
USACE / CESAJ

DEPARTMENT OF THE ARMY CESAJ 02 22 13 (Apr 2006)
U.S. ARMY CORPS OF ENGINEERS

JACKSONVILLE DISTRICT LOCAL MASTER GUIDE SPECIFICATION

SECTION 02 22 13

VIBRATION MONITORING REQUIREMENTS FOR EXISTING STRUCTURES
12/06

NOTE: This guide specification was developed to address damages (and alleged damages) to structures that were caused by construction equipment vibration on beach renourishment contracts.

Comments and suggestions are welcome. Using e-mail for feedback is encouraged. Comments should be directed to:

Engineering Division, Design Branch, Specifications Section.

ALL COMMENTS RECEIVED WILL BE DISSEMINATED TO THE PROPER OFFICE FOR RESPONSE.

PART 1 GENERAL

1.1 SUBMITTALS

NOTE TO SPEC WRITER: FOR CLARITY AND TO COMPLY WITH NEW SUBMITTAL DESIGNATIONS IN CESAJ SECTION 01 33 00 SUBMITTAL PROCEDURES, THE BELOW LISTED ADMINISTRATIVE SUBMITTALS ARE REQUIRED EITHER AFTER NOTICE OF AWARD AND PRIOR TO PRECONSTRUCTION CONFERENCE OR THEY ARE ITEMS NEEDED DURING CONSTRUCTION.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

- Vibration Control Specialist; G|DO
- Vibration Control Specialist Alternate; G|DO
- Vibration Monitoring Technician(s); G|DO
- Structural Inspection/Evaluation Engineer; G|DO

Within 5 calendar days after Notice of Award, submit qualifications for the Vibration Control Specialist and his Alternate; Vibration Monitoring Technician(s); and, Structural Inspection/Evaluation Engineer. Refer to qualifications in paragraph PERSONNEL QUALIFICATIONS below for each person.

Pre-Construction Structural Survey; G|DO

Within 15 calendar days after Notice of Award and prior to mobilization of equipment, submit 3 copies of the Pre-Construction Structural Survey. Refer to requirements in paragraph PRE-CONSTRUCTION STRUCTURAL SURVEY below.

Vibration Control Plan; G|DO

Within 20 calendar days after Notice of Award and prior to mobilization of equipment, submit 3 copies of a Vibration Control Plan. Submit the Vibration Control Plan for compliance with the requirements in paragraph VIBRATION CONTROL PLAN below. The Plan shall include, but not be limited to, the following:

- a. List of structures that are susceptible to vibration damage.
- b. Number of monitors (seismographs) required for the project and location of monitors that will operate simultaneously in each work area.
- c. Calibration data for each seismograph that will be used for the project. Calibrations shall be current, not older than one year, and follow the manufacturer's recommended procedures.
- d. List of methods and procedures to reduce ground vibrations induced by construction activities to below the pre-determined maximum allowable vibration level for the designated vibration sensitive structure(s); i.e., reducing equipment speed, changing fill placement method, reducing equipment size, and using manual labor.
- e. Plan for each work area showing the proposed construction equipment in the area, the description of susceptible structure(s) in the work area, monitors in the work area, and the list of methods and procedures in subparagraph d. above.
- f. The minimum safe working distance that vibration producing equipment may operate from each vibration sensitive structure(s).
- g. The maximum allowable ground vibration level that is permissible without causing threshold damage to each vibration sensitive structure(s).

SD-06 Test Reports

Vibration Monitoring Report

Submit a Vibration Monitoring Report every 2 weeks for compliance with the requirements in paragraph VIBRATION MONITORING REPORT below. Submit the Vibration Monitoring Report and the

Daily Instrument Logs concurrently.

Daily Instrument Logs

Submit the Daily Instrument Logs every 2 week for compliance with the requirements in paragraph DAILY INSTRUMENT LOGS below. Submit the Daily Instrument Logs and the Vibration Monitoring Report concurrently.

Post-Construction Structural Survey; G|DO

Submit 3 copies of the Post-Construction Structural Survey within 15 calendar days after completion of the inspection. Submit the Post-Construction Structural Survey for compliance with the requirements in paragraph POST-CONSTRUCTION STRUCTURAL SURVEY below.

1.2 PERSONNEL QUALIFICATIONS

1.2.1 Vibration Control Specialist

The Vibration Control Specialist shall have a background in structural and/or geotechnical engineering, have a minimum of three years of demonstrated experience in vibration monitoring and related work, and be a registered professional engineer or registered professional geologist. The alternate may serve in the event of the Vibration Control Specialist's absence. Periods of absence shall not exceed one week at any one time and not more than fifteen workdays during a calendar year. The requirements for the alternate are the same as for the Vibration Control Specialist. The Vibration Control Specialist shall be designated in the Vibration Control Plan.

1.2.2 Vibration Monitoring Technician(s)

Personnel responsible for operation, maintenance and calibration of seismographs shall have a minimum of three years of demonstrated experience in vibration monitoring and related work.

1.2.3 Structural Inspection/Evaluation Engineer

Structural inspections shall be performed by professional structural engineers registered in the State of Florida with a minimum of three years of demonstrated experience in structural condition inspections. The Structural Inspection Engineer shall have responsibility for pre-construction and post-construction structural surveys. The Structural Inspection Engineer shall be designated in the Vibration Control Plan.

1.2.4 Organizational Changes

When it is necessary to make changes to personnel, resubmit qualifications in accordance with paragraph SUBMITTALS above.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 VIBRATION CONTROL PROGRAM

Implement a program that protects existing structures from damages that

result from construction equipment operations and vibrations. The purpose of the program is to avoid damages and potential claims that allege damages were caused by construction activities. The Contractor is responsible to document pre-existing conditions, to avoid damaging existing structures that were determined to be susceptible to vibration damage, and to avoid damaging existing structures that were not determined to be susceptible to vibration damage; related responsibilities include inspection, damage claims, and work stoppage that results from monitoring.

The Contractor's attention is called to Clauses PERMITS AND RESPONSIBILITIES and PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS of Section 00700 CONTRACT CLAUSES in Volume 1 of this contract that define the Contractor's responsibilities. The Contractor shall process any claim arising from his operation; in particular, all property damage claims shall be acknowledged by the Contractor (or his agent) immediately, and the claimed damage inspected within 30 calendar days following initial notification, and processed to a conclusion (honored, denied, or compromised) within 90 calendar days after completion of the contract; but, in no case shall the claim(s) remain unresolved for a period exceeding six months.

3.2 PRE-CONSTRUCTION STRUCTURAL SURVEY

Inspect existing structures within 200 feet from the beach fill limit as to their potential susceptibility to vibration damage from construction equipment induced ground vibration. Visible structural and/or cosmetic damage to buildings, exterior walls, foundations, decks, pools, bulkheads and seawalls shall be documented by photographs, sketches, and field notes.

Factors to consider in determining potential susceptibility shall include but not be limited to: foundation design; foundation conditions; soils testing data; changes in structural loads and local water levels due to beach fill placement; structural condition including construction materials; past damage history and existing stresses, magnitude, frequency, and duration of predicted vibrations from construction equipment and distance from fill placement.

Inspect all existing structures that are determined to be vibration sensitive. Any damage found shall be documented thoroughly by photographs (supplemented with video as necessary), sketches of visible structural and/or cosmetic damage, and field notes. Photographs shall be at least 3-by 5-inch (or digital) and shall provide a detailed visual explanation of the damage. Include a reference scale in each close-up photograph. Sketches shall show the general damage location and extent. All inspection items shall be indexed and cross-referenced and shall use the stationing and locations shown on the contract drawings. Include hotel/motel names and addresses where applicable. Structural damage shall be additionally documented by measuring crack or damage size, width, and length. Every effort shall be made to inspect and document the condition of the building's interior where the building has been determined to be extremely susceptible to vibration damage. Structure(s) determined not to be susceptible to vibration damage shall be noted as such.

3.3 VIBRATION CONTROL PLAN

Use the results of the Pre-Construction Structural Survey to develop the Vibration Control Plan. The Plan shall include procedures to monitor vibration sensitive structures, adjust daily mobilization and demobilization activities, and alter fill placement operations. The Plan

shall include the appropriate tolerable ground vibration level for each structure that has been determined to be susceptible to vibration damage. Should ground vibrations equal or exceed the pre-determined maximum vibration level(s), construction operations shall be halted and corrective measures taken in accordance with the approved Plan.

The minimum safe working distance that vibration producing equipment may operate from each vibration sensitive structure shall be documented in the Plan.

The maximum allowable ground vibration level that is permissible without causing threshold damage to each vibration sensitive structure shall be documented in the Plan. Threshold damage is defined as the occurrence of cosmetic damage.

Each seismograph shall have the capability to measure peak particle velocity and frequency and shall be equipped with an alarm system to alert the on-site Vibration Control Specialist that ground vibrations are approaching the maximum tolerable ground vibration level.

The Contractor's personnel responsible for implementation of the Plan is hereinafter called Vibration Control Specialist. The Vibration Control Specialist shall be on the site during mobilization, demobilization and operation of fill placement equipment.

3.4 DAILY INSTRUMENT LOGS

Daily instrument logs shall document satisfactory performance of the equipment during monitoring periods. Strip charts shall be documented daily with monitoring station number, date, technician signature, and instrument serial number.

3.5 VIBRATION MONITORING REPORT

The monitoring report shall detail the daily activities of the vibration monitoring program. This report shall include, but not be limited to, locations of monitoring equipment; instrument serial number; date and times of readings; magnitude of vibration levels; a sketch and photograph (3- by 5-inch) of each monitoring station showing the relationship of the monitor to vibration sensitive structures; daily instrument logs; instructions transmitted to the Contractor's personnel regarding the modification or stoppage of work operations to keep vibrations below the allowable levels; description of complaint(s); and, any other information pertinent to the vibration monitoring program.

3.6 POST-CONSTRUCTION STRUCTURAL SURVEY

Immediately after completion of work, conduct a post-construction inspection of the structures previously inspected under the Pre-Construction Structural Survey. Documentation procedures shall be identical to those performed under the Pre-Construction Structural Survey. Changes or deviations from the pre-construction inspection conditions in any structure shall be identified and described in the inspection documentation. All citizen complaints and remedies that occurred during the placement of beach fill shall be summarized and included in the report.

-- End of Section --