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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 12898-2009

Replacing GB 12898-1991

Specifications for the third and fourth order leveling

国家三、四等水准测量规范

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1 Scope

GB/T 12898-2009 is the Chinese national standard on specifications for the third and fourth order leveling, in the field of natural and applied sciences. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 6 May 2009 by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China; Standardization Administration of China, and has been in force since 1 October 2009. Classification: ICS 07.040, CCS A76. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This standard specifies the principles for the establishment of the third and fourth order leveling network, leveling methods, precision indicators and technical requirements. This standard applies to the deployment of the third and fourth order leveling network.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 3161 Optical Theodolite GB/T 10156 level

3 Terms and definitions

The following terms and definitions apply to this standard.

3.1 Node The benchmark in the leveling network that connects at least three leveling lines.

3.2 Leveling line Leveling line between two adjacent nodes in the same order leveling network.

3.3 Section Leveling line between two adjacent basic benchmarks in a leveling line.

3.4 Leveling section Leveling line between two adjacent benchmarks.

3.5 Connect leveling The observation of including a benchmark or other elevation point in a leveling line.

3.6 Branch leveling Observation from any benchmark in a leveling line to any other fixed

point.

4 Leveling network

4.1 Elevation system and elevation reference The elevation of the benchmark uses a normal elevation system, which is calculated from the 1985 national elevation benchmark. The original elevation of Qingdao is

4.3 Layout principles

4.3.1 Third and fourth order leveling networks are further densified on the basis of the first and second order leveling networks. If necessary, annexed lines, loops or node networks are laid in the higher order leveling network, to directly provide elevation control points as necessary for the topographic maps and various engineering constructions.

4.4 Benchmark layout density On the third and fourth order leveling lines, it shall bury one common benchmark stone every 4 km ~ 8 km; in densely populated and economically developed areas, it can be shortened to 2 km ~ 4 km; in desert areas, the leveling branch lines can be increased to about 10 km.

4.6 Connection of new line and surveyed line

4.6.1 The starting point and end point of the newly established leveling line shall be the benchmarks of the surveyed higher or equivalent order leveling line.

4.6.2 When the newly established third and fourth order leveling line is within 4 km away from each surveyed equivalent benchmark, it shall be subject to connect leveling or adjoining leveling. In case of adjoining leveling, it shall check the surveyed benchmarks in accordance with the provisions of clause 7.8.

4.7 Technical design of leveling network

4.7.1 Prior to the deployment of the 3rd and 4th order leveling networks, surveys shall be conducted to collect geological, hydrological, meteorological and road data. The technical design is based on the existing different grades of leveling lines.

5.1 Point selection

5.1.1 Selection of leveling line Leveling line shall be laid along highways, roads and small-gradient country roads that are conducive to survey. Leveling lines shall avoid as far as possible crossing obstacles such as rivers, lakes and marshes above 500 m.

5.1.2 Selection of benchmark The benchmarks shall be selected at locations where the soil is solid, safe and secluded, convenient to observe and conducive to long-term preservation. The following points shall not be selected for benchmarks.

5.2 Stone burial

5.2.1 Mark stone types See Table 2 for the type of mark stone used in the third and fourth order benchmarks and their applicable area.

5.2.5 Land occupation and hosting of mark stones

5.2.6 Data submitted after stone burial The data that shall be submitted after stone burial includes.

6 Technical requirements of instrument

6.1 Selection of instruments The instruments used for leveling are performed as specified in Table 3. Table 3

6.2.3 The inspection of electro-optical level and digital level and their scales above DS3 level used for the third and fourth order leveling shall be performed in accordance with the requirements of GB/T 12897.

7.1 Observation methods

7.1.1 The third order leveling uses the central wire reading method for round trip measurement. When using level gauges with optical micrometers and line- type invar leveling scales, one-trip double-turn point observations can also be performed.

7.2 Survey station setting requirements

7.2.1 The third and fourth order leveling uses the scale for turning point, the scale mass is not less than 1 kg. The observation shall be performed when the scale division imaging is clear and stable; if the imaging is not good, it shall appropriately shorten the length of the line of sight, until the imaging is clear and stable.

7.3.1 Optical level observation

7.3.2.3 The operating procedure for a station is as follows (taking a third order leveling as an example).

7.4 Interval and detection

7.4.1 In case of interval of observations, it is best to end the observation at the benchmark. Otherwise, it shall select two fixed points which are stable and reliable, smooth and projected, and easy to place scale from the last survey station as the interval point. If there is no fixed point, it may drive the capped wood stakes at the turn points of the last two survey stations before the interval as the interval point.