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DEPARTMENT OF THE INTERIOR

GENERAL LAND OFFICE

WASHINGTON May 16, 1922.

ADDRESS ONLY THE
COMMISSIONER OF THE GENERAL LAND OFFICE

SPECIAL INSTRUCTIONS

Connections from triangulation stations of U. S. Coast and Geodetic Survey to monuments of public-land survey.

Extension of provisions of paragraph 13, Sec. 236, Revised Manual of Surveying Instructions.

Appropriation: Surveying the Public Lands.

By letter dated April 8, 1922, the Director of the U. S. Coast and Geodetic Survey, Department of Commerce, suggested that it would benefit the public in many ways for a cadastral engineer to cooperate with triangulation parties of the Coast and Geodetic Survey for the purpose of assisting in making connections from authentic monuments of the public-land survey to triangulation points of the North American Datum.

The Coast and Geodetic Survey will furnish blueprints of the scheme of triangulation, showing preliminary reconnaissance survey, with description of each of the

selected stations of the triangulation. This will enable the cadastral engineer to select points of the General Land Office survey which may be conveniently connected to the triangulation. Where possible to engage in the preliminary cadastral work in advance of the triangulation survey, the cadastral engineer will furnish to the chief of the triangulation party a sketch showing the approximate location of the public-land monument with respect to the stations in the scheme of triangulation, with the lines of visibility marked on the sketches, with description of the General Land Office monument and with information relative to the accessibility by roads or trails. The geodetic engineer will make precise connections to all public-land corners where such information is furnished in advance.

Subsequent to the completion of the triangulations the Coast and Geodetic Survey will furnish information as to the precise latitude and longitude of each public-land monument so connected, said position in latitude and longitude to be fully adjusted to the North American Datum.

The cadastral engineer will ascertain the locus of the triangulation stations and will cooperate with the geodetic engineer in making connections from said triangulation stations to monuments of the public-land survey.

Preference will be given to public-land corners in order of importance: (a) points on standard lines; (b) points on township boundaries; and (c) subdivisional corners. Monuments on state and county boundary lines will be employed when available.

The cadastral engineer will provide such data with reference to public-land surveys as may be required, and will make such retracements and investigations as may be necessary in order to identify the points of reference. Only existent corners will be employed, and in case of lost corner, retracement will be extended in order to ascertain the position of a known monument.

The monuments of the public-land survey employed for reference purposes and precise determination in latitude and longitude, will be reconstructed in accordance with standard specifications adopted by the Board of Surveys and Maps of the Federal Government for this class of permanent stations, as follows:

Metal tablets. Each station which has been located with precise, primary or secondary accuracy, as defined by the Board of Surveys and Maps, should be marked by a tablet of some durable copper alloy, in the form of a metal disk not less than 2½" in diameter, held in place by a stem

not less than 3" long, so shaped as to resist extraction, change of elevation or rotation.

Designation of station. Each tablet should bear the name of the organization which establishes it. The name of the station, and the year in which it was established, shall be legibly stamped upon it, or such other methods used as will insure the identification of the station.

Setting of Tablets. Stations for horizontal control must often be located where the permanent marking of them is difficult and for that reason a great variety of settings for the tablets must be permitted.

(1) In rock outcrop. Where a tablet is to be set in a rock ledge above the surface care should be taken that the rock in which a mark is set is hard and a part of the main ledge, not a detached fragment. The tablet should be countersunk and well cemented in.

(2) In boulders: When set in a boulder the tablet should be countersunk and cemented in. The boulder must be of durable rock, and have a cross-section and depth below surface, at least equal to the standard concrete mark described below.

(3) Rock ledges below Surface. When the ledge is only slightly below the surface, a tablet set in the usual manner in the ledge will be sufficient, provided two reference marks are established.

Where the ledge is so far below the surface that a surface mark is required, a tablet or copper bolt should be set in the ledge, the ledge carefully brushed or washed off for a space of at least 18" in diameter, and a concrete surface mark placed above the sub-surface mark. A tablet shall be set in the surface mark directly over the sub-surface tablet or bolt. If the rock ledge in which the sub-surface is set is very smooth, it should be furrowed with a chisel to afford better anchorage for the concrete.

(4) In concrete.

(a) Shape. The mark should be either a frustum of a cone or a pyramid, or have the form of a post with an enlarged base. If of pyramidal form the sides should have a batter of at least one inch to one foot. When an enlarged base is used, it should have a horizontal diameter at least 50 per cent greater than the bottom of the post proper and a vertical thickness of at least six inches. If the concrete is cast in place, the enlarged base can easily be provided for by enlarging the bottom of the hole at the sides with the digger.

(b) Size and depth. The concrete post should not be less than 12" in diameter and should extend to a depth of from 30 to 36 inches, depending upon the kind of soil. It should extend from 2" to 4" above the surface, unless located in the path of traffic, in which case it should be placed level with the surface or slightly below it.

(c) Materials. Strong concrete marks can be obtained only by using clean materials, mixing well, preferably by mixing them dry before adding the water, and then tamping the mixture well. If a coarse aggregate is used the proportions can vary from 1-2-4 to 1-3-5 while if sand and cement only are used the proportions should be from 1-2 to 1-3, the richer mixture being used near the surface. No reinforcing is needed with the size of monuments here prescribed.

SPECIAL CONDITIONS.

Under certain conditions special marks will often be required, and these should conform in size and durability to the marks described above.

(1) Sand: In sand, which if used as a mould would spoil the concrete by absorbing the water from it, sewer tiles, 8" in diameter and 30" long, should be used, set with the bell end down, filled with concrete and with the base end set in concrete. A metal tablet should be set in the center of the top.

(2) Marsh: Where the surface of the ground is too soft to hold a mark of the usual type, a post of durable wood should be forced down vertically as far as it will go, its top cut off flush with the surface and a sewer tile at least six inches in diameter set into the marsh around the top of the post. The tile should then be filled with concrete and a tablet set in the top.

UNDERGROUND MARKS.

Underground marks need not be used exeept in special cases where the surface mark is liable to be displaced.

REFERENCE MARKS.

Reference marks should in every case consist of a metal tablet similar in material and shape to the station mark, but bearing an arrow which points to the station. A reference mark should be stamped with the same designation as its station mark and where there is more than one reference mark, each should be numbered. It should be set under thesame conditions as specified for the station mark, except that the concrete post in which it is set may be two inches smaller in diameter and six inches shorter than for the station mark.

Each station mark must have at least one reference mark. If the station mark, due to surface conditions, is entirely beneath the surface, there should be two reference marks, unless there are permanent witness marks, such as road crossings, etc., which will give the approximate location of the station mark. If the station mark is on ground liable to be disturbed or washed away, two reference marks should invariably be established. These should be so located as to avoid the probability of both being disturbed by the same cause. They should also preferably be so located as to give a good angle of intersection at the station, or else be placed in range with the station.

The permanent monument, as described above, will be established in addition to but without destroying the evidence of the original monument. Reference or witness monuments will be so constructed as to insure the greatest possible safety in the perpetuation of the point. The marks to be employed will conform to the standard marks described in Chapter 4 of the Revised Manual. An iron post, set in concrete in accordance with the above described specifications may be employed in lieu of the metal tablet above mentioned.

The cadastral engineer will prepare a report furnish-

ing information relative to each corner of the public-land survey system to which connection is to be made, giving description of monument conforming to the requirements of Sec. 423 of the Revised Manual.

Where the connections are to be made by the geodetic engineer, the selection by the cadastral engineer of the points to be connected to triangulation stations should be made in harmony with the following considerations:

1. The General Land Office monument to which the connection is to be made should be selected with a view to facilitating said connection without undue expense, with an accuracy prescribed for the secondary triangulation, i. e., with the error of closure not exceeding 1/5000.

2. Each monument is to have a check on its determination, to avoid the possibility of error. Said check may be obtained in any one of three ways:

(a) By a closed triangle, with all stations occupied;

(b) By intersection observations from three stations, which will give a check in length; and,

(c) By traverse run in two directions, which will also give an adequate check.

The closed triangle may be used under two conditions:

(a) Where the General Land Office mark selected is visible from two occupied stations of the triangulation, By observing on the General Land Office mark from two triangulation stations and occupying the point observed on, a check is obtained.

(b) The second method will occur where the triangulation stations are far apart, making it difficult to find points which can be observed on from two or more stations. A point can be selected near one station in such a location that a base can be measured, one end of which is at the Land Office monument selected and with sufficient length to give an angle at the triangulation station of not less than 20°. The base would be measured with secondary accuracy by the triangulation party. The stations at both ends of the base, one of which would be the Land Office monument to which the connection is to be made, would be occupied with a 7" theodolite and the other angle observed by the triangulation party during its regular occupation of the main scheme station.

Where the connections are to be made by the cadastral engineer, the methods employed will be such as to give an accuracy required in secondary triangulation, i.e., with error of closure not exceeding 1/5000.

After the conclusion of the field work, the cadastral engineer will prepare a report in quadruplicate. Copies of said report to be supplied as follows: (a) Commissioner of the General Land Office; (b) Director, U. S. Coast and Geodetic Survey; (c) Supervisor of Surveys; and (d) U. S. Surveyor General in whose district the points are located.

The Coast and Geodetic Survey will determine the latitude and longitude of the points of reference, the geographic position of which will be based upon adjustment to the North American Datum. Preliminary results will be furnished when available, and final adjusted positions will be published by the Coast and Geodetic Survey when all calculations have been completed.

William Sprague
Commissioner.

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