan diagrams. Post Blast Reports shall contain all blast design information required in the blast plans and shall show as-built changes and a summary of vibration monitoring results.

(C) Blasting Documentation System for Individual Blasts

Blast planning forms, drill log forms, and post blast report forms included in the Blasting Documentation System, shall be used to document individual blasts. The Contractor may customize these forms to add more information for their own purposes. If the Contractor chooses to use their own forms, all of the information contained on forms in the Blasting Documentation System shall be included on the Contractor's forms. The Blasting Documentation System is available at the following web address:

www.ncdot.org/doh/preconstruct/ps/contracts/letting.html

(D) Pre-construction Condition Surveys

Conduct pre-construction condition surveys in accordance with the "Project Requirements" section of this provision and the accepted General Blast Plan. Text of reports shall be typed (or printed) and two copies shall be submitted.

At a minimum, reports shall include the following:

- Summary naming the person who performed the survey and comments about each structure and existing condition
- Sketches of interior and exterior walls and foundations with existing cracks and a written description of the cracks including the length, width, type and angle
- Reports shall include hard copy color photographs from a 5-megapixal or greater digital camera or 35-mm Kodak or Fuji Film, sized at least 4 x 6 inches, printed on Kodak of Fuji Film Paper in glossy format; or printed two-to-a-page on glossy photo-quality paper by a digital printer. Photos must be taken of all cracks and other damaged, weathered or otherwise deteriorated structural conditions. If necessary, macro lenses and flash illumination shall be used to ensure defects are shown clearly in the photographs. Photos shall contain an accurate date stamp. Submit two copies of CD or DVD format disks of digital pictures attached to the two submitted copies of written reports.
- A walk-through video-tape with audio commentary shall be done for each surveyed structure or improvement within the specified survey boundaries. Audio comments shall include name(s) of survey staff, property type, name of owner, date and time of survey, and comments about the condition of the observed structure. Video-audio tapes shall be made with digital quality camcorders and two copies shall be submitted in DVD format Disks attached to two submitted copies of written reports.

(E) Blast Videotaping

The Contractor shall set up a video camera to record all blasts in High Definition format. The camera shall be run remotely without an operator if located within 200 feet of the blast. A copy of the video file shall be submitted with final blast reports.

Blast Monitoring

At a minimum, monitor vibration and air-overpressure (noise) at a minimum of three locations. One instrument shall be located at the nearest occupied building. Two other instruments shall be located at other structures or utilities of concern. All instruments and their use shall fully conform to standards published by the Vibration Section of the International Society of Explosive Engineers (ISEE). All monitoring equipment shall be calibrated within one year of the date the data is collected. Interpret the recorded data and submit a blast monitoring report signed by the Vibration Monitoring Consultant with the post-blast report signed by the Blaster-In-Charge within 3 days after each blast or before the next blast, whichever is sooner.

Damage Notification

If damage occurs from blasting or if damage is alleged, notify the Engineer immediately. Submit a blast damage report signed by the Blaster-in-Charge (and Blast Monitoring Consultant, if applicable) with the post-blast report that includes the following:

- Property owner's (and injured person's, if any) names, addresses and telephone numbers

- No dynamite or nitroglycerin-based explosives should be used.
- Subdrilling of blastholes beyond the desired lines of cut slopes shall not exceed 6 inches (15 cm).
- Only shock-tube or electronic initiation systems shall be used for this work. The use of electric detonators and cap-and-fuse is prohibited. Use delay blasting to detonate production blast holes towards a free face.
- Maximum burden of rock between all portions of charges and nearest rock surface shall be at least 25-charge-diameters. For example, for 2-inch-diameter charges, minimum confining burden is 50 inches (25 x 2) or 4.2 feet.
- All charges shall be stemmed with at least 25 charge-diameters of clean washed crushed stone sized from 3/8 to ½ inch.
- All blasts located within 500 feet of structures or power lines should be covered with blasting mats or 3 feet of dirt.
- Blast benches should be wetted with sprayed water to suppress dust on days when maximum forecasted wind speed is greater than 20 mph.
- The minimum scaled distance used to limit charge-per-delay shall be 80 for occupied residential and commercial structures; and 140 for historic structures.

(C) Controlled Blasts

(1) Presplitting

Presplitting is required for final cut slopes ¾:1 (H:V) or steeper. Design presplitting such that irregularities in the presplit rock face between holes does not exceed 1 ft (0.3 m) and in accordance with the following unless otherwise approved:

- Use presplit blast holes with a diameter of 2 to 3 inches (50 to 75 mm)
- Space presplit blast holes 10 times the hole diameter
- Minimize subdrilling between lifts to only the width of the horizontal offset between lifts
- Do not subdrill below final grade
- Extend presplit blast holes a minimum of 30 ft (9.1 m) beyond the limits of the production blasting or to the end of the cut section
- Bench height or lift thickness may not exceed 25 ft (7.6 m)
- Do not use ANFO or any other bulk loaded products
- Use cartridge explosives or other types of explosives specifically designed for presplitting
- The maximum charge diameter may not exceed one half the diameter of the presplit blast holes except for the charge in the bottom 2 ft (0.6 m) of the holes
- Presplitting may be performed with production blasting provided all presplit blast holes are fired at least 75 ms before the production blast holes and no more than 200 ms before adjacent blasthole

(2) Cushion Blasts

Cushion blasts refer to either trim or cushion blasting. Design cushion blasts in accordance with the following unless otherwise approved:

- Diameter of cushion blast holes may not exceed 3" (76 mm)
- Minimize subdrilling to only that required for excavation of the final cut slopes
- Do not subdrill below final grade
- Bench height or lift thickness may not exceed 25 ft (7.6 m)
- Use a maximum of half the charge density and burden of the production blast holes for the cushion blast holes
- Do not use bulk ANFO or any other bulk loaded products
- Fire cushion blast holes after production blast holes with a minimum 50 ms delay

(D) Trench Blasts

Design trench blasts in accordance with the following unless otherwise approved:

- Diameter of trench blast holes may not exceed 3" (75 mm)
- Do not use bulk ANFO or any other bulk loaded products
- Use cartridge explosives or other types of explosives specifically designed for trench blasting
- Use a charge diameter ½ to ¾ inch (13 to 19 mm) less than the diameter of the trench blast holes

Test Blasts

A test blast is defined as drilling, blasting and excavation of a test section before beginning or restarting full scale blasting. When test blasts are required in the "Project Requirements" section of this provision or as directed by the Engineer, perform the required number of test blasts for both production and controlled blasting (presplitting, cushion or trim blasting) or trench blasting before beginning full scale blasting. Submit proposed test blast locations with the General Blast Plan. Also, if the Engineer suspends blasting operations after full scale blasting has begun, one or more test blasts may be required before resuming blasting. When this occurs, inform the Engineer of the test blast locations before submitting any Individual Blast Plans.

Perform test blasts in accordance with the submittal, blast design and construction requirements except submit an Individual Blast Plan for test blasts 72 hours before beginning drilling. Full scale blasting may not begin or resume until the test blasts are acceptable to the Engineer. The Engineer will not consider whether a test blast is acceptable until the rock face is exposed and the post-blast report is submitted. Examples of results that may be unacceptable include excessive vibration, air-overpressure or flyrock, overbreakage, damage to the final cut slope face and overhangs.

Blasting Methods and Activities

Before beginning drilling, conduct a pre-blast kick-off meeting to discuss the blasting and monitoring. Schedule this meeting after the General Blast Plan has been submitted and accepted.

The Resident Engineer, Roadway Construction Engineer, Geotechnical Operations Engineer, Contractor and Blaster-in-Charge, Blasting Consultant, Blasting Specialist and Vibration Monitoring Consultant will attend this pre-blast meeting.

Drill and blast in accordance with Individual Blast Plans, the general blast plan, and this provision as directed by the Engineer. Use explosives in accordance with all applicable government regulations, professional society standards and manufacturer guidelines and recommendations.

Remove all overburden material along the top of the excavation for a minimum of 30 ft (9.1 m) beyond the blast holes or the end of the cut unless otherwise approved. Inspect all rock surfaces to identify free faces and weaknesses for the purpose of appropriately locating blast holes so charges are adequately confined.

Drill blast holes within 3" (75 mm) of planned location and control drilling to maintain the final cut slope angles and to assure sub-drilling does not exceed specified amounts in shallow rock slopes. Accurately determine the angle at which the drill steel enters the rock. Alignment is crucial for presplit holes (if used). Drilling will not be permitted if the alignment of presplit holes can not be verified during drilling to the satisfaction of the Engineer. Deviations in presplit holes from the required alignment by more than 6" (150 mm) either parallel or normal to the cut slope are not allowed.

Cover or plug all blast holes after drilling to prevent unwanted backfill and identify and mark each hole with hole number and depth. Blast holes are required to be free of obstructions the entire depth. Load holes without dislodging material or caving in the blasthole wall.

Notify all occupants of residences, businesses and structures in the surrounding area and the Engineer at least 24 hours before blasting. Check for misfires immediately after each blast before signaling all clear. Remove any loose, hanging or potentially dangerous conditions by hand or machine scaling methods. Resume drilling only after scaling is complete.

When the height of a cut requires multiple lifts or benches, offset the controlled blast holes for each subsequent lift the minimum distance necessary to allow for drill equipment clearances. Adjust the alignment of controlled blast holes to account for this offset as well as any drift that occurred in the preceding lift.

The Engineer may suspend blasting operations in accordance with Article 108-7 of the *Standard Specifications* when vibration, air-overpressure or flyrock limits are exceeded, unsatisfactory rock cut slopes are produced or other reasons.