

ADMINISTRATIVE BULLETIN

NO. AB-058 :

DATE : March 25, 2008 (Updated 01/01/14 for code references.)

SUBJECT : Building Seismic Instrumentation

TITLE : **Procedures for Seismic Instrumentation of New Buildings**

PURPOSE : To describe requirements and procedures for installing, monitoring, and reporting data from required or voluntarily installed seismic instruments in buildings.

REFERENCES : 2013 San Francisco Building Code, Section 1604.12, Earthquake Recording Instrumentation.
2013 California Building Code Appendix L.
Federal Emergency Management Agency, July 2000, Recommended Post-Earthquake Evaluation and Repair Criteria for Existing Welded Steel Moment-Frame Buildings, FEMA 352, Washington, D.C.
CSMIP (California Strong Motion Instrumentation Program) Document: CGS/DGS SYSREQ 2007-TR State of California, System Requirements: Integrated Tri-Axial Accelerograph, Downloadable at:

<http://www.conservation.ca.gov/cgs/smip/Documents/SystemRqmts-TriaxialAccelerograph.pdf>

DISCUSSION : Information regarding building performance in earthquakes is important in improving construction practices to further reduce the risk of future earthquake damage by developing codes, standards, and mitigation measures. Such information also helps to understand the movement of buildings following earthquakes and provides data to guide in the inspection, testing and repair of post-earthquake building damage. San Francisco has adopted California Building Code Appendix L, requiring provision of instrumentation for the collection of building seismic data.

A. REQUIRED INSTRUMENTATION

Installation Required

As detailed in California Building Code Appendix L, every new building in San Francisco over six stories in height with an aggregate floor area of 60,000 square feet (5574 m²) or more, and every new building over 10 stories in height regardless of floor area, shall be provided with not less than three approved recording accelerographs with triaxial seismic sensors.

Approval and Documentation of Instrumentation

Project sponsors who are required to provide accelerographs for new buildings must submit two sets of submittal documents, as part of the building permit submittal documents, detailing the proposed installation. Such documents shall clearly identify the following:

- Floor plans of building showing locations of accelerographs.

- Specifications of accelerographs and related instruments and equipment.

Plans will be submitted to DBI for approval.

Approved plans will be transmitted to California Strong Motion Instrumentation Program.

Guidelines for Installation of Accelerographs:

1. *Location.* The accelerographs shall be located in the basement, midportion, and near the top of the building. The preferred locations for the accelerographs are in small, seldom-used rooms or closets near a column. Instruments ideally should be vertically aligned. Adequate space shall be provided to mount the accelerographs and to contain an approved protective enclosure. The protective enclosure shall be securely fastened to the floor or ceiling.

2. *Service Requirements.* Each accelerograph shall be located so that access is maintained at all times. Access shall be unobstructed by room contents. A sign stating "Maintain Clear Access To This Instrument" shall be posted in a conspicuous location near each instrument. This sign shall also include the phone numbers of the local building contact and the Department of Building Inspection.

Each accelerograph requires AC power.

A dial-up telephone line is required at the base-level accelerograph.

2. *Installation Details.* All accelerographs shall be installed with the same orientation relative to the building, with the orientation chosen such that the reference or long dimension of the instrument is aligned with a major axis of the building. The orientation shall be clearly and permanently marked on the floor near the location of each instrument. The accelerographs' triggering threshold shall be set to 1% g, nominal. Auxiliary devices (e.g. telephone switch) shall be secured to the floor, ceiling or to the enclosure.

3. The accelerographs shall be interconnected for common start and common timing.

4. The owner of the building shall be responsible for the correct installation and the required documentation of the accelerographs.

Maintenance

1. Programs for the maintenance and service of the instruments, and remote and onsite access to the data, shall be provided by the owner of the building, subject to approval by the Director of DBI. Once each year, the building owner shall submit a form to DBI certifying that the equipment is in operating order and describing any changes in the equipment or access procedures. (See attached Appendix B).

2. Log book on-site by owner.

3. *Long Term Monitoring and Data Recovery.* Upon acceptance of the installation, the California Strong Motion Instrumentation Program agrees to perform long-term monitoring of the accelerographs to help assure their correct operation. The California Strong Motion Instrumentation Program will perform periodic operational checks and function tests remotely via the provided phone line. California Strong Motion Instrumentation Program will notify the building contact person and Department of Building Inspection when any repair actions are needed. For instruments monitored by CSMIP, equipment operation will be remotely checked and the building owner will be notified of needed repairs. Needed repairs shall be made by the building owner.

Data Recovery and Analysis

Data produced by the instruments shall be made available to DBI upon request. Data shall be retrievable remotely by internet connection or modem. After a significant earthquake, California Strong Motion Instrumentation Program will recover the recorded data, process it and provide results to the designated building contact person and to the Department of Building Inspection. With the approval of the Department of Building Inspection, strong motion data from an instrumented building may be made public on the California Strong Motion Instrumentation Program web site, with the location of the building identified generically, with no specific building address provided.

If the basement acceleration exceeds 5% g then the set of records must be transmitted to the owner and DBI.

B. VOLUNTARY INSTRUMENTATION

Voluntary instrumentation of new and existing buildings not required to be instrumented is encouraged. Compliance to the guidelines in this Administrative Bulletin is recommended for voluntary instrumentation.

If inspections are required, data from instrumentation systems meeting the minimum standards of California Building code Appendix L will be considered for reduction of connection inspection requirements following an earthquake. More comprehensive instrumentation is strongly recommended, particularly for tall or irregular buildings.

Signed by:

Vivian L. Day, C.B.O.
Director
Department of Building Inspection

Approved by the Building Inspection Commission March 19, 2008

Attachments: APPENDIX A *Cabling, Communications And Equipment Specifications*
APPENDIX B *Instrumentation Program and Annual Renewal*

**APPENDIX A
CABLING, COMMUNICATIONS
AND EQUIPMENT SPECIFICATIONS**

Cabling

- a) *Communication: A continuous 4-pair communications cable (plenum-rated Category 5 such as Belden 1624P or approved equal) is required between the instruments.*
- b) *Interconnection: A continuous 4-pair interconnection cable (plenum-rated RS485 cable similar to Belden 9844 or approved equal) is required between the instruments. (Conduit is only required where the cable is likely to be damaged.)*
- c) *Alternate communication and interconnection methods using dedicated building cabling between the instruments may be approved after review.*

Communications

A four-port AC-powered telephone switch (such as ComSwitch 7500 or approved equal) is to be installed at the base-level instrument (with the default port connected to that instrument), to allow communication with all three instruments via one phone line. The other telephone switch ports are to be connected to the other instruments via the communication cable. Alternate methods of communication between the instruments may be approved after review.

Equipment Specifications

The minimum performance requirements for the accelerographs are as follows:

The instruments should be comprised of either a central-recording system with simultaneous sampling of the sensors or of three interconnected individual accelerographs located as required above. In either case, the system shall be digital recording, of a type *approved and in use by the CGS or USGS strong motion programs*, and meet the following criteria:

1. Sampling rate: 200sps.
Full scale recording capability: >3 g.
2. Rms noise of system shall be less than 40 micro-g measured over a 0-80 Hz band.
3. If separate accelerographs are used, they must have common triggering and common timing, with timing to better than 2 milli-seconds.
4. The accelerograph system *may* extract peak accelerations and velocities in real time, and transmit these together with event time and location, by e-mail to the building owner or his agent.
5. Owners are encouraged to employ more than the minimum three instruments.
6. Instruments meeting the referenced System Requirements will be monitored to assure correct operation by CSMIP at the owner's request.

ATTACHMENT B

**APPENDIX B
INSTRUMENTATION PROGRAM
AND ANNUAL RENEWAL**

*TO BE SUBMITTED ON INSTALLATION DATE AND EACH YEAR
BEFORE ANNIVERSARY OF ORIGINAL INSTALLATION*

Building Address: _____ San Francisco, California.

Staff Building Engineer or other local contact person:

Name: _____

Address: _____

Work Phone: _____

Fax No.: _____

Pager: _____

Cell Phone: _____

Home Phone: _____

E-mail: _____

All seismic instrumentation equipment has been checked to be in operating order

The building owner has changed. The new owner is:

Equipment or access procedures have changed as follows:

(signature) _____ Date: _____

(typed name)

The updated documentation for this building has been accepted by the Department of Building Inspection.

Accepted by: _____ Date: _____

RETURN ONE COPY OF THIS FORM TO BUILDING OWNER AFTER REVIEW & ACCEPTANCE

