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Specification for the construction of seismic station Seismic intensity rapid reporting and earthquake early warning station

地震台站建设规范 地震烈度速报与预警台站

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1 Scope

This Standard specifies station site selection, station address testing, station communication and lightning protection requirements, observation pier construction, observation well construction, observation room construction, station security protection construction, equipment configurations, and data archiving in the construction of seismic intensity rapid reporting and earthquake early warning station.

This Standard is applicable to new seismic intensity rapid reporting and earthquake early warning station at national, provincial, city and county levels. Reconstructed and expanded seismic intensity rapid reporting and earthquake early warning station shall refer to this Standard for use. The rapid vibration reporting and early warning station construction in other fields can refer to this Standard for use.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 19531.1-2004, *Technical requirement for observational environment of seismic stations Part 1: Seismometry*

GB 50057-2010, *Design Code for Protection of Structures against Lightning*

GB 50169-2006, *Code for construction and acceptance of grounding connection electric equipment installation engineering*

GB 50223-2008, *Standard for Classification of Seismic Protection of Building Cons*

GB 50343-2012, *Technical code for protection of building electronic information system against lightning*

earthquake.

[DB/T 59-2015, definition 3.1.4]

3.6 seismic intensity instrument

A special instrument for monitoring ground vibration and measuring instrument seismic intensity.

[DB/T 59-2015, definition 3.1.2]

3.7 [seismic intensity rapid reporting and earthquake early warning] reference station

A seismic station that continuously observes ground motion speed and acceleration, conducts real-time transmission of observed waveforms, that is used for earthquake early warning and can be used for seismic intensity rapid reporting.

3.8 [seismic intensity rapid reporting and earthquake early warning] basic station

A seismic station that continuously observes ground motion speed and acceleration, conducts real-time transmission of observed waveforms, that is used for seismic intensity rapid reporting and can be used for earthquake early warning.

3.9 [seismic intensity rapid reporting and earthquake early warning] simple station

A seismic station that continuously observes ground motion speed and acceleration or conducts real-time transmission of observed waveforms or transmits observed waveforms or vibration characteristics parameters (such as arrival time, peak value, cycle of excellence) when an earthquake is triggered, that can be used for seismic intensity rapid reporting and earthquake early warning.

3.10 [seismic intensity rapid reporting and earthquake early warning] station

A general term for reference station, basic station, simple station of seismic intensity rapid reporting and earthquake early warning.

3.11 seismic observation system time delay

Time required for a seismic observation signal to reach the receiving end from generation, including the sum of the time delays of seismometer detection signals, data collector conversion and packaging signals, signal transmission

bedrock.

4.3.2 The location conditions of the observation site of the basic station shall comply with the provisions of 4.1.1 in DB/T 17-2006.

4.3.3 The basic station shall avoid sources of vibration that may affect observation, such as large motors, pumping stations, generators, tower structures, heavy vehicle access, large pipelines, airports and railways. The root-mean-square value of the maximum background vibration acceleration noise of the ground pulsation of the basic station in the frequency band of 1Hz ~ 20Hz shall not be greater than 0.01m/s^2, preferably less than 0.001m/s^2.

4.3.4 The basic station shall choose a location with real-time and continuous communication conditions.

4.4 Simple station

4.4.1 The simple station shall be built on the ground. If the simple station is built on a building, the building shall be a small building of two floors or below and there is no backfill soil above 1m at the foundation.

4.4.2 The location conditions of observation site for the simple station that is built on the ground shall comply with the provisions of 4.1.1 in DB/T 17-2006.

4.4.3 When the simple station is used for earthquake early warning, the root-mean-square value of the maximum background vibration acceleration noise of the ground pulsation in the frequency band of 1Hz ~ 20Hz shall not be greater than 0.01m/s^2, preferably less than 0.001m/s^2.

4.4.4 When the simple station is only used for seismic intensity rapid reporting, the root-mean-square value of the maximum background vibration acceleration noise of the ground pulsation in the frequency band of 1Hz ~ 20Hz shall not be greater than 0.02m/s^2.

4.4.5 The simple station shall choose a location with real-time communication conditions.

5 Station address testing

5.1 The reference station that is built on the ground shall be subject to the observation and calculation of environmental ground noise. The methods for observation and calculation of observation environmental ground noise shall be in accordance with the provisions of Annex A in GB/T 19531.1-2004.

5.2 The reference station that is built under the well shall be subject to engineering geological test. The engineering geological test shall comply with

shall be less than 10^{-6}. The seismic observation system time delay shall not be greater than 2.5s.

6.1.3 Transmission requirements for simple station

6.1.3.1 The communication rate of simple station shall not be less than 56kbps.

6.1.3.2 The simple station shall choose wired transmission link. The channel bit error rate of the wired transmission link shall be less than 10^{-7}. The seismic observation system time delay shall not be greater than 1.5s.

6.1.3.3 When the communication requirements are met, the simple station can choose a wireless transmission link of 2.5G or above. The channel bit error rate of the wireless transmission link shall be less than 10^{-6}. The seismic observation system time delay shall not be greater than 2.5s.

6.2 Station lightning protection

6.2.1 Station lightning protection shall be mainly based on induction lightning protection, considering direct lightning protection.

6.2.2 Lightning protection measures shall be taken at the station areas, power supply lines, communication transmission lines, sensor leads, etc.

6.2.3 Lightning protection of station buildings shall, according to the estimated number of lightning strikes or average number of thunderstorm days at the station location and GB 50057-2010, determine the lightning protection type of the building and take corresponding lightning protection measures.

6.2.4 The lightning protection of the station's electronic information system shall be fortified in accordance with the provisions of GB 50343-2012.

7 Observation pier construction

7.1 General requirements

7.1.1 Observation pier shall be built for basic station and reference station that is built on the ground, used to install observation devices.

7.1.2 Observation pier shall be built for simple station, used to install observation devices. The observation devices of simple station can be fixed on ground or building’s load-bearing wall or column.

7.2 Observation pier specifications

7.2.1 Observation pier size of reference station: when a three-directional independent speed meter and a three-directional integrated accelerometer are

anti-seepage measures shall be taken. The groove shall be filled with loose material.

7.3.9 The observation pier surface shall be marked with a geographical north direction or a permanent geographical north direction marking device shall be installed. The error shall be less than 0.5°.

7.3.10 The observation pier shall be marked with geographic parameters. The coordinate system shall use 2000 National Geodetic Coordinate System (CGCS2000) and 1985 National Elevation Datum, in accordance with the following provisions:

a) Latitude and longitude measurement error shall be less than 0.3";

b) Elevation measurement error shall be less than 20.0m.

8 Observation well construction

8.1 Observation well construction shall comply with the provisions of 4.2.2 and 5.2 in DB/T 16-2006.

8.2 See Annex D for sealing holes of observation well.

9 Observation room construction

9.1 Basic requirements

9.1.1 The reference station that is built on the ground shall build a dedicated observation room. The reference station that is built under the well shall build a dedicated observation room. It may also use observation hood as observation room. The basic station shall preferably build a dedicated observation room. It may also use observation hood as observation room. The simple station shall preferably use observation hood as observation room. It may also use the existing building (structure) as observation room.

9.1.2 The construction of the observation room shall be carried out after the construction of the observation pier is completed and the geographical parameters of the observation pier are determined.

9.1.3 The anti-seismic design of the observation room shall comply with the provisions of GB 50223-2008 for Class B buildings.

9.1.4 Observation room shall take fireproof and anti-theft measures.

9.1.5 The indoor working environment temperature of the observation room

9.4.1 The observation room power distribution shall adopt TN-S power distribution system or TT power distribution system.

9.4.2 The observation room shall be installed with power distribution box and power socket. The distribution box shall be provided with a zero bar and a ground bar. Main switch and multiple branch switch shall be set. Power socket shall choose "two or three sockets". Socket wiring shall be wired in accordance with the principle of "left-zero right-fire". The power distribution lines from the power distribution box to each power socket shall be covered with PVC pipes and other protective pipes, buried in the wall, or laid in open wire grooves.

9.4.3 The power supply lines and the lighting power lines of the observation room shall be independent from each other.

9.4.4 Power line shall be horizontal and vertical.

10 Station security protection construction

10.1.1 The station shall have marks of protection.

10.1.2 It is necessary to construct necessary safety protective walls or fences outside the dedicated observation room and the observation hood. The height of the wall or fence shall not be lower than 1.7m. The distance between each side and the observation room shall not be less than 2.0m. The wall or fence construction can be constructed according to the surrounding environment of the site. The appearance shall be neat and beautiful.

11 Equipment configurations

11.1 The reference station shall be equipped with three-directional accelerometer, three-directional speed meter, and data collector and transmission equipment.

11.2 The basic station shall be equipped with three-directional accelerometer, data collector and transmission equipment.

11.3 The simple station shall be equipped with three-directional seismic intensity instrument and transmission equipment.

11.4 The technical indicators of the observation equipment configured by the station shall meet the requirements of DB/T 10-2001, DB/T 22-2007 and DB/T 59-2015.

11.5 The station shall be equipped with auxiliary equipment according to operation and maintenance needs, such as uninterruptible power supply

Annex A

(normative)

Ground pulsation test

A.1 Test instruments

The site ground pulsation test shall use an instrument that can directly obtain the amount of the ground surface pulsation acceleration. The instrument operating frequency range shall include 0Hz ~ 80Hz. Record the pulsation acceleration time course of the ground surface.

A.2 Test requirements

A.2.1 Each station shall perform routine calibration to the test instrument before and after the test in accordance with the instrument instructions. Analyze the calibration data to ensure that the test instrument is in a normal state and the parameters are accurate and provide instrument parameters for analysis of test data.

A.2.2 The setting of test instrument sampling rate shall not be lower than 100Hz during the test.

A.2.3 The continuous data-recording time obtained by the test shall not be less than 24h.

A.2.4 The surface of the test equipment shall be leveled and hardened during the test. Ensure a firm connection between the test instrument and the ground.

A.3 Analysis and processing of test data

A.3.1 After the site ground pulsation test is completed, the data shall be analyzed for validity first. Occasional interference shall be eliminated. The effective recording time per hour after elimination shall not be less than 40min.

A.3.2 When processing test data, it shall perform calculation analysis on the effectively-recorded data. First, conduct bandpass filtering. The filtering frequency range shall be selected from 0.1Hz ~ 80Hz. Second, determine the root-mean-square value (rms) of the background vibration acceleration noise observed at the station site every 1h. The root-mean-square value of the maximum background vibration acceleration noise in 24h as the root-mean-square value of the maximum background vibration acceleration noise of the station ground pulsation.

A.3.3 Calculation of root-mean-square value (rms): the sum of squares of N

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