

National Engineering Manual

Part 540 - Field Surveys

KS540.0 General

Survey data for earth dams shall be adequate to determine locations, directions, areas, and volumes to aid in geologic investigations, design, construction, and post reviews. Procedures for obtaining survey data are contained in [Section KS650.180 of the National Engineering Handbook Part 650, *Engineering Field Handbook*](#). These procedures are to be used for any dam in which the Natural Resources Conservation Service (NRCS) participates in the geologic investigation done by drilling, any general plan dams, project dams, and dams in Job Class V or higher.

KS540.1 Responsibility

C. The establishment of the final permanent bench marks, which will be recorded on the as-built plans, is to be included as a part of basic staking. Final permanent bench marks shall be established in accordance with the following procedure:

- (1) Two types of bench marks are authorized—the cast metal cap and the 5/8-inch bar.
 - (i) Cast metal cap
 - (a) This type of bench mark is to be used on project dams (Public Law 566 [P.L. 566] or Resource Conservation and Development [RC&D]) or dams that require a permit from the Kansas Department of Agriculture, Division of Water Resources and meet the requirements of high-impact dams. It shall consist of a stamped, cast metal cap securely embedded in the upper end of a reinforced concrete post set at least 3 feet in the ground (it may be cast in place). The concrete post shall be approximately 12 inches in diameter and have the equivalent of two 3/8-inch diameter deformed steel reinforcing bars placed near the center.
 - (b) The cast metal cap shall be stamped with the letters “BM” and an identifying number. The elevation shall not be stamped into the cap.
 - (c) Example of stamped BM top:

 - (d) Cast aluminum caps are available from the state office and will be supplied to each area office as requested.
 - (ii) Round metal bar—This type of bench mark may be used on all other dams not meeting the requirements in C(1)(i) above. It shall consist of a 5/8-inch diameter steel reinforcing bar 3 feet long driven flush or nearly flush with the ground.
- (2) The bench mark locations should be selected to fulfill the following requirements:
 - (i) A bench mark shall be on the centerline alignment at each end of the dam. Additional bench marks may be needed on dams with a point of intersection (PI) or dogleg.
 - (ii) All bench marks shall be placed so as not to interfere with operation and maintenance of the structure.
 - (iii) The bench mark shall be set beyond the end of the compacted fill of the embankment in undisturbed material, if practical.
 - (iv) If possible, the bench mark shall be placed in an easily relocated and protected area such as a fence line.
- (3) Each bench mark shall be referenced to at least two permanent or semi-permanent landmarks by distance and bearing. The location of the bench marks shall be described in reference to centerline stationing and offset. The distances and bearings, locations, and reference points shall be shown on the as-built plans.
- (4) The bench mark elevation shall be established to the nearest 0.01 foot. Elevations for all project dams and dams that meet the requirements of [Technical Release \(TR\) 60](#) shall be referenced to the national geodetic vertical datum of 1988. Elevations for all other dams may be referenced to an assumed datum.
- (5) The horizontal control of the bench marks shall be referenced to the Kansas state plane coordinate system. Use metric units when located with global positioning coordinates or feet distances from the nearest or most convenient section corner. All bench marks on project dams shall be located with a survey grade global positioning system.

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KS540.2 Format

B. Specific survey and documentation requirements for conservation practices are also listed in the [electronic Field Office Technical Guide \(eFOTG\)](#) for each practice that involves engineering.