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3300 GENERAL SURVEYING

3300.1 Purpose

This policy sets suggested standards and guidelines and indicates areas of responsibility for people performing office or field survey functions.

3300.2 Definition of Terms

ACHD	Ada County Highway District, political body or authorized agent
BM	benchmark
C	cut
CL	Centerline
Control Line	Reference line shown on the construction plans which is established during the design phase. All facilities on a project are referenced to the line.
CP&F	Corner Perpetuation and Filing – Corner record filed to perpetuate the location of a section corner or other property controlling corner.
Data Collector	Electronic device that records information directly from a total station or GPS unit.
F	fill
GPS	Global Positioning System – Equipment using communication with satellites to determine location on ground. Used by surveyors to gather topographic data and provide construction staking.
PVC	point of vertical curve
PVI	point of vertical intersection
PVT	point of vertical tangent
P-Line	preliminary line
PC	point of curvature
PCC	point of compound curve
PI	point of intersection of tangents
PLSS Monuments	Monuments set to perpetuate the corners originally set by the government for the orderly disposal of federal lands. Often used to control property boundaries.
POC	point on curve
PRC	point of reverse curve
PT	point of tangent
RAD PT	radius point
ROS	record of survey
RP	reference point
Scanner	Instrument used to create a high-density point cloud of a surface. Each point in the point cloud as a 3D position (X, Y, and Z)
Section Line	Line connecting two PLSS corners. Often used as a control line on section line roads.
TBC	top back curb
TBM	temporary benchmark

Total Station Survey instrument used to measure horizontal angle, vertical angle and Distance from a known point to prism on a natural or manmade feature.

3300.3 Land Surveying

Surveying establishes or re-establishes land lines and property corners. The definition of Land Surveying was expanded in 2015 and is defined and regulated by Idaho Code Section 54-1202(12)(a).

3300.3.1 I.C. 54-1202(12)(a)

(12)(a) "Professional land surveying" and "practice of professional land surveying" mean responsible charge of authoritative land surveying services using sciences such as mathematics, geodesy and photogrammetry and involving:

- (i) The making of geometric measurements and gathering related information pertaining to the physical or legal features of the earth, improvement of the earth, and the space above, on or below the earth; and
- (ii) Providing, utilizing or developing the same into survey products such as graphics, data, maps, plans, reports, descriptions or projects. Professional services include acts of consultation, investigation, testimony, planning, mapping, assembling, and interpreting and gathering measurements and information related to anyone (1) or more of the following:

1. Determining by measurement the configuration or contour of the earth's surface or the position of any fixed objects;
2. Performing geodetic surveys to determine the size and shape of the earth or the position of any point on the earth;
3. Locating, relocating, establishing, reestablishing or retracing property lines or boundaries of any tract of land, road, right-of-way, easement or real property lease;
4. Making any survey for a division or subdivision or a consolidation of any tracts of land;
5. Locating or laying out of alignments, positions or elevations in the field of the construction of fixed works;
6. Determining, by the use of principles of surveying, the position for any boundary or nonboundary survey monument or reference point or for establishing or replacing any such monument or reference point;
7. Certifying elevation information;
8. Preparing narrative land descriptions; or
9. Creating, preparing or modifying electronic or other data necessary for the performance of activities in subparagraphs 1 through 8 of the s paragraph.

3300.3.2 I.C. 54-1202(12)(b)

(12)(b) "Professional land surveying" and "practice of professional land surveying" shall not mean:

- (i) Mapping or geographic information system work that is for nonauthoritative boundaries and nonauthoritative elevations;
- (ii) Construction survey work that is unrelated to establishing vertical and horizontal project control; or
- (iii) Construction staking of fixed works or the development and use of electronic models for machine-controlled construction that by design are unrelated to determining boundaries described in paragraph (a)(ii)3. Of this subsection.

3300.3.3 I.C. 54-1202(13)

"Professional land surveyor" means a person who is qualified by reason of his or her knowledge of the principals of land surveying acquired by education and practical experience to engage in the practice of professional land surveying and who has been duly licensed as a professional land surveyor by the board under this chapter.

3300.3.4 Professional Land Surveyor Supervision Required

Any surveys associated with property boundaries including boundary/right-of-way determination, establishment of right-of-way angle points, and calculations for right-of-way acquisition including the preparation of legal descriptions are considered land surveying under Idaho Code, and must meet the provisions of Idaho Code Title 54 and 55. This requires that all District land surveys be supervised by a professional Land Surveyor licensed in the State of Idaho.

3300.3.5 Monuments and Monumentation

All property monuments within or adjacent to highway rights-of-way must be preserved and protected. If construction shall remove, destroy or disturb the monuments, they shall be re-established and perpetuated by reference, resetting and filing documentation with the Ada County Recorder at the end of the construction project. This must be done by a Professional Land Surveyor licensed in the State of Idaho according to Idaho Code 55-1613 and according to the provisions of the Corner Perpetuation and Filing Act, Idaho Code Title 55, Chapter 16 and IDAPA 24.32.01. Subchapter D, and Recording of Surveys, Idaho Code Title 55, Chapter 19. A Corner Perpetuation and Filing (CP&F) shall be recorded with the county for all corners originally set by the federal government such as section corners and quarter corners. In addition, ACHD requires CP&F's on all sixteenth corners. Property controlling corners (Block corners, intersection monuments, etc.) shall have either a CP&F filed or a record of survey shall be filed. A Record of Survey shall be filed to show all property pins reset with ties to at least two (2) public land survey corner monuments of record in one (1) of the sections containing the record of survey, or in lieu of public land survey corners, ties to two (2) corners of records recognized by the county surveyor. Records of survey which are within previously platted subdivisions of record need not be tied to public land survey corner monuments. For all ACHD projects, if a monument is reset, a record must be filed with the county.

Idaho Code 54-1227 provides that it shall be the duty of each Professional Land Surveyor licensed in the State of Idaho, whenever making any professional boundary land survey, that is not preliminary in nature, to set permanent and reliable magnetically detectable monuments at all un-monumented corners field located, and that the minimum size of the monument shall be one-half (1/2) inch

in diameter and two (2) feet long iron or steel rod unless special circumstances preclude the use of such monument. The monument must be permanently marked with the license number of the Professional Land Surveyor license in the State of Idaho responsible for placing the monument.

ACHD shall require placement of a minimum of five-eighths (5/8) inch diameter and two (2) feet long rebar to define the right-of-way for all new monuments. When the monument falls in the sidewalk or other concrete structures excluding concrete roadways or intersections, a one (1) inch copper plug with a magnet shall be placed to represent the corner. The monument must be permanently marked with the license number of the Professional Land Surveyor licensed in the State of Idaho responsible for placing the monument.

3300.3.6 Reconstruction of Public Land Survey System (PLSS) Monuments

Idaho Code 55-1608 requires monuments set to reconstruct or rehabilitate a monument of the public land survey system shall conform to the provisions of Idaho Code 54-1227 and shall be surmounted with a cap of such material and size that can be permanently and legibly marked as prescribed by the manual of surveying instructions issued by the United States Department of the Interior, Bureau of Land Management, including the license number of the Professional Land Surveyor licensed in the State of Idaho responsible for placing the monument.

3300.3.7 Contractor's Responsibility

It shall be the contractor's responsibility to protect survey monuments and benchmarks outside the construction limits whether or not they are indicated on the project plans or specifications. If the monuments or benchmarks are disturbed, the contractor shall have them replaced by a Professional Land Surveyor licensed in the State of Idaho at the contractor's sole expense. If a monument is shown on the plans as "Retain and Protect", it shall be the contractor's responsibility to protect that monument throughout the life of the project. In the event the monument is destroyed, it shall be the responsibility of the contractor to replace the monument. The monument shall be replaced by or under the direction of a Professional Land Surveyor license in the State of Idaho. The cost associated with replacing the monument shall be the contractor's responsibility. ACHD will not pay for resetting any monument identified in the plans as retain and protect. All costs associated with maintenance or replacing monuments shall be incidental to the project; no separate payment will be made.

3300.3.8 Preplacement of Monuments Identified as "Reference and Reset"

Monuments identified on the project plans or specifications as "Reference and Reset" will be reset by a Professional Land Surveyor licensed in the State of Idaho.

3300.4 Topographic Surveys

Topographic surveys collect field data from which a map is made showing the location of natural and man-made artificial features, and elevation of points on the ground.

3300.4.1 Acceptable Topographic Surveys

Acceptable topographic surveys are performed with electronic data collection, using a total station, scanner and/or GPS. Photogrammetric methods are addressed in special provisions for each project. GPS observations for topographic surveys shall be for a minimum of 3 epochs (i.e. seconds). Control points and monuments such as property monuments, intersection monuments, and PLSS corners shall be observed for 3 minutes.

3300.4.2 ACHD Topographic Survey Process

Right of Entry Letter

Idaho Code Sections 40-2301, 7-705, 6-202 and 18-7008 grants and/or authorize to the District surveyor or agents of the District the right to enter upon private property and made surveys for the purposes of highways and bridges. Licensed consultant surveyors performing topographic surveys for the District are considered agents of the District.

Any survey that requires the survey crew to potentially enter upon private property will begin with a letter to all property owners within the limits of the project, identifying the project, the scope of work, and when the survey crew expects to be surveying in the area. It will contain the name and contact number of the of the Survey Coordinator for questions regarding the survey. It will also contain the name and contact number of the Project Manager for questions specifically related to the project. The letter will be sent out a minimum of one week before the survey crew is expected to begin the survey.

3300.4.3 Topographic Surveys shall Include:

A. Project Control

All projects shall be referenced to land corners; i.e., section corners, $\frac{1}{4}$ corners, $\frac{1}{16}$ corners, $\frac{1}{64}$ corners, street intersections or lot and block corners. All projects will be based on the Idaho State Plane Coordinate System, Zone 1103 modified to the Ada County GIS Projection. The specifications for traverse, triangulation and leveling are given in attached Exhibits as is the order of accuracy. The survey points for the project control network shall normally be second order level of accuracy. For all other survey points such as Photogrammetric picture points, structure control points, location surveys and project details, third order accuracy in acceptable. Construction staking control can be less than third order accuracy unless otherwise directed by the District.

Vertical control such as benchmarks will be on the North American Vertical Datum (NAVD) 1988. Benchmarks will be set approximately 500 feet apart throughout the length of the project. The purpose of this is to have one benchmark per design sheet. The benchmark will be set in a location to minimize disturbance of the benchmark during construction. Each benchmark shall be shown on the plans with the design station, offset, northing, easting, and elevation. A level notes shall be submitted with the topo survey. Roadway projects, arterial and collector intersection projects, and bridge projects shall have horizontal and vertical control set around the perimeter of the project known and calibration control. Four (2) monuments will be set which completely surround the project. The monuments may be used by

contractors and consultants to calibrate the project. The monuments will be occupied for a minimum of three minutes by GPS for horizontal values. The vertical value will be established by running a level loop through each point. The initial benchmark used to establish the elevations and its value (GPS, NGS) shall be identified.

B. Survey Limits and Data to be Collected

Topographic surveys shall include all detail to the face of garage or house or for 100 feet beyond the proposed right-of-way as conditions warrant. The survey crew shall extend the topo survey further if special design, construction, or right-of-way considerations are anticipated. Surveys shall include, but shall not be limited to: above ground and underground utilities and warning signs; buildings; asphalt and concrete walks, curbs, vehicle facilities and names of each; approaches; fences (type and height); irrigation structures; lawn sprinkler and irrigation facilities; flow and direction of free drainage; laterals; canal structures and names of each; storm drain and sanitary sewer facilities with rim elevations of manholes; all traffic signals, control boxes, and signs, commercial signs and landscaping, including notations identifying trees and/or bushes with trunk and drip line diameter. All pipe inverts and sizes shall be shown indicating type of facility.

3300.4.4 Cross Sections (X-Sections)

X-Sections shall be taken at right angles to the existing roadway centerline and normal to curves at a minimum of 50-foot stations. In addition, X-Sections will be taken at grade breaks, driveways, approaches and other unusual conditions. X-Sections shall be extended 50-feet outside expected cut or fill slopes, the proposed right-of-way line, or as conditions warrant. X-Sections shall be gathered by electronic data collection methods with post-processing software that provides a report showing a point number, northing, easting, elevation and description of the point (i.e.P,N,E,Z,D).

3300.5 Right-of-Way Appraisal Staking

Survey provides locations of proposed acquisitions for ACHD projects. The staking provides the Right-of-Way Agents and appraiser a visual delineation of the proposed acquisitions when meeting with property owners. ACHD Surveys will provide the Right-of-Way Department with appraisal staking for each project. A set of 100% Right-of-Way Plans shall be created showing the locations of all acquisitions on the project. This will typically happen at the 99% design milestone. The plans will have coordinates at the beginning of the alignment with the bearings and distances labeled on tangents and radii, length of curve, chord bearing and chord distance for all curves. The Right-of-Way Plans shall show the station/offset of all angle points along the existing right-of-way, proposed right-of-way, proposed permanent easements and proposed temporary easements. The plans will also have the station and offset of each of these lines at the intersections with property lines. An exception to this is when one line can easily be calculated from the location of another line. For example, if the existing right-of-way on the north side of the road is 25 feet from the alignment and the proposed right-of-way is 23 feet, the offset can easily be calculated at 48 feet.

The right-of-way appraisal stakes shall be set where the existing right-of-way,

proposed right-of-way, proposed permanent easement, and the proposed temporary easement intersect property lines, where they begin and end, at all angle points, and the intersection with existing right-of-way.

When performing appraisal staking, the following colored flagging shall be used:

Existing RW – Red
Proposed RW – Orange
Permanent Easement – Yellow
Temporary Easement - Blue

3300.6 General Construction Surveys

3300.6.1 Construction Staking

Surveys that provide locations and grades for constructing roadways and structures. Construction surveying may be done using GPS or a total station. GPS elevations may be used for rough grading, GPS will not be used for finish grade work. The current vertical accuracy of GPS is not accurate enough for finish grading of roadways, structures and curb and gutter. When using GPS to set finish grade stakes, levels must be run from project benchmarks. When using GPS for elevations, GPS will be written on the stake at the elevation.

Construction staking shall include all requirements as outlined in ACHD's General Conditions.+

3300.6.2 Provided to Contractor

Calibration Control: For roadway projects, arterial intersection projects and bridge projects, if the contractor is going to use Automated Machine Guidance (AMG).

3300.6.3 Notice Required for Staking

All notices required for staking shall be done in accordance with ACHD's General Conditions.

3300.6.4 Sub-Grade Elevation

Sub-grade elevation shall be checked at the request of a District representative. It shall be conducted as outlined in the ACHD's General Conditions.

3300.6.5 Slope Stakes & Reference Hub and Stake

Slope Stakes and Reference Hub and Stake information shall be done in accordance with ACHD's General Conditions.

3300.6.6 Finishing Stakes or Blue Tops

Finishing stakes or blue tops shall be done in accordance with ACHD's General Conditions.

3300.6.7 Pipe and Ditch Staking

Pipe and ditch staking shall be with hub and stake on an offset line. This shall not fall within trench excavation. Pipes and ditches shall be staked at 100-foot stationing and at the beginning, ending, angle points, and grade breaks. Offsets

shall be to centerline of pipe or structure and marked with cut or fill (C/F) to flow line (FL). Where new construction is connecting to existing structures or flowlines, all existing horizontal and vertical locations shall be checked before final grade setting.

3300.6.8 Minor Structures

Minor structures such as irrigation structures, sand and grease traps, and manholes shall be staked to the centerline of structure with reference hubs and stakes. The stakes will be marked with an offset and cut or fill (C/F) to invert in/out.

3300.6.9 Major Structures

Major structures such as bridges, shall be staked by setting hub and tack or other suitable monument on each side of the major structural parts and centerline control. The District may request a different system.

3300.6.10 Curb and Gutter Staking

Curb and gutter stakes shall be placed every 50-feet, or at grade breaks and angle points along the roadway. The offset of the stake to the top back of curb (TBC) shall be requested by the contractor. If no offset is requested, ACHD surveyors shall place the offset stakes at three (3) feet behind walk or three (3) feet behind TBC where the sidewalk is detached. The offset may change based on the topography. Stakes shall also be set to include grade breaks/changes, high/low point on vertical curves, PC, PT, and radius points for curves with a radius under 50-feet, or where practical. Curves with larger radii shall have stakes every 25-feet or less, where practical or required, and shall have offset distance to TBC and cut or fill (C/F) to TBC. Where new construction is connecting to existing curb and gutter the horizontal and vertical locations shall be checked before final grade setting.

ACHD Surveys will not stake driveway locations.

ACHD Surveys will not stake signage.

3300.6.11 Utility Staking

ACHD Surveys shall provide the location of new ACHD facilities at conflict locations for utility companies relocating within the project area as follows:

- A. For the relocation of poles, the utility company shall provide a list of the new pole locations using the ACHD approved construction plan stationing or a drawing showing the location of the new poles using ACHD approved construction plan stationing. ACHD Surveys will provide a state and lath at the right-of-way or permanent easement with an offset and cut or fill (graded with GPS) to the TBC at the requested stationing. It will be the utility company's responsibility to read the plans and determine where their facilities may be placed, both horizontally and vertically.
- B. Relocation of underground utilities running longitudinally through the project. The utility shall provide the limits of the relocation. ACHD shall provide a state and lath at the right-of-way with an offset and cut or fill (graded with GPS) to the TBC every 300 feet and at grade breaks and changes in typical sections through the requested stationing limits. It will be the utility company's responsibility to read the ACHD approved

construction plans and determine where their facilities may be placed both horizontally and vertically.

- C. Utilities crossing over or under new ACHD storm drain facilities and new irrigation facilities. This includes, but is not limited to, storm drain pipes and infiltration beds; ACHD will provide a stake and lath at the right-of-way with an offset and cut to the invert or bottom of the ACHD facility. The utility company shall provide the stationing of the crossing as part of the survey request.

For the purposes of this policy, City services shall be considered a utility. ACHD Surveys shall only provide the staking listed above. ACHD Design Supervisor or ACHD Survey Coordinator must approve, in writing, the use of ACHD survey services for any staking of City facilities (manholes, water services, fire hydrants, sewer services, city communications).

3300.7 Legal Records

3300.7.1 Field Notes and Office Files Become Legal Records of the Survey

Field notes must be need, orderly, concise, legible, complete and prepared in a manner consistent with good survey practice. The records will be subject to interpretation by others, possibly several years in the future. Due to the increased use of data collectors and total stations, hand-written field notes are not as prevalent as they once were. Data collectors are valuable and necessary in survey work, but they are not intended to replace hand-written field notes. District or consultant surveyors will continue to keep notes on projects. Field notes shall include the data of the entry/field work, personnel on the field work for that day and a brief note on work to the done.

A. Field notes shall be created for the following:

1. Levels for benchmarks
2. Construction staking
3. Calibration Control
4. Reference ties (R.P.'s) to inter X – 1/4 - 1/16 – section corners, intersections, intersections etc. and filing CP&Fs
5. Manhole / catch basin / drop inlet / irrigation structure flowline depths and sketches showing direction, size and type of pipes (CMP, RCP, PVC, HDP, etc.)
6. All boundary surveys specified elsewhere in this section
7. All control information for example Section, 1/4, 1/16 corners, calibration points, benchmarks including ties as necessary and a brief description or vicinity map to reach each point.
8. All critical features of a project
9. Notes of project specific conversations, including conflicts with public property owners, inspectors and contractors. Notes may include problems found in the plans with resolutions to the problem and who determined the resolution.

3300.7.2 Electronic Field Files – Raw and Modified

Upon completion of the boundary and/or topographic survey, the raw field file for boundary and topographic surveys will be downloaded and stored unedited. Any manipulation of the field file, (for example to correct rod heights or descriptions) will be done to a copy of the field file.

3300.8 Provisions for Consultants Performing Construction Staking

3300.8.1 Field Notebooks and Forms

Upon completion of the boundary and/or topographic survey, the raw field file for boundary and topographic surveys will be downloaded and stored unedited. Any manipulation of the field file, (for example to correct rod heights or descriptions) will be done to a copy of the field file. When data is collected by a consultant Surveyor, all original field notes and computer files, including edited files, shall be submitted to the District and will become the property of the District.+ Field notebooks used for the work shall be made available to a District representative upon request at any time during the job. Such requests may be made verbally or in writing.

Field notes shall be kept in a standard format on "rite in the rain" weatherproof field book or approved equivalent. Corrections shall be made by lining out. Crew names, positions, and dates shall be recorded in the field books on the beginning sheet of each day's work. A Professional Land Surveyor licensed in the State of Idaho, shall sign and seal all notes.

3300.8.2 Qualifications of Personnel

The Consultant shall employ enough qualified personnel experienced in highway and construction surveying to do the work. Supervision of such personnel is the responsibility of the Surveyor, and any errors by such personnel shall be corrected at the expense of the Surveyor.

Consultant's Notice of Required Staking shall meet the requirements as outlined in the ACHD General Conditions.

The Contractor or their subcontractors are not allowed to request any surveying needs directly with a Surveying Consultant. Contractor shall only coordinate with the project inspector for all project surveying needs.

3300.8.3 Surveyor Responsibility

The Surveyor is responsible for calculation of the grades and alignments for staking. Any discrepancies in grade, alignment locations, or dimensions detected by the Surveyor shall be shown to the Engineer. Staking of these areas shall be delayed until differences are reconciled. The Surveyor shall compare the staked centerline cut and fill depth with the design data.

3300.8.4 District Responsibility

The District may check the accuracy of the construction stakes, lines, grades, and layouts. It is not responsible for the accuracy of the final result of the construction stakes, lines, and layouts.

3300.8.5 Consultant Responsibility

The Consultant shall furnish all stakes, surveying equipment, and other devices necessary for setting, checking, marking and maintaining the required points.

3300.8.6 Survey Supplies

A. Lumber

All lumber shall have the following minimum dimensions in inches:

Hubs 2 x 2 x 6

Lath ½ x 2 x 48

Stakes 1 x 2 x 16

B. Plastic Flagging

Flagging shall be plastic supplied in red, white, blue, yellow and orange. Paint of a highly visible type, may be used on the top 2" of stake.

Topo – Survey Control Points –
Pink Flagging

Right-of-Way Staking (Appraisal Staking) –
Existing RW – Red
Proposed RW – Orange
Permanent Easement – Yellow
Temporary Easement – Blue

Construction Staking
Survey Control – Pink
Offset Staking – White

3300.9 Basic Survey Control

The specifications for traverse, triangulation and leveling are given in attached Exhibits as is the order of accuracy. The survey points for the project control network shall normally be second order level of accuracy. For all other survey points such as Photogrammetric picture points, structure control points, location surveys and project details, third order accuracy is acceptable. Construction staking control can be less than third order accuracy unless otherwise directed by the District.

3300.9.1 Vertical Control

All projects shall be referenced to District bench mark datum, unless otherwise stated. The District bench mark book will be available on request to consultants working on District projects. Additional bench marks set by consultants will be typed on 8½"x11" sheet showing origin of bench circuit that is the District bench mark that initiated the additional bench marks. The 8½"x11" typed sheets plus the original field notes will become the property of the District.

3300.9.2 Horizontal Control

All projects shall be referenced to land corners; i.e., section corners, 1/4 corners, 1/16 corners, 1/64 corners, street intersections or lot and block corners. Local coordinate systems are acceptable. In some cases, the District will provide Ada County Base Map coordinates for control corners of a project.