

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
CHARLES D. WALCOTT, DIRECTOR.

INSTRUCTIONS

RELATING TO

WORK OF THE TOPOGRAPHIC BRANCH

OF THE

UNITED STATES GEOLOGICAL SURVEY.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1900.

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PREFATORY ORDER.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., February 23, 1900.

From time to time various instructions have been issued for the guidance of those engaged in topographic work, and it is now deemed advisable to assemble these and publish them in a convenient form. The instructions were originally prepared, in each instance, after a full consultation with those interested, and they have been revised for the purpose of this publication, so that they may be considered as embodying the latest and best information on the subjects treated. They should be carefully read by the members of the Topographic Branch, as a strict compliance with all the provisions is expected.

This publication is to be regarded as supplementary to the book of Regulations (1893) approved by the Honorable Secretary of the Interior; it has been the intention to include herein nothing that is contained in the latter.

Charles D. Walcott,

Director.

Approved March 3, 1900:

E. A. Hitchcock

Secretary.

INSTRUCTIONS FOR THE TOPOGRAPHIC BRANCH OF THE UNITED STATES GEOLOGICAL SURVEY.

1. PRIMARY TRIANGULATION.

1. Signals should be of sawed lumber whenever it can be obtained, and great care must be taken to secure perfect centering of instrument and target over station mark.

2. All stations should be selected with a view to their adaptability to topographic expansion, and when the exact location of a station is decided upon, one of the standard iron posts, copper plugs, or bronze tablets must be set as a permanent mark. In light soil a bottle or similar object must be left as a subsurface mark. These marks should be at exact center of station, and in addition there should be left one or more reference marks.

3. Ends of base lines should be marked as follows:

(a) *Station mark*, a bronze or aluminum tablet, countersunk and cemented in center of top of a stone post at least 48 by 8 by 8 inches, set flush with surface of ground.

(b) *Reference marks*, standard bench-mark posts, set 42 inches in ground at right angles to base, one on either side 20 feet distant, and one on prolongation of base 20 feet distant; also, azimuths and distances to near-by permanent objects.

(c) If a stone post can not be obtained for a station mark a bench-mark post may be used, but it must be set in a cubic yard of concrete and the top be stamped or lettered, to distinguish it from the reference posts.

4. Whenever practicable, set the theodolite over center of station while reading angles, to obviate reduction to center.

5. The theodolite when in use must be sheltered from the sun and wind. When setting the theodolite tripod, leave the head-bolt thumbscrews loose until the legs are firmly placed.

6. Never, under any circumstances, attempt to place the circle so that when pointing at any particular station the micrometers will be set to even degrees.

7. Use book No. 9-912 for all field records, and do not crowd notes. Have notes plainly written with No. 4 pencil or with ink, and never erase, but draw a single line through erroneous records.

8. On page immediately preceding record of angles, write a minute and complete description of the station occupied, giving nearest trails or roads, camping places, station marks, etc., as well as ownership of land when possible. Write this description before leaving the station. In addition, plat a rough diagram of pointings, showing also plan of eccentric location of instrument, if there be such.

9. Before observations are commenced at a station, test all adjustments of theodolite, and correct such as are found in error, paying special attention to micrometers to avoid the errors of run.

10. For micrometer theodolites, angles must be measured either by the method of circle readings (directions) or by single angles, and in either case each set of angles must be kept on a single page of notebook. If the method of directions be adopted, each complete set must consist of pointings with telescope direct, and reverse pointings with telescope inverted, always closing horizon. See U. S. G. S. Monograph XXII for additional details in use of micrometer theodolites.

11. No angle should be considered finally determined that has not been measured on at least five different parts of the circle.

12. The error of closure of any triangle in primary schemes should not exceed 5".

13. Opposite each angle recorded give any necessary information in regard to visibility of signals or atmospheric conditions.

14. Do not trust to memory for notes. Make all notes as complete as though it were expected another person would compute them.

15. Magnetic declination must be determined at each azimuth station and at each county seat.

16. Observations for azimuth on Polaris before and after elongation must be made on two nights from at least one station in each square degree, to consist of not less than 6 angles between mark and star with telescope direct and reversed. See Monograph above referred to for form of record. Great care must be taken in adjusting and leveling the horizontal axis of theodolite. Watch error must be determined by telegraphic comparison of time or by astronomical observations.

17. Two marks of dressed stone or masonry, about 500 feet apart on a true north-south line, must be established at each county seat, by the following method:

- (a) Set station mark (preferably the south mark), consisting of a bronze or aluminum tablet, countersunk and cemented in center of top of a stone post at least 36 by 8 by 8 inches, the post to project not more than 4 inches above ground.

- (b) Set temporary mark, consisting of a small box with a slit about $\frac{1}{8}$ inch wide and 6 inches long cut in it (having also ventilating holes); box to be firmly nailed to stakes driven in ground, and at same distance from station mark that distant meridian mark is to be, and as nearly on the same meridian with station mark as can be determined from compass or street lines.
- (c) Set tripod over station mark and leave it undisturbed until all observations are completed. Obtain watch error by telegraphic comparison or time observation. The azimuth observations to consist of a series of not fewer than three direct and three reverse measures on three equidistant parts of the circle between Polaris and the azimuth mark before and after elongation; the reduction to be by the rigorous formula given in Monograph XXII, p. 38; this computation to be checked by the approximate method given in the Land Office Manual, pp. 112-119.
- (d) Having distance between instrument and mark, the offset to exact position of meridian can be computed by multiplying the distance into the tangent of the observed azimuth of mark, and the offset laid off by direct linear measurement, then checked by angular measure with theodolite. If not convenient to make linear offset, the azimuth mark can be set in any convenient place and the true meridian determined from it by angular measures exclusively.
- (e) After setting the distant mark, check its accuracy by a series of similar observations another night.
- (f) The field record should be complete in all respects, giving watch error, date, and all details of observation and field reduction; the general description to be made in the following order:

Location of station, ——.

Station mark, ——.

Reference marks, ——.

True azimuth and distance, ——.

Distant mark, ——.

Reference marks, ——.

True azimuth and distance, ——.

Local referee, ——.

Magnetic declination, day, hour, and minute.

18. Angles at each station must be reduced to center of permanent mark in order to test triangle closures. Arbitrary adjustments and preliminary computations should be made in the field. All computations except distances and coordinates must be in book No. 9-889.

19. Keep a careful plot of the work on a scale of 10 miles to an inch, and each month send a copy with monthly report, indicating angles measured by the usual signs.

20. On fly leaf of each notebook write an index of contents of book, and state make and number of theodolite used.

21. The observer should always endeavor to locate prominent points that may be of use to the topographer, or that may be used for future stations.

22. Special attention must be paid to the location of county court-houses, section and county corners, and State-line marks.

23. Useful locations can often be made by the "three-point method," the theodolite being set up for the purpose while going to or from stations.

24. Keep in view the fact that station names are to be published, and select such as have local significance.

2. PRIMARY TRAVERSE.

1. The instruments to be used are a 20" or 30" transit; one 300-foot steel tape graduated to feet for 5 feet at either end; one spring balance; one 100-foot steel tape; two thermometers; four hand recorders; two flag poles, and one good watch.

2. The party should consist of: One chief, as transitman; one recorder; two tapemen, either of whom may act as front or rear flagman; and one flagman.

3. At each station the transitman should proceed as follows: Set telescope on rear flag, read both verniers, transit telescope, set on front flag and read both verniers. Shift the circle and remeasure the same angle with telescope reversed. If the two angles thus measured differ more than 60", repeat the operation.

4. Along a railroad the operation of measuring is to be conducted as follows: The front tapeman puts a 20-pound tension on the front end of the 300-foot tape with a spring balance. He makes a chalk mark on the rail, or places a tack or nail on a tie, stake, or measuring board, under the 300-foot mark for full tape lengths, and under the fractional graduation at stations. The distance which he records is checked by the transitman and at least one other member of the party. The tack or nail is left, surrounded by conspicuous chalk marks, and the same process is continued.

5. The rails should be counted by two other members of the party, who also check the number of tape lengths at the first opportunity. Each station should be marked by a small-headed tack or pricking needle through a piece of white paper or cloth, its number being chalked on the rail near where it falls. The distance between stations should be limited to the visibility of the flag poles. Rails or center of track must not be used as alignment sights.

6. Along highways or open country the tape should be kept level. On steep slopes a plumb bob must be used, either to bring the tape vertically over an established point or to establish a new one, as the case may be. Tape lengths are marked on the measuring board, tie, or stake with the pricking needle. Where slopes are so steep as to render the leveling of the 300-foot tape impracticable a shorter tape must be used.

7. The chief and two other members of the party must keep an independent count of tape lengths. The temperature of the tape must be taken every hour in the day. Stations should be made at even tape lengths whenever practicable.

8. Observations for azimuth must be made at close of each day's work when possible, and azimuth stations should be not more than 10 miles apart, except on long tangents.

9. An azimuth observation must consist of not less than three direct and three reverse measures on three parts of the circle between Polaris and an azimuth mark, to be made at any hour, but preferably near elongation, and the place, date, time, and watch error should be recorded.

10. The watch should be compared with standard time often enough to determine its error within ten seconds.

11. Where the line traversed is very crooked the instrument should be fitted for observation of solar azimuths, and these should be made at least twice in each day, weather permitting, in addition to Polaris observations.

12. The record must contain a description of the starting point of the line and the beginning and ending of each day's work; also location of each railroad station, milepost, and switch passed, and wagon road, stream, land or county line crossed, and connection with corners of the public-land surveys.

13. Two permanent marks, either the copper bolts or the standard bronze tablets of the Survey, should be placed not less than 500 feet apart at the beginning and end of each line, also at prominent junction points from which other primary control lines may be started. A complete description and detailed sketch of these should be entered in the notebook.

14. Permanent marks of some kind should be left at such points passed during cloudy or unfavorable weather as it may be necessary to return to for the observation of azimuths.

15. Meridian marks, consisting of two of the standard bronze tablets set into dressed stone or masonry posts and placed 500 feet or more apart, must be established at each county seat passed in the progress of the work. (See sec. 1, Primary Triangulation, par. 17.)

16. Observations for magnetic declination must be made at several points in the course of a season's work, especially at county seats.

17. A complete record must be kept by the transitman in book No. 9-905, and a separate record of tape lengths by the front tape-man.

18. The transit notes should be entered and worked up in the following manner:

Station.	Pointings: back and transited.		Mean pointing.	Deflection angle.	Comp. azimuth.	Remarks.
	Vernier A.	Vernier B.				
392 100 rails. 2,975 feet.	65° 48' 00"	245° 48' 00"	65° 48' 00"	0° 46' 00"		11 a. m. 72°.
	65 02 00	245 02 00	65 02 00	0 46 00		76 road crossing.
	64 16 00	244 16 00	64 16 00	0 46 00		
393 39 rails. 1,197 feet.	64 16 00	244 16 00	64 16 00	4 41 30		12 m. 73°.
	68 57 30	248 57 30	68 57 30	4 41 30		On road crossing.
	73 39 00	253 39 00	73 39 00	4 41 30		

3. SPIRIT LEVELING.

1. A sufficient amount of accurate spirit leveling will be done to insure the placing of at least two permanent bench marks in each township or equivalent area surveyed, except in forest-clad and mountain areas and in the region east of the ninety-fifth meridian, where at least one shall be established; and these shall be established, whenever practicable, near the township corners of the public-land surveys. In addition to these, other bench marks should be located in prominent places, where they may be of service in the prosecution of future public or private surveys.

2. For each general locality of field work some centrally situated place will be chosen in which an elevation above sea level can be determined with approximate accuracy from railroad or other surveys. In this place is to be established a central datum bench mark, preferably a tablet cemented in some solid masonry structure, to which will be referred all other bench marks in its neighborhood.

3. Permanent bench marks established in the course of the subsequent work should be so located that, like the central datum benches, they will not be liable to injury or disturbance, yet should be so prominently situated that they will be easy to find. They should consist of bronze or aluminum tablets, fastened with Portland cement into solid rock or masonry structures, as the foundations of buildings or bridge piers; or of the standard bronze-capped iron posts, which should be so set in the ground as to project about 1 foot. The intersection of the cross lines is the bench mark.

4. Primary level lines should be run with one or two rodmen and one levelman, and when necessary, a bubble tender. Wherever practicable such lines should be run in circuits which will check back upon themselves or other lines. Where long, unchecked lines are run, two rodmen must be employed.

5. *Single-rodded lines.*—Levelman and rodman must keep separate notes and compute differences of elevation immediately. As levelman and rodman pass, the former must read the rod himself, record and compare readings, then compute the H. I., and after computations are made compare results with the rodman. No comparisons should be made until the record is complete. If the results differ, each must read the rod before comparing anything but results.

6. Work on primary lines should not be carried on during high winds or when the air is "boiling" badly. During very hot weather an effort should be made to get to work early and to remain out late, rather than to work during midday.

7. Fore and back sights should be of equal length, and no sight over 300 feet should be taken excepting under unavoidable circumstances, as in crossing rivers at fords or ferries or in crossing ravines. In such cases extraordinary precautions must be taken, as repeated readings at changed positions of rod and level, etc.

8. If it is impracticable to take equal fore and back sights, as soon as the steep slope is passed take enough unequal sights to make each set balance. In this case extra care must be taken to insure correct adjustment of the level.

9. Distances along a railroad can be obtained by counting rails; at other times stadia or pacing may be used, according to the quality of the work. The distances in feet of both the fore and back sights must be recorded in both notebooks in the proper columns.

10. Always level the instrument exactly before setting the target. After setting it and before giving the signal "all right," examine the level bubble. If found to be away from center, correct it and reset target.

11. The level must be adjusted daily or oftener, if necessary. The adjustment of the line of collimation and of the level tube is especially important.

12. Provide rodmen with conical steel pegs, 6 to 12 inches long, with round heads, to be used as turning points. Never take turning points on rails, ties, or between them. Always drive the pegs firmly into the ground.

13. When the rod is lengthened beyond 6.5 feet, both the rodman and the levelman must examine the setting of the target as well as the reading of the rod vernier. When the rod is closed see that the rod vernier indicates 6.5 feet, not depending upon the

abutting end to bring it back to place. Keep the lower end of the rod and the top of the turning point free from mud and dirt.

14. Plumbing levels must always be used and kept in adjustment, and long extensions of the rod avoided.

15. Leave temporary bench marks at frequent intervals, marked so that they can be easily identified. These may be on a solid rock well marked, a nail driven in the root of a tree or in a post, or on any place where the mark will not be disturbed for a few weeks. One such bench mark should be left for every mile run, in order to give sufficient points to which to tie future levels. Mark in large figures, in a conspicuous place when possible, the elevation to the nearest foot. Make notes opposite all elevations at crossings of roads, railroads, streams, bridges, and in front of railway stations and public buildings, and of such other facts as may aid the topographer in his work.

16. Endeavor to so locate permanent bench marks that the observed elevation shall be within one-tenth foot of the marked elevation. The figures of elevation must be stamped well into the metal cap before the word "feet," and to the nearest foot only, also name or initial letter of the central datum point after the word "datum."

17. A complete description, accompanied by a large-scale sketch, must be made of each bench mark, giving its exact elevation as computed from the mean of the two sets of notes. After bench marks are stamped both levelman and rodman must examine them, and record in notebooks the figures stamped thereon.

18. The limit of error in feet should not exceed $.05 \sqrt{\text{distance in miles}}$.

19. Use the regular Survey level books; keep full descriptive notes on title-page of every book, giving names, dates, etc. Each man should be responsible for his own notebook; and under no circumstances should erasures be made, a single pencil line being drawn through erroneous records.

20. At end of each day's work columns of fore sights and back sights must be added; the difference between the sums applied with proper signs to original elevations should give the closing elevation.

21. When errors are discovered as the work progresses, they must be reported at once to the topographer in charge.

22. Keep each set of notes separately and independently as taken, paying no attention whatever to other notes except to compare results. If on comparison errors are discovered, correct them only by new observations or computations. All notes must be recorded directly in notebook. Separate pieces of paper for figuring, or temporary records, must not under any circumstances be used.

23. An index book or list of bench marks must be kept posted in the field, in ink, for all classes of leveling done. In these, location sketches of permanent bench marks may be made, and descriptions should in every case refer, with distance, to some village, section corner, or other place of local importance. All circuit-closure errors should be distinctly noted, with cross reference by page to the connecting lines.

24. In long, single-rodDED lines make two target settings on each turning point, by first signaling "up" or "down" to a setting, which is recorded by the rodman, then unclamping and signaling in the opposite direction to a setting. If the two differ more than .002 of a foot, additional readings must be made. The rodman should record all readings, using in his computations only the first of the pair adopted, and the levelman the last.

25. *Double-rodDED lines.*—In running unchecked or single primary lines with two rodmen, they should set on turning points 10 to 20 feet apart, but each at equal distances for fore and back sights; otherwise the above instructions are to be followed with the following modifications.

26. The tripod clamping screws should be loosened when the instrument is set, and tightened only after the legs are firmly planted; and the instrument must be shaded at all times by the bubble tender.

27. The laborer should place the steel turning points for fore sights and then return and not remove the back-sight points until the levelman has set targets on the new fore sight, so that there shall be in the ground at all times two turning points the elevations of which are known.

28. Bench marks left at termination of work at night, or for rain or other cause, should be practically turning points in a continuous line. They should consist of large wooden pegs driven below the surface of the ground, with a copper nail firmly embedded in the top. One of these pegs is to be used as the final turning point for each rodman. They are to be covered with dirt, or otherwise hidden, their location being marked by sketches in notebooks showing relation to railroad ties, telegraph poles, etc.

4. TOPOGRAPHIC FIELD WORK.

1. At least two primary triangulation points or a primary control line should be platted on each atlas sheet previous to commencing field work.

2. All existing map material should be diligently sought for; such of this as may be of value, as Public Land plats, railroad, water supply, city, Coast Survey, or other public or private material, should be carefully compiled. If on field inspection

this proves adequate, it should be brought up to date and incorporated in the field sheets.

3. At least two primary triangulation points or a primary control line should be platted on each atlas sheet previous to commencing field work.

4. On each atlas sheet, in addition to primary levels, such other elevations should be obtained instrumentally that aneroids need never be left without a check elevation for distances exceeding 5 miles. These control elevations may come from profiles of railroads, spirit levels, or from vertical angulation.

5. Plane-table triangulation must be conducted on the large sheets to a scale of 1:45000 or 1:90000, and it is desirable that as fast as intersections are obtained by the topographer the vertical heights of stations and intersected points should be computed.

6. In conducting plane-table triangulation, as many hilltops, churches, houses, and other notable features should be intersected and located as is possible, in order to furnish the basis of connection with the traverse work, while gaps or passes and salients on ridges should also have their positions and elevations determined as far as possible from the plane-table stations.

7. Secondary topographic control must precede topographic sketching and the filling in of minor details of the map. The topographer should execute plane-table triangulation or run main controlling traverse lines prior to commencing detailed topographic sketching. His assistants may in the meantime be engaged in running additional control or minor traverses.

8. Field sheets must be as few in number and as large as the character of the topography will permit, and all main control must be adjusted thereon; this to be done before the filling in of minor detailed sketching is commenced. These minor details may be obtained by traverse on separate sheets, but must at once be transferred to and adjusted on main field sheets, so that no uncompleted spaces shall be left on them in the field.

9. Elevations should be adjusted between check points previous to sketching. Sketching must be in continuous contours.

10. All prominent objects within a reasonable distance of the traverse should be sighted with the alidade, from various traverse stations. Sights should also be taken to such objects as may be located by the topographer. If necessary, the traversemen should occasionally ascend low hills to check aneroid elevations with those obtained by triangulation, and to sight to other hills, churches, etc., for purposes of orientation.

11. All permanent buildings, other than barns or sheds grouped about a dwelling house, must be indicated by the traverseman on his plane-table sheets and transferred by the topographer to his field sheet.

12. The topographer in charge will be responsible not only for the quality of the topographic work but also for the quality and management of the spirit-leveling done under his direction and for the location and marking of the bench marks, each of which he should endeavor to examine personally. Permanent bench marks must all be located on the resulting topographic map and their elevations written thereon.

13. Only so much of the field sheets should be inked in the field as can be done with sufficient care to permit of their being accepted as final drawings and of their being directly photographed or photolithographed (excepting where land-survey plats are used as field sheets). Accordingly, only such inks should be used as will photograph readily, namely, mixed burnt sienna for contours, Higgins's black for culture, and only mixed prussian blue with about one-tenth burnt sienna or orange for drainage.

14. A full record must be made on the title-page of each notebook, stating character of work, locality, atlas sheet, and date of record; also name of topographer and maker of notes. A similar record is to be made on field and traverse sheets, with the addition of scale and contour interval.

15. Plats, on a large scale, should be made or obtained of all villages and cities, showing the streets and houses in detail.

16. The determination and spelling of names of streams, mountain peaks, villages, and other places of note should receive particular attention.

5. FIELD SHEETS.

1. The preparation of so-called "original drawings" made in office from the field sketch sheets will be dispensed with as far as practicable.

2. Field sketch sheets should, wherever possible, consist of a single sheet, or at most two half sheets, to each atlas sheet.

3. These field sketch sheets are to be inked clearly and carefully in the three standard colors heretofore adopted, and in such manner as to adapt them for one-third reduction to publication scale.

4. On such field sheets intermediate contours, where uniformly spaced, may be omitted. On them is to appear all other contouring, drainage, and culture, as it is to be engraved; also all figures showing elevations, boundaries, lettering, and marginal lettering.

5. Where it is evident that boundaries follow streams or roads, they should be omitted so as not to disguise copy. In such cases they should be clearly followed on a photolithograph in a colored pencil to show their continuity.

6. Lettering should be simple and open, so as not to disguise topography, but should be neatly executed. Shaded letters need not be filled in, the outlines only being drawn. Lettering should

be placed, as far as possible, in the position in which it is desired on the published sheet.

7. No timber or land classification outlines should appear on the field sheets. They should be submitted on a separate tracing to accompany the latter when transmitted to the editor.

8. Symbols used for roads, secondary roads, and trails should be described by a marginal legend.

6. CLASSIFICATION OF LANDS.

1. All lands hereafter mapped in the course of topographic surveys will be classified as (1) woodland, (2) pasture or grass land, (3) cultivable land, (4) waste or desert land.

2. Woodland will be subclassified as (*a*) merchantable timber; (*b*) tracts containing trees so small in size or of such quality as not to be valuable for lumber, but which may be used for fence posts, firewood, etc.; (*c*) brush, such as chaparral; (*d*) burnt areas.

3. Natural pasture or grass land will be subdivided into two varieties: (*a*) such as may be used for pasturage or cut for hay; (*b*) land which is partly covered with brush or stumps and is indeterminate, being occasionally used for pasturage or cultivation, or having run to young brush.

4. Cultivable land is to be considered of one variety only—that upon which any kind of cultivated crop, including orchards and seeded hay, is grown.

5. Waste or desert land is to be indicated as of one class only, including sand dunes, sea beaches, salt marshes, and steep rocky slopes barren of timber. In the classification of deserts in the arid region particular attention is to be paid to the question of possible irrigation and to the location of reservoir sites.

6. The classifications are to be made graphically, preferably on tracing linen placed over the field sheets. This may be done in pencil on the field sheets, in which event the outlines should be transferred to tracing linen at the end of each day, using colored ink or pencils for each of the four principal classifications, as follows: Green for woodland; blue for pasture land; red for cultivable land; black for waste or desert land.

7. The graphic classification is to be supplemented by notes, to be kept for each area described, on two facing pages of book No. 9-896. On one page should be marked, on a diagram of a shape corresponding to that of the atlas sheet, the locality described; on the other page, the description referring to the area indicated on the diagram. (*a*) Woodland should be described by reference to the principal species of trees and their relative abundance or percentage, distinguishing them by their common names, as pine, fir, cedar, oak, chestnut, maple, hickory, etc.; (*b*) pasture or grass land should be described according to its crop; (*c*) cultivable land

should be described according to the predominant character of the crops grown, as forage, grain, small fruits, orchards, vegetables, etc.; (d) waste or desert land should be distinguished according as it is sand, rock, alkali, or other barren kind.

8. The information obtained will be published by a combination of colors as overprints on the topographic sheets, with a description on the back of the sheet, and it is expected that great care will be exercised in securing sufficient data for the purpose above mentioned.

7. MONTHLY REPORTS OF FIELD PARTIES.

1. Promptly at the close of every month each party chief will mail a report to his section chief, on the proper form.

2. For the report of topographic field work, form 9-908 is to be used. So far as practicable one such sheet should be used in reporting work done on each separate quadrangle, in order that section chiefs may be able to keep a separate account of each quadrangle, and thus estimate its quality and cost. For example, in making up reports of field work on three quadrangles in one month, the party chief should apportion the amount of work and the cost among the three report sheets as nearly as practicable, because he is better able to make such a division than are the section chiefs. The total of the three should be accurate, though the details of each may necessarily be approximate.

3. In making up the diagrams on the back of the report sheet, the endeavor should be, where several kinds of work are in progress in one party, to use a separate diagram for each kind. Thus, one diagram should show the area controlled by traverse, distinguishing between kinds of traverse; another, the area leveled, and a third, the area sketched. Frequently it will be impossible so to distinguish the varieties of work.

4. Party chiefs making out reports for primary triangulation or traverse should use the form (9-920) provided for this purpose, and should fill in the various details noted thereon, so far as circumstances will permit. A separate report should be submitted for each area on which work was prosecuted during the month, provided the areas are in different localities.

8. EMPLOYMENT OF FIELD ASSISTANTS.

1. Hereafter only graduates of engineering schools or experienced surveyors will be eligible for employment as field assistants in the topographic or land surveys of the Geological Survey.

2. Persons employed as rodmen, chainmen, and flagmen shall be not less than twenty years of age, and if students at school or college they must agree to remain with the Survey until the close of the field season, provided their services are satisfactory.

3. The assistants grouped under the general term of laborers, including drivers, packers, and cooks, will be employed during the field season by the chiefs of parties as necessity may arise, by the day, week, or month.

4. All the employees above mentioned will, when practicable, be engaged in or near the areas under survey, and they must present themselves at the field outfitting point of the party to which they are attached, and will be discharged at the end of the field season. No traveling expenses to or from the field will be allowed.

9. GEOLOGICAL SURVEY RATION.

1. A ration is the food estimated to be necessary to subsist one man one day. To facilitate the field work of the Geological Survey, its parties in camp may purchase at the expense of the Survey the rations described below. The amounts of the various articles in the ration are designed to be sufficiently liberal for all circumstances. They are maximum amounts, which must not be exceeded. This ration allowance is neither an emolument nor a perquisite, but is a provision for facilitating the field work of camping parties.

2. The Survey ration is made up of the following articles and amounts:

No.	ARTICLE.	Unit.	100 rations.	200 rations.
1	Fresh meat, including fish and poultry (<i>a</i>) ----	Pounds --	100	200
2	Cured meat, canned meat, or cheese (<i>b</i>) -----	do -----	50	100
3	Lard -----	do -----	15	30
4	Flour, bread, or crackers -----	do -----	80	160
5	Corn meal, cereals, macaroni, sago, or corn-starch.	do -----	15	30
6	Baking powder or yeast cakes -----	do -----	5	10
7	Sugar -----	do -----	40	80
8	Molasses -----	Gallons --	1	2
9	Coffee -----	Pounds --	12	24
10	Tea, chocolate, or cocoa -----	do -----	2	4
11	Milk, condensed (<i>c</i>) -----	Cans -----	10	20
12	Butter -----	Pounds --	10	20
13	Dried fruit (<i>d</i>) -----	do -----	20	40
14	Rice or beans -----	do -----	20	40
15	Potatoes or other fresh vegetables (<i>e</i>) -----	do -----	100	200
16	Canned vegetables or fruit -----	Cans -----	30	60
17	Spices -----	Ounces --	4	8
18	Flavoring extracts -----	do -----	4	8
19	Pepper or mustard -----	do -----	8	16
20	Pickles -----	Quarts --	3	6
21	Vinegar -----	do -----	1	2
22	Salt -----	Pounds --	4	8

a Eggs may be substituted for fresh meat in the ratio of 8 eggs for 1 pound of meat.

b Fresh meat and cured meat may be interchanged on the basis of 5 pounds of fresh for 2 pounds of cured.

c Fresh milk may be substituted for condensed milk in the ratio of 5 quarts of fresh for 1 can of condensed.

d Fresh fruit may be substituted for dried fruit in the ratio of 5 pounds of fresh for 1 pound of dried.

e Dried vegetables may be substituted for fresh vegetables in the ratio of 3 pounds of fresh for 1 pound of dried.

10. ENTERTAINING PERSONS IN CAMP.

1. Heads of parties and all other employees of the Survey are cautioned, when on field duty, against entertaining in camp any persons, whether acquaintances, friends, or relatives, in a manner to interfere with public business. Instruments, outfit, and supplies are provided at Survey expense for official purposes only, and should be employed solely to advance official work. Members of the Survey are required to give their time and labor strictly to official business.

2. Division, section, and party chiefs are expected to bring this order to the attention of all concerned and to enforce it strictly, reporting to the Director any violation thereof.

11. INSTRUMENTS AND RECORDS.

INSTRUMENTS.

1. Requisitions for instruments to be issued by the custodian, and lists of instruments to be returned to him, must be made out on a special form addressed to him. The former are to be approved by the section chief.

2. Receipts will be given by heads of parties, who will be held personally responsible for the instruments receipted for until the same have been delivered to the custodian or accounted for by transfer receipts.

3. When transferring instruments from one person to another, a receipt must be taken from the transferee and immediately forwarded to the custodian, for his information and to enable him to make the necessary change in his records. The regular instrument receipt card is preferred in making these transfers.

4. It is expected that care will be taken in handling Survey instruments. All persons using them will be held personally responsible for them, and be required to replace or repair loss or injuries resulting from carelessness. A special written report should be submitted in explanation of the cause of serious damage.

5. When, in cases of emergency, instruments or bench marks are ordered from the field, bills should be sent direct to purchaser, to be checked and initialed by him and forwarded to the section chief. The latter will procure and approve signed vouchers, sending the same to the chief disbursing clerk for payment.

RECORDS.

1. Each notebook and each single piece of map material for filing in the records should be plainly marked with all information requisite to filing it in its proper place.

2. Material for filing should be transmitted to the custodian. Under no circumstances is anything to be returned to the records without his knowledge.

3. If errors are discovered in the marking of any material drawn from the records, this fact should be brought to the attention of the custodian, in order that the card catalogue may be corrected.

12. CARE AND STORAGE OF PUBLIC PROPERTY AND PASTURAGE OF PUBLIC ANIMALS.

1. In arranging for the storage of camp property and the pasturage of public animals at the close of field work, effort should be made to store the same as near as possible to a main line of railway.

2. The camp material should be placed in boxes, the boxes numbered, and lists made of articles stored in each box. The boxes should be stored in a camp wagon under shelter or in a storeroom, and should be securely packed and nailed, so that if necessary they may be in condition to be shipped by rail.

3. Signed agreements should be entered into with the person taking charge of the property or pasturing the animals, using the forms provided for this purpose.

4. The following precautions should be taken in storing property, and individuals will be held personally responsible for neglect of the same:

- (a) All cooking utensils, etc., must be thoroughly cleaned and dried before packing, and no provisions should be stored.
- (b) All tents, harness, blankets, ropes, etc., must be thoroughly dried in the sun, and time taken to insure this result before packing.
- (c) All harness must be oiled with harness oil.
- (d) All axles of vehicles must be cleaned with coal oil and well covered with axle grease.
- (e) Detailed inventory of all property stored must be taken on form 9-054a, with statement of condition.

13. ACCOUNTS.

Vouchers for accounts are divided into two general classes—main vouchers and subvouchers. Under the head of main vouchers are classed purchase vouchers, traveling-expense vouchers, and service vouchers.

PURCHASE VOUCHERS.

1. Purchase vouchers (forms 9-006 and 9-008) are to be used for direct payment by disbursing officer to person from whom a purchase is made and for assembling the miscellaneous expenses of an employee.

2. It is desirable that payment for purchases—other than board and lodging—involving large amounts should be made by the disbursing officer direct on purchase vouchers, rather than through the chief of party by means of subvouchers. Accounts for amounts less than ten dollars should generally, however, be settled by a subvoucher.

3. When field material, such as tents, wagons, etc., is ordered through the section chief, the consignee should check and approve bill and forward same to section chief, so that the latter may prepare and approve purchase vouchers.

TRAVELING-EXPENSE VOUCHERS.

1. Separate traveling vouchers (form 9-016) are required from each employee who holds a Secretary's appointment.

2. Subvouchers must be submitted for all unusual items, as well as for hotel and livery bills and all miscellaneous expenses, such as lodging, hack fares, fees for handling baggage, etc., when the amount is one dollar or over. Regular railroad, stage, steamboat, sleeping-car, or street-car fares do not require subvouchers. Pullman-car fares are not allowed for day journeys of less than 100 miles, nor are porter's fees allowed for day journeys.

3. Journeys must be by shortest usually traveled route and without unnecessary stop-overs.

4. In filling out Government transportation requests, fill in the blank spaces "enroute —— to ——," giving initial and terminal points, unless there is a necessary stop-over of one day or more. Employees failing to do this will be charged with the difference between local and through fares. Always give date of special traveling order, or if that is not known, date of last general order, and name of officer authorizing the journey, on back of request. When the cash fare would be less than five dollars, avoid the use of requests except on bonded roads.

5. An account for a continuous journey may be submitted at the end of the journey, even though portions of two months are included.

VOUCHERS FOR SERVICES.

1. Vouchers for services must never include more than one calendar month. Service voucher (form 9-010) is to be used for a single person, and pay roll (form 9-012) for two or more persons.

2. Write in blank space at head of pay roll the locality where services are rendered. If this is not the post-office to which checks are to be sent, give post-office address for each person on line with signature in last column.

3. The body of the pay roll must state for each person the name, occupation, time of service, rate of pay, and total amount

due, and be properly signed. Where time is less than a full month, give first and last dates.

4. Pay for Sundays will not be allowed employees working by the day unless a statement is made that they rendered services on that day.

5. In computing rates of pay for fractions of a month, the actual number of days in the month will be considered, and amounts computed by aid of the tables published herewith. (See sec. 15, Monthly Payment Tables.)

6. In order to secure prompt payment of salaries, it is advisable to mail pay rolls for approval by the 20th of the month. If an employee leaves the service after a pay roll has been mailed, payment to him in cash must not be made, but immediate notice should be given the disbursing officer by telegraph in case a change is necessary.

7. Checks for each party will be mailed in a single envelope addressed to the chief of party, unless the disbursing officer is requested not to do so.

SUBVOUCHERS.

1. Subvouchers (form 9-019) are to be used only in connection with main vouchers, never as main or independent vouchers.

2. *Under no circumstances must a subvoucher be signed before the amount in words is written in the receipt.* Each chief of party will be held strictly responsible for an enforcement of this rule.

3. Each employee who has an appointment from the Secretary must submit his own subvoucher accounts, these accounts to be assembled in chronological order on a purchase voucher. Subvoucher accounts must not be submitted more than twice in the same month, and must include expenditures for one month only, except in case of defective accounts returned by the certifying officer for correction; these should be included in the first account submitted after the corrections are made.

4. Give year, month, and day of purchase in body of voucher. Give first and last meal or lodging in all board and lodging accounts, which must always be paid in cash; also name the title of employee for whom the same were furnished. Give first and last meal for forage accounts; and use terms "breakfast," "dinner," and "supper" for men and animals.

5. Subvouchers should be completely written up as soon as possible after they are signed, and not left incomplete until the last of the month; and they should be forwarded for payment as soon as possible after the close of the month.

6. Duplicate subvouchers should not be separated into sets.

7. Complete copies of telegrams must accompany vouchers in payment of same, and only Government rates will be allowed for telegraphic service. When messages go over the lines of two companies, state the fact on the voucher, giving charge for each.

GENERAL INSTRUCTIONS.

1. All vouchers are to be prepared in duplicate, and must be sent to the section chief for approval before they go to the disbursing officer for payment. The body of the vouchers should be made out in full and properly signed before they are sent to section chief for approval. The total amount *in words* must always be written in the receipt, except in a main voucher supported by subvouchers. Never fill in the date, place of payment, or name of disbursing officer in the receipt; these are to be filled in by the disbursing officer to correspond with date, etc., on check.

2. When one voucher blank will not hold the account, use two or more, the last one only to be signed. Never paste the vouchers together.

3. All vouchers should be indorsed "correct" in lower left-hand corner, with initials of the chief of party. The certificate is to be left blank for the signature of the section chief.

4. All vouchers for supplies must state, for each item, the date of purchase, the number of units (pounds, quarts, ounces, bushels, etc.), and the rate per unit (the *correct* rate for each item). If it should be necessary to pay an unusual price for any article, or to make an unusual purchase, the reason must be stated on the voucher.

5. Full descriptions—age, height, weight, color, sex, brands, etc.—must accompany vouchers for the purchase of animals.

6. Effort should be made to secure special rates for board and livery when the service is for a large number or an extended period.

7. Stamped receipts must accompany vouchers for freight or expressage from incorporated companies. The vouchers must give date of shipment, shipping point, destination, names of consignee and consignor, weight, rate, amount charged, and condition when received.

8. If cash payments for freight are made to "land-grant" railroads, such payments must be on basis of one-half regular rate.

9. Freight shipments from points west of Chicago to Washington must be made through the nearest United States Army quartermaster.

10. All signatures must be *by the person named* at head of voucher; a "per" is not in any case admissable. Vouchers in favor of an incorporated company must be signed by an officer or agent of the

company, with his title. Signature by mark (X), in cases of those unable to write their names, must be attested by a disinterested person who signs as witness. A surname alone is not sufficient, first name or initials being always required. The signature "Mrs. Smith" is incomplete. "Mary Smith" is preferable to "Mrs. Mary Smith" or "Mrs. John Smith."

14. AUCTION SALES.

1. General authority is granted each year by the Director for the disposal of worn-out or useless property at auction; sales to be made at times and places designated by section chiefs.

2. Duplicate inspection reports (form 9-047) must be prepared, giving a complete inventory of all property to be sold, with statement as to its condition and reasons why sale should be made.

3. The property must be advertised by posters, for which blanks are provided. The posters are to be put up in conspicuous places at least forty-eight hours before the sale. There being no contingent fund from which to pay the fee of an auctioneer, it will be necessary for some member of the Survey to act in that capacity. All sales must be for cash, and a record must be made of each article sold, including name of purchaser and amount received. Articles of little value may be sold in lots, in which case each item in the lot, as well as the price for which the lot is sold, is to be reported. Inspection and sale reports must agree as to the items mentioned. Accounts of auction sales must be in duplicate, on form 9-040, and as soon as practicable after the sale these forms must be properly filled out and transmitted, with the inspection reports, to the Director, through the section chief, together with the amount received from the sale.

15. MONTHLY PAYMENT TABLES.

Table for payments by the month, or fractions thereof.

[Month of 30 days. Rates from \$15 to \$40.]

	\$15	\$16	\$17	\$18	\$19	\$20	\$25	\$30	\$35	\$40
<i>Days.</i>										
1	.50	.53	.57	.60	.63	.67	.83	1.00	1.17	1.33
2	1.00	1.07	1.13	1.20	1.27	1.33	1.67	2.00	2.33	2.67
3	1.50	1.60	1.70	1.80	1.90	2.00	2.50	3.00	3.50	4.00
4	2.00	2.13	2.27	2.40	2.53	2.67	3.33	4.00	4.67	5.33
5	2.50	2.67	2.83	3.00	3.17	3.33	4.17	5.00	5.83	6.67
6	3.00	3.20	3.40	3.60	3.80	4.00	5.00	6.00	7.00	8.00
7	3.50	3.73	3.97	4.20	4.43	4.67	5.83	7.00	8.17	9.33
8	4.00	4.27	4.53	4.80	5.07	5.33	6.67	8.00	9.33	10.67
9	4.50	4.80	5.10	5.40	5.70	6.00	7.50	9.00	10.50	12.00
10	5.00	5.33	5.67	6.00	6.33	6.67	8.33	10.00	11.67	13.33
11	5.50	5.87	6.23	6.60	6.97	7.33	9.17	11.00	12.83	14.67
12	6.00	6.40	6.80	7.20	7.60	8.00	10.00	12.00	14.00	16.00
13	6.50	6.93	7.37	7.80	8.23	8.67	10.83	13.00	15.17	17.33
14	7.00	7.47	7.93	8.40	8.87	9.33	11.67	14.00	16.33	18.67
15	7.50	8.00	8.50	9.00	9.50	10.00	12.50	15.00	17.50	20.00
16	8.00	8.53	9.07	9.60	10.13	10.67	13.33	16.00	18.67	21.33
17	8.50	9.07	9.63	10.20	10.77	11.33	14.17	17.00	19.83	22.67
18	9.00	9.60	10.20	10.80	11.40	12.00	15.00	18.00	21.00	24.00
19	9.50	10.13	10.77	11.40	12.03	12.67	15.83	19.00	22.17	25.33
20	10.00	10.67	11.33	12.00	12.67	13.33	16.67	20.00	23.33	26.67
21	10.50	11.20	11.90	12.60	13.30	14.00	17.50	21.00	24.50	28.00
22	11.00	11.73	12.47	13.20	13.93	14.67	18.33	22.00	25.67	29.33
23	11.50	12.27	13.03	13.80	14.57	15.33	19.17	23.00	26.83	30.67
24	12.00	12.80	13.60	14.40	15.20	16.00	20.00	24.00	28.00	32.00
25	12.50	13.33	14.17	15.00	15.83	16.67	20.83	25.00	29.17	33.33
26	13.00	13.87	14.73	15.60	16.47	17.33	21.67	26.00	30.33	34.67
27	13.50	14.40	15.30	16.20	17.10	18.00	22.50	27.00	31.50	36.00
28	14.00	14.93	15.87	16.80	17.73	18.67	23.33	28.00	32.67	37.33
29	14.50	15.47	16.43	17.40	18.37	19.33	24.17	29.00	33.83	38.67
30	15.00	16.00	17.00	18.00	19.00	20.00	25.00	30.00	35.00	40.00

Table for payments by the month, or fractions thereof.

[Month of 30 days. Rates from \$45 to \$150.]

	\$45	\$50	\$60	\$65	\$75	\$100	\$125	\$150
<i>Days.</i>								
1	1.50	1.67	2.00	2.17	2.50	3.33	4.17	5.00
2	3.00	3.33	4.00	4.33	5.00	6.67	8.33	10.00
3	4.50	5.00	6.00	6.50	7.50	10.00	12.50	15.00
4	6.00	6.67	8.00	8.67	10.00	13.33	16.67	20.00
5	7.50	8.33	10.00	10.83	12.50	16.67	20.83	25.00
6	9.00	10.00	12.00	13.00	15.00	20.00	25.00	30.00
7	10.50	11.67	14.00	15.17	17.50	23.33	29.17	35.00
8	12.00	13.33	16.00	17.33	20.00	26.67	33.33	40.00
9	13.50	15.00	18.00	19.50	22.50	30.00	37.50	45.00
10	15.00	16.67	20.00	21.67	25.00	33.33	41.67	50.00
11	16.50	18.33	22.00	23.83	27.50	36.67	45.83	55.00
12	18.00	20.00	24.00	26.00	30.00	40.00	50.00	60.00
13	19.50	21.67	26.00	28.17	32.50	43.33	54.17	65.00
14	21.00	23.33	28.00	30.33	35.00	46.67	58.33	70.00
15	22.50	25.00	30.00	32.50	37.50	50.00	62.50	75.00
16	24.00	26.67	32.00	34.67	40.00	53.33	66.67	80.00
17	25.50	28.33	34.00	36.83	42.50	56.67	70.83	85.00
18	27.00	30.00	36.00	39.00	45.00	60.00	75.00	90.00
19	28.50	31.67	38.00	41.17	47.50	63.33	79.17	95.00
20	30.00	33.33	40.00	43.33	50.00	66.67	83.33	100.00
21	31.50	35.00	42.00	45.50	52.50	70.00	87.50	105.00
22	33.00	36.67	44.00	47.67	55.00	73.33	91.67	110.00
23	34.50	38.33	46.00	49.83	57.50	76.67	95.83	115.00
24	36.00	40.00	48.00	52.00	60.00	80.00	100.00	120.00
25	37.50	41.67	50.09	54.17	62.50	83.33	104.17	125.00
26	39.00	43.33	52.00	56.33	65.00	86.67	108.33	130.00
27	40.50	45.00	54.00	58.50	67.50	90.00	112.50	135.00
28	42.00	46.67	56.00	60.67	70.00	93.33	116.67	140.00
29	43.50	48.33	58.00	62.83	72.50	96.67	120.83	145.00
30	45.00	50.00	60.00	65.00	75.00	100.00	125.00	150.00

Table for payments by the month, or fractions thereof.

[Month of 31 days. Rates from \$15 to \$40.]

	\$15	\$16	\$17	\$18	\$19	\$20	\$25	\$30	\$35	\$40
<i>Days.</i>										
1	.48	.52	.55	.58	.61	.65	.81	.97	1.13	1.29
2	.97	1.03	1.10	1.16	1.23	1.29	1.61	1.94	2.26	2.58
3	1.45	1.55	1.65	1.74	1.84	1.94	2.42	2.90	3.39	3.87
4	1.94	2.06	2.19	2.32	2.45	2.58	3.23	3.87	4.52	5.16
5	2.42	2.58	2.74	2.90	3.06	3.23	4.03	4.84	5.65	6.45
6	2.90	3.10	3.29	3.48	3.68	3.87	4.84	5.81	6.77	7.74
7	3.39	3.61	3.84	4.06	4.29	4.52	5.64	6.77	7.90	9.03
8	3.87	4.13	4.39	4.65	4.90	5.16	6.45	7.74	9.03	10.32
9	4.35	4.65	4.94	5.23	5.52	5.81	7.26	8.71	10.16	11.61
10	4.84	5.16	5.48	5.81	6.13	6.45	8.06	9.68	11.29	12.90
11	5.32	5.68	6.03	6.39	6.74	7.10	8.87	10.65	12.42	14.19
12	5.81	6.19	6.58	6.97	7.35	7.74	9.68	11.61	13.55	15.48
13	6.29	6.71	7.13	7.55	7.97	8.39	10.48	12.58	14.68	16.77
14	6.77	7.23	7.68	8.13	8.58	9.03	11.29	13.55	15.81	18.06
15	7.26	7.74	8.23	8.71	9.19	9.68	12.10	14.52	16.94	19.35
16	7.74	8.26	8.77	9.29	9.81	10.32	12.90	15.48	18.06	20.65
17	8.23	8.77	9.32	9.87	10.42	10.97	13.71	16.45	19.19	21.94
18	8.71	9.29	9.87	10.45	11.03	11.61	14.52	17.42	20.32	23.23
19	9.19	9.81	10.42	11.03	11.64	12.26	15.32	18.39	21.45	24.52
20	9.68	10.32	10.97	11.61	12.26	12.90	16.13	19.35	22.58	25.81
21	10.16	10.84	11.52	12.19	12.87	13.55	16.94	20.32	23.71	27.10
22	10.64	11.35	12.06	12.77	13.48	14.19	17.74	21.29	24.84	28.39
23	11.13	11.87	12.61	13.35	14.10	14.84	18.55	22.26	25.97	29.68
24	11.61	12.39	13.16	13.93	14.71	15.48	19.35	23.23	27.10	30.97
25	12.10	12.90	13.71	14.52	15.32	16.13	20.16	24.19	28.13	32.26
26	12.58	13.42	14.26	15.10	15.93	16.77	20.97	25.16	29.35	33.55
27	13.06	13.93	14.81	15.68	16.55	17.42	21.77	26.13	30.48	34.84
28	13.55	14.45	15.35	16.26	17.16	18.06	22.58	27.10	31.61	36.13
29	14.03	14.97	15.90	16.84	17.77	18.71	23.39	28.06	32.74	37.42
30	14.52	15.48	16.45	17.42	18.39	19.35	24.19	29.03	33.87	38.71
31	15.00	16.00	17.00	18.00	19.00	20.00	25.00	30.00	35.00	40.00

Table for payments by the month, or fractions thereof.

[Month of 31 days. Rates from \$45 to \$150.]

	\$45	\$50	\$60	\$65	\$75	\$100	\$125	\$150
<i>Days.</i>								
1	1.45	1.61	1.94	2.10	2.42	3.23	4.03	4.84
2	2.90	3.23	3.87	4.19	4.84	6.45	8.06	9.68
3	4.35	4.84	5.81	6.29	7.26	9.68	12.10	14.52
4	5.81	6.45	7.74	8.39	9.68	12.90	16.13	19.85
5	7.26	8.06	9.68	10.48	12.10	16.13	20.16	24.19
6	8.71	9.68	11.61	12.58	14.52	19.35	24.19	29.03
7	10.16	11.29	13.55	14.68	16.94	22.58	28.23	33.87
8	11.61	12.90	15.48	16.77	19.35	25.81	32.26	38.71
9	13.06	14.52	17.42	18.87	21.77	29.03	36.29	43.55
10	14.52	16.13	19.35	20.97	24.19	32.26	40.32	48.39
11	15.97	17.74	21.29	23.06	26.61	35.48	44.35	53.23
12	17.42	19.35	23.23	25.16	29.03	38.71	48.39	58.06
13	18.87	20.97	25.16	27.26	31.45	41.94	52.42	62.90
14	20.32	22.58	27.10	29.35	33.87	45.16	56.45	67.74
15	21.77	24.19	29.03	31.45	36.29	48.39	60.48	72.58
16	23.23	25.81	30.97	33.55	38.71	51.61	64.52	77.42
17	24.68	27.42	32.90	35.65	41.13	54.84	68.55	82.26
18	26.13	29.03	34.84	37.74	43.55	58.06	72.58	87.10
19	27.58	30.65	36.77	39.84	45.97	61.29	76.61	91.94
20	29.03	32.26	38.71	41.94	48.39	64.52	80.65	96.77
21	30.48	33.87	40.65	44.03	50.81	67.74	84.68	101.61
22	31.94	35.48	42.58	46.13	53.23	70.97	88.71	106.45
23	33.39	37.10	44.52	48.23	55.65	74.19	92.74	111.29
24	34.84	38.71	46.45	50.32	58.06	77.42	96.77	116.13
25	36.29	40.32	48.39	52.42	60.48	80.65	100.81	120.97
26	37.74	41.94	50.32	54.52	62.90	83.87	104.84	125.81
27	39.19	43.55	52.26	56.61	65.32	87.10	108.87	130.65
28	40.65	45.16	54.19	58.71	67.74	90.32	112.90	135.48
29	42.10	46.77	56.13	60.81	70.16	93.55	116.94	140.32
30	43.55	48.39	58.06	62.90	72.58	96.77	120.97	145.16
31	45.00	50.00	60.00	65.00	75.00	100.00	125.00	150.00

16. OFFICE SUPPLIES FOR FIELD PARTIES.

1. Requisitions should be on form 9-125, using numbers and titles as below.

2. The articles generally needed by field parties engaged in different classes of work are indicated thus: Tr., for triangulation; To., for topographic; L., for leveling.

3. The articles mentioned in the following list are supplied by the section of documents and stationery.

- Tr., To., L. 9-006. Purchase voucher, short.
- Tr., To., L. 9-008. Purchase voucher, long.
- Tr., To., L. 9-010. Pay voucher.
- Tr., To., L. 9-012. Pay roll, short.
- Tr., To. 9-016. Traveling-expense voucher.
- Tr., To., L. 9-019. Subvoucher book.
- To. 9-040. Account of auction sales.
- To. 9-047. Inspection report of property.
- To. 9-048. Affidavit for lost property.
- Tr., To. 9-049. Request on quartermaster, freight shipments.
- Tr., To. 9-052. Notification of shipment of property.
- Tr., To., L. 9-054. Inventory of property.
- Tr., To. 9-125. Requisition blanks.
- Tr., To. 9-160. Penalty label.
- Tr. 9-889. Computation books.
- Tr., To. 9-896. Pocket notebook, detachable leaves.
- Tr. 9-901. Computation of geodetic distances.
- Tr. 9-902. Computation of geodetic coordinates.
- L. 9-903. Level book.
- To. 9-908. Monthly report, topographic party.
- Tr. 9-920. Monthly report, triangulation party.
- Tr. 9-912. Triangulation, field notebook.
- To. 9-913. Vertical angle, traverse record.
- To. 9-914. Vertical angle, record.
- 9-915. Public-land survey field notes.
- L. 9-916. Bench-mark descriptions.
- Tr., To., L. 1-944. Account book, 60 pages, index in front.
- To. 1-951. Memorandum book, 140 pages, indexed through.
- To. Brushes.
- Tr., To. Cards, chief clerk address.
- Tr., To., L. Cards for forwarding mail.
- Tr., To. Cards, meal.
- Tr., To., L. Cards, postal.
- L. Cards, weekly report, level party.
- Tr., To., L. Envelopes, official, letter size.
- Tr., To. Envelopes, official, letter size, return.
- Tr., To. Envelopes, official, note size.
- Tr., To., L. Envelopes, official, printed address.
- Tr., To., L. Envelopes, official, blue, cloth lined.
- Tr., To. Envelopes, official, manila, 9½ by 12½ inches.
- To. Paper, blotting.
- Tr., To., L. Paper, pads, figuring, note size.
- Tr., To., L. Paper, pads, official.
- Tr., To. Paper, pads, ruled.

To.	Paper, manila, large sheets.
Tr., To.	Pencils, No. 4.
L.	Pencils, No. 5.
To.	Pencils, green, blue, red.
Tr., To., L.	Penholders.
Tr., To., L.	Pens, assorted.
To.	Pins, pyramid or black steel.
L.	Rubber bands, $\frac{1}{4}$ by 2 inches.
Tr., To., L.	Rubber bands, assorted.
Tr., To.	Rubber pencil erasers.
Tr., To.	Rubber pencil tips.
To.	Tacks, thumb.
To.	Twine, large and small sizes.
To.	Wax, sealing.

4. The articles mentioned in the list below are furnished by the custodian of instruments.

To.	Alidades, telescopic.
To.	Alidades, sight, 18''.
To.	Alidades, sight, 10''.
To.	Alidades, sight, 6''.
To.	Alidades, extra level bubbles for.
To.	Aneroids, 3,000, 5,000, 8,000, 10,000, 15,000.
To.	Compasses, box.
Tr.	Compasses, prismatic.
	Chains, 100, 66, or 33 feet.
Tr., L.	Cement, cans.
To.	Copy book, rolling.
To.	Counters, hand.
	Drawing instruments.
Tr., To.	Glasses, field.
Tr.	Gradienters.
To.	Ink, indelible, black, orange, green.
Tr., To., L.	Ink, fountain-pen filler.
To.	Ink, burnt sienna.
To.	Ink, prussian blue.
To.	Levels, circular.
To.	Levels, Locke, hand.
L.	Levels, plumbing.
L.	Levels, Y.
L.	Leveling rods, New York.
L.	Leveling rods, Philadelphia.
To.	Odometers.
To.	Pads, sandpaper.
L.	Paint, cans.
L.	Paint brushes.
To.	Paper, drawing, single-mounted.
To.	Paper, drawing, double-mounted.
To.	Paper, traverse.
To.	Paste, tubes.
To.	Pencils, 7-H.
	Pins, marking.
L.	Pins, turning-point.

To.	Plane-table boards, 24 by 31.
To.	Plane-table boards, 18 by 24.
To.	Plane-table boards, 20 by 20.
To.	Plane-table boards, 15 by 15.
To.	Plane-table boards, 15 by 15, Johnson plate.
To.	Scales, 45,000.
To.	Scales, 90,000.
To.	Scales, special.
	Scribes, timber.
To., L.	Steel dies, sets, figures.
L.	Steel dies, reference letters.
To.	Steel dies, V. A. letters.
To.	Tables, vertical angle.
To.	Tables, stadia.
L.	Tablets, aluminum.
L.	Tablets, bronze.
Tr.	Tablets, meridian.
Tr.	Tablets, triangulation.
	Tablets, special.
Tr.	Tapes, 300-foot, steel.
Tr.	Tapes, 100-foot, steel.
Tr.	Tapes, 50-foot, steel.
To., L.	Tapes, 25-foot, metallic.
Tr.	Theodolites.
To.	Tracing cloth.
To.	Tracing paper.
Tr.	Transits, solar or 30''.
To.	Tripods, Johnson.
To.	Tripods, traverse.