

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
441 G Street, NW
Washington, DC 20314-1000

*ER 1110-2-103

CECW-EC

Engineer Regulation
No. 1110-2-103

11 June 2020

Engineering and Design
STRONG-MOTION INSTRUMENTS FOR MONITORING AND RECORDING
EARTHQUAKE MOTIONS

1. Purpose.

a. This engineer regulation (ER) provides requirements and guidance for installing, upgrading, and servicing strong-motion (seismic) instruments for recording earthquake site response (whether naturally occurring or induced) on United States Army Corps of Engineers (USACE) dam and navigation structures. Measured site-specific ground motion information is necessary for assessing potential damage to USACE dams, initial near-real-time notification of a seismic event, coordinating and prioritizing post-event responses for regional or portfolio-wide analysis of facilities in comparable seismotectonic regions, and for assessing facilities with comparable expected seismic performance.

b. This regulation requires the use of state-of-practice procedures for near-real-time ground motion data collection and event reporting. This regulation facilitates a partnership with the United States Geological Survey (USGS) to leverage their expertise in installation and monitoring of strong-motion instruments.

2. Applicability. This regulation applies to USACE-owned dams and navigation structures. This regulation does not apply to construction vibration monitoring for blasting, pile driving, and other activities unrelated to earthquake motions.

3. Distribution Statement. Approved for public release; distribution is unlimited.

FOR THE COMMANDER:


JOHN P. LLOYD
COL, EN
Chief of Staff

*This regulation supersedes ER 1110-2-103, dated 10 December 1981.

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4. References.

a. ER 1110-2-1156, Safety of Dams, Policy and Procedures.
https://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1110-2-1156.pdf

b. ER 1110-2-1802, Reporting Earthquake Effects.
https://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1110-2-1802.pdf

c. Engineer Manual 1110-2-1908, Instrumentation of Embankment Dams and Levees.
https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1908.pdf

d. American Society of Civil Engineers (ASCE), Standard, Minimum Design Loads, and Associated Criteria for Buildings and Other Structures, ASCE 7.
<https://doi.org/10.1061/9780784414248>

e. Guideline for [Advanced National Seismic System] ANSS Seismic Monitoring of Engineered Civil Systems, USGS Open-File Report 2005-1039 (or use the latest version of this guideline). <https://doi.org/10.3133/ofr20051039>

f. USGS National Seismic Hazard Mapping Program.
<https://earthquake.usgs.gov/hazards/interactive/>

5. Records Management (Recordkeeping) Requirements. The records management requirement for all record numbers, associated forms, and reports required by this regulation are addressed in the Army Records Retention Schedule—Army (RRS-A). Detailed information for all related record numbers are located in the Army Records Information Management System (ARIMS)/RRS-A at <https://www.arims.army.mil>. If any record numbers, forms, and reports are not current, addressed, and/or published correctly in ARIMS/RRS-A, see Department of the Army Pamphlet 25-403, Guide to Recordkeeping in the Army.

6. Background. The objective of this regulation is to update and standardize seismic instrumentation across USACE consistent with USGS state-of-practice instruments and procedures. The advantages of using the USGS state-of-practice are the following:

- a. Leverages USGS protocols of remote data recording and near-real-time data reporting capability in modern seismic devices.
- b. Allows for remote monitoring of the status of seismic devices to facilitate timely maintenance and repair and decrease the likelihood of devices malfunctioning during ground motion events.
- c. Sustains the USACE seismic monitoring program through access to USGS seismic monitoring resources and allows USACE and USGS to partner to improve seismic monitoring at project sites.
- d. Allows informed prioritization of resources for seismic repair/upgrade alternatives and risk assessments.

7. Seismic Instrumentation Requirements. The following criteria must be used to establish seismic instrumentation needs:

- a. Seismic instrumentation is required where a risk assessment performed at the site identifies risk-driver seismic potential failure mode, and the existing USGS strong-motion network near the project is insufficient as recommended by the risk assessment team to provide site-specific motion data.

- b. In the absence of a risk assessment, the following guidelines will be used to determine the need for seismic instrumentation.

- (1) Seismic instrumentation is not required for projects where a site-specific seismic study has been completed within the last 10 years, and that study has demonstrated the site has low seismic hazard.

- (2) Seismic instrumentation is not required for projects where the estimated Peak Ground Acceleration (PGA) is less than 0.1g (2,475-year return period).

(3) A minimum of one free-field seismic instrument is required for sites where the estimated PGA is greater than or equal to 0.1g but less than 0.2g (2,475-year return period).

(4) A minimum of four instruments (including one free-field) are required for sites where the estimated PGA is equal to or greater than 0.2g (2,475-year return period).

c. Districts are to use risk-informed decision making. For projects where the PGA is less than 0.2g, consider screening site-specific seismic hazard at the project site using USGS National Seismic Hazard Mapping Program (NSHMP) tools, site-specific Probabilistic Seismic Hazard Analysis, past performance of facilities during earthquake events, state and federal policies and priorities, and risk assessment findings. The use of USGS NSHMP tools, including areas of induced seismicity, must utilize the most recent USGS update and/or accepted updates by state agencies.

d. Where site-specific shear wave velocities are known, they should be used for classifying and adjusting the PGA. Where there is limited information, then the PGA will be determined using NSHMP tools based on a 2% probability of exceedance in 50 years (2,475-year return period) adjusted for the representative site classification (ASCE 7-16).

8. Site-Specific Instrumentation Locations.

a. Based on minimum number of instruments indicated in Section 6, projects where the PGA is greater than 0.2g or a seismic risk driving failure mode has been identified, strong-motion instruments must be installed to measure the free-field ground motions and dynamic response of the structure. Instruments must be located on the dam crest, downstream toe in the maximum section of the dam, on one of the abutments at the dam crest elevation, and one in the free-field located at least 3 dam heights downstream of the dam toe. Free-field instruments are to be located on bedrock or undisturbed overburden at locations that are less susceptible to amplification/deamplification of ground motions in order to establish baseline ground motions for the project.

b. For high risk seismic failure modes, additional instruments could be necessary to measure structural response of critical project features such as dam piers, gates, and intake towers.

9. Upgrading/Installing Seismic Instrumentation.

a. The goals of strong-motion instrumentation are to provide immediate seismic data to assess potential damage to USACE dams, guide emergency response and post-earthquake inspection, improve the portfolio-wide characterization of seismic hazard and facility seismic response, and assess facilities with comparable expected seismic performance.

b. Purchase and installation of new seismic instruments are to be coordinated with the USGS strong-motion team before procurement to ensure system-wide compatibility at state-of-practice capabilities. All instruments must meet the requirements for inclusion into the USGS Advanced National Seismic System. All devices must be installed consistent with USGS requirements and meet USGS trigger threshold.

10. USACE Headquarters Responsibilities.

a. Maintain an interagency Memorandum of Agreement (MoA) between USACE and USGS.

b. Review and approve waivers submitted by the Major Subordinate Command (MSC) from districts for exemptions to the Standard Corps of Engineers seismic installation methods and reporting requirements in accordance with this ER.

11. USACE MSC Responsibilities.

a. Submit to Headquarters, Corps of Engineers, Civil Works waivers from districts for exemptions to the Standard Corps of Engineers seismic installation methods and reporting requirements in accordance with this ER.

b. Verify that districts include the status of seismic instrumentation in the Annual Instrumentation Reports submitted by districts.

c. Perform Quality Assurance to verify that districts are complying with the regulations of this ER in a timely fashion.

12. USACE District Responsibilities.

a. Report the status of seismic instrumentation and earthquake events in the Annual Instrumentation Reports.

b. District Dam Safety Program Managers must coordinate with the Operations Division and through the USGS point of contact to plan new seismic instruments or to maintain, repair, troubleshoot, replace, or update seismic instruments.

c. Request maintenance and other instrumentation-related funding through the annual operations and maintenance budget submissions.

d. Supply broadband, power, and backup power (solar and battery bank and associated accessories).

e. Submit waivers for exemptions to the Standard Corps of Engineers seismic installation methods and reporting requirements to the MSC.

Appendix A

Memorandum of Agreement Between the U.S. Department of Interior and USACE

MEMORANDUM OF AGREEMENT
BETWEEN
THE U.S. DEPARTMENT OF INTERIOR
AND
THE U.S. ARMY CORPS OF ENGINEERS

Article I - Purpose and Authority

This Memorandum of Agreement (MOA) is entered into by and between the U.S. Army Corps of Engineers (USACE), and the U.S. Department of Interior (DOI) (collectively the Parties) for the purpose of establishing a mutual framework governing the respective responsibilities of the Parties for the provision of goods and services related to planning, design, environmental support, and construction assistance. This MOA is entered into pursuant to the Economy Act (31 U.S.C. § 1535).

Article II – Scope

Goods and services that USACE may provide under this MOA include: planning; design; construction, contract administration and oversight; engineering or technical assistance; flood risk management; dam and levee safety; hydropower; hazardous or toxic materials assessments and/or removal or remediation, and ecosystem restoration; environmental collaboration and conflict resolution support; research and development; emergency management; cultural and historic preservation surveys, assessments, mitigation, and other services; archeological collection, curation, and management services; tribal consultation and engagement services; real estate; training and professional development, geospatial information services, information and management systems, uniforms for Natural Resources Management program employees, and such other related goods or services as may be agreed upon in the future.

Goods and services that DOI may provide under this MOA include investigations in earth sciences, biological and environmental sciences, remote sensing and geospatial data applications, research and development, environmental restoration and management, and water supply management; dam safety and hydropower assessments, engineering and construction; demolition, fish and wildlife resource management, fire management, recreation, information and data management systems, mitigation, preservation, and interpretation of historical, cultural, and natural resources, recreation and park planning and management; environmental collaboration and conflict resolution support; training and professional development, emergency management, and such other related goods or services as may be agreed upon in the future.

Nothing in this MOA shall be construed to require either party to provide any goods or services to the other party, except as may be set forth in Orders. Orders also commonly known as Interagency or Economy Act Agreements.

All USACE entities, including USACE headquarters, districts, centers, field operating activities, laboratories, divisions, and directorates, are authorized to provide and receive assistance under this MOA.

All DOI bureaus and agencies are authorized to provide and receive assistance under this MOA.

Article III – Points of Contact

To provide for consistent and effective communication between the Parties, each Party shall appoint a Principal Representative to serve as its central point of contact on matters relating to this MOA. Additional representatives may also be appointed to serve as points of contact on orders.

For the U.S. Army Corps of Engineers

USACE Agreements Manager
Interagency & International Services
Phone: 202-761-5844

For the U.S. Department of the Interior

Team Leader, Environmental Cleanup and Liability Management (ECLM) Team
Office of Environmental Policy and Compliance
Phone: 202-208-6128

Article IV - Orders

In response to requests from the one party (the Ordering Agency) for the other Party's (the Servicing Agency) assistance under this MOA, the Parties shall conclude mutually agreed upon written orders. Goods or services shall be provided under this MOA only after an appropriate order has been signed by an authorized representative of each Party. Prior to full implementation of G-Invoicing by both agencies, orders will be executed on FS Form 7600B (or another format acceptable to both Parties that contains the same substantive information as an FMS Form 7600B). Once fully implemented, orders will be developed using the 7600B format in G-Invoicing. Funding for an order will be transferred via a FS Form 7600B when both parties have such capability within G-Invoicing, or via a DD Form 448, Military Interdepartmental Purchase Request (MIPR) when either party does not. By executing an order both Parties certify that the following Economy Act requirements have been met:

1. The Ordering Agency has determined that funds are available;
2. The Ordering Agency has determined that the order is in the best interest of the United States Government;
3. The Servicing Agency has determined that it is able to provide or get by contract the ordered goods or services; and
4. The Ordering Agency has determined that the ordered goods or services cannot be provided by contract as conveniently or economically by a commercial enterprise.

By executing an order, both Parties also certify that any required written Economy Act Determinations and Findings (D&F) have been completed. Upon signature by each Party's authorized representative, an order shall constitute a valid Economy Act order. Orders must include:

- a. A detailed scope of work statement;
- b. Schedules;
- c. Funding arrangements, including whether payment shall be in advance or by reimbursement;
- d. The amount of funds required and available to accomplish the scope of work as stated above; and
- e. The Ordering Agency's fund citation and the date upon which the cited funds expire for obligation purposes.
- f. As appropriate, orders may identify:
 - i. Individual project managers;
 - ii. Types of contracts to be used (if known);
 - iii. Types and frequency of reports;
 - iv. Identification of which Party is to be responsible for government-furnished equipment; contract administration; records maintenance; rights to data, software, and intellectual property; and contract audits;
 - v. Procedures for amending or modifying the order; and
 - v. May include such other information as may be necessary or appropriate to describe clearly the obligations of the Parties with respect to the requested goods and services.

In the event of a conflict between this MOA and an order, this MOA shall control.

Article V - Responsibilities of the Parties.

A. Responsibilities of the Servicing Agency.

1. The Servicing Agency shall provide the Ordering Agency with goods or services in accordance with the purpose, terms, and conditions of this MOA and with specific requirements set forth in orders and implementing arrangements.

2. The Servicing Agency shall identify and authorize the Servicing Agency representatives to sign the orders.

3. The Servicing Agency shall use its best efforts to provide goods or services either by contract or by in-house effort.

4. The Servicing Agency shall provide detailed periodic progress, financial and other reports to the Ordering Agency as agreed to in the order. Financial reports shall include an accounting of all funds received, obligated, and expended, and on forecast obligations and expenditures.

5. The Servicing Agency shall inform the Ordering Agency of all contracts entered into under each order.

B. Responsibilities of the Ordering Agency.

1. The Ordering Agency shall certify, prior to the execution of each order under this MOA, that the order complies with the requirements of the Economy Act, and that any required written Economy Act D&F has been completed.

2. The Ordering Agency shall pay all costs associated with the Servicing Agency's provisions of goods or services under this MOA and shall certify, at the time of signature of a order, the availability of funds necessary to accomplish that order.

3. The Ordering Agency shall ensure that only authorized Ordering Agency contracting officers sign orders.

4. The Ordering Agency shall develop draft orders to include scope of work statements.

5. The Ordering Agency shall obtain for the Servicing Agency all necessary real estate interests and access to all work sites and support facilities, and shall perform all coordination with and obtain any permits from state and local agencies, as necessary during the execution of each order.

Article VI – Funding.

This MOA does not create any obligation of funds between the Parties nor is it intended to commit either Party in advance or excess of appropriations. Any obligation of funds in support of this MOA will be accomplished by executing an order in accordance with Article IV.

The Ordering Agency shall pay all costs associated with the Servicing Agency's provision of goods or services under this MOA. The Servicing Agency shall bill the Ordering Agency monthly for costs incurred using Standard Form 1080, Voucher for Transfers between Appropriations and/or Funds. The Ordering Agency will use the Intra-Governmental Payment and Collection System (IPAC) to automatically reimburse the Servicing Agency. Upon request by the Servicing Agency, the Ordering Agency shall provide funds in advance of any obligation. Bills rendered will not be subject to audit in advance of payment.

If the Servicing Agency forecasts its actual costs under an order to exceed the amount of funds available under that order, it shall promptly notify the Ordering Agency of the amount of

additional funds necessary to complete the work under that order. The Ordering Agency shall either provide the additional funds to the Servicing Agency, require that the scope of work be limited to that which can be paid for by the then-available funds, or direct termination of the work under that order.

Within 90 days of completing the work under an order, the Servicing Agency shall conduct an accounting to determine the actual costs of the work. Within 30 days of completion of this accounting, the Servicing Agency shall return to the Ordering Agency any funds advanced in excess of the actual costs as then known, or the Ordering Agency shall provide any additional funds necessary to cover the actual costs as then known. Such an accounting shall in no way limit the Ordering Agency's duty in accordance with Article X to pay for any costs, such as contract claims or other liability, which may become known after the final accounting.

Article VII - Applicable Laws.

This MOA and all documents and actions pursuant to it shall be governed by the applicable statutes, regulations, directives, and procedures of the United States. Unless otherwise required by law, all contract work undertaken by the Servicing Agency shall be governed by the Servicing Agency policies and procedures.

Article VIII - Contract Claims and Disputes.

All contractor claims and disputes arising under or relating to contracts awarded by the Servicing Agency shall be resolved in accordance with federal law and the terms of the individual contract. The Servicing Agency shall have dispute resolution authority for these claims. Any contracting officer's final decision may be appealed by the contractor pursuant to the Contract Disputes Act of 1978 (41 U.S.C. § 7101). The Armed Services Board of Contract Appeals (ASBCA) is designated as the appropriate board of contract appeals for USACE contracts executed pursuant to this MOA. The Civilian Board of Contract Appeals (CBCA) is designated as the appropriate board of contract appeals for DOI contracts executed pursuant to this MOA. In lieu of appealing to the ASBCA or CBCA, the contractor may bring an action directly to the United States Court of Federal Claims.

The Servicing Agency shall be responsible for handling all disputes arising under or relating to the contracts, including litigation involving disputes and appeals, and for coordinating with the Department of Justice as appropriate. The Servicing Agency shall notify the Ordering Agency of any such litigation and afford the Ordering Agency an opportunity to review and comment on the litigation proceedings and any resulting settlement negotiations.

Article IX - Dispute Resolution.

The Parties agree that, in the event of a dispute between the Parties, the Ordering Agency and the Servicing Agency shall use their best efforts to resolve that dispute in an informal fashion through consultation and communication, or other forms of non-binding alternative dispute resolution mutually acceptable to the Parties. In the event such measures fail to resolve the dispute, the parties shall elevate the issue through their respective chains of command.

Article X — Responsibilities for Costs.

If liability of any kind is imposed on the United States relating to the Servicing Agency's provision of goods or services under this MOA, the Servicing Agency will accept accountability for its actions, but the Ordering Agency shall remain responsible as the program proponent for providing such funds as are necessary to discharge the liability, and all related costs. This obligation extends to all funds legally available to discharge this liability, including funds that may be made legally available through transfer, reprogramming or other means. Should the Ordering Agency have insufficient funds legally available, including funds that may be made legally available through transfer, reprogramming or other means, the Ordering Agency remains responsible for seeking additional funds. Nothing in this MOA shall be construed to imply that Congress will, at a later date, appropriate funds sufficient to meet the deficiencies.

Notwithstanding the above, this MOA does not confer any liability upon the Ordering Agency for claims payable by the Servicing Agency under the Federal Torts Claims Act. Provided further that nothing in this MOA is intended or will be construed to create any rights or remedies for any third party and no third party is intended to be a beneficiary of this MOA.

Article XI - Public Information.

Justification and explanation of the Ordering Agency's programs before Congress and other agencies, departments, and offices of the Federal Executive Branch shall be the responsibility of the Ordering Agency. The Servicing Agency may provide, upon request, any assistance necessary to support the Ordering Agency's explanation of the Ordering Agency's programs conducted under this MOA. In general, the Ordering Agency is responsible for all public information. The Servicing Agency may make public announcements and respond to all inquiries relating to the ordinary procurement and contract award and administration process. The Ordering Agency or the Servicing Agency shall make its best efforts to give the other Party advance notice before making any public statement regarding work contemplated, undertaken, or completed pursuant to orders under this MOA.

Article XII – Miscellaneous.

A. Other Relationships or Obligations: This MOA shall not affect any pre-existing or independent relationships or obligations between the Ordering Agency and the Servicing Agency nor prevent either Party from entering into other relationships.

B. Survival: The provisions of this MOA which require performance after the expiration or termination of this MOA shall remain in force notwithstanding the expiration or termination of this MOA.

C. Severability: If any provision of this MOA is determined to be invalid or unenforceable, the remaining provisions shall remain in force and unaffected to the fullest extent permitted by law and regulation.

D. Transferability: This MOA is not transferable except with the written consent of the Parties.

Article XIII – Required Reviews.

The Parties will review this MOA annually on or around the anniversary of its effective date for financial impacts and triennially in its entirety.

Article XIV - Amendment, Modification and Termination.

This MOA may be modified or amended only by the written and mutual agreement of the Parties. Either Party may unilaterally terminate this MOA by providing at least 180 days written notice to the other Party. In the event of termination, the Ordering Agency shall continue to be responsible for all costs incurred by the Servicing Agency under any order entered under this MOA and for the costs of closing out or transferring any on-going contracts.

Article XV - Effective Date and Expiration.

Unless otherwise modified or extended per Article XIV hereof, this MOA takes effect beginning on the day after the last Party signs and expires nine years after the day the last Party signs.

ARTICLE XVII – CANCELATION OF PREVIOUS AGREEMENT

This MOA cancels and supersedes the previously signed MOA between the same Parties dated February 16th, 2016

AGREED:

For the U.S. Army Corps of Engineers

For the Department of Interior



Alvin B. Lee
Director of Civil Works



Michaela E. Noble, Director
Office of Environmental Policy and
Compliance

Date: 6/5/2020

Date: 5/5/2020