Construction Bridge Surveying

Course Number: ST-02-301

PDH: 4

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BRIDGE SURVEYING

Section I. LOCATION

SURVEYS

Bridge surveying is necessary to locate a site, obtain information for design, and furnish lines and grades for construction. A reconnaissance survey is made at all possible sites. A preliminary survey is made at the best site to establish horizontal and vertical control and to obtain information for the bridge design and construction planning. A location survey is made to lay out the bridge according to the bridge plans. During the actual construction, the surveyor establishes any additional lines and grades required by the construction foreman.

The accuracy of measurements and the number and type of survey markers vary with the degree of precision demanded and the type of construction. Variations may range from hand-level and sketchboard work for a tactical bridge to precise measurements for a prefabricated steel bridge.

RECONNAISSANCE

Tentative bridge sites are selected by reconnaissance and the more promising ones are reconnoitered in detail. The selection of a bridge site is governed by both tactical and technical considerations. Tactical requirements fix the general area for the bridge site. Technical requirements fix the exact location and may sometimes eliminate sites that are tactically acceptable. For permanent construction, technical considerations govern the bridge location.

Access Roads

Maps or prepared overlays show existing roads and the distances of railheads from the bridge site. Descriptive symbols indicate the width, condition, and types of roads. The surveyor draws sketches of approach roads to be constructed on overlays and includes them in the reconnaissance report.

Bridge Length

The surveyor determines the length of the bridge crossing to estimate the materials required for construction. Depending on the distance and equipment available, the surveyor measures this distance with a tape, an electronic measuring device, or by stadia method.

Banks

The surveyor reports on the character and shape of the riverbanks. This includes the amount and type of vegetation; the slope, height, and composition of the banks; and pertinent dimensions of any natural dikes. The surveyor selects tentative abutment positions and measures the size and location of any usable abutments or piers for possible use in the proposed construction.

Character of the Flow
The surveyor determines stream velocity by timing a floating object over a measured course. High-water levels are determined by noting drift and marks on vegetation or piers, questioning local inhabitants, and consulting tide tables and local flood records.

Character of the River Bottom The surveyor observes the character of the river bottom for each site and reports in- formation on the design of intermediate supports. If a floating bridge is to be constructed, the surveyor determines the character of the river bottom so the holding power of anchors can be estimated.

Profile
The surveyor profiles the streambed or gap to facilitate the design of intermediate supports. The profile interval is measured by a tape or cable stretched horizontally across the stream or gap or by the instrument-stadia method. Vertical measurements for the profile are referenced to the horizontal tape, cable, or water surface. For floating bridges, profiles are required only for setting trestles near the shores.

Local Materials
The surveyor estimates and records quantities of local materials such as standing timber, sand and gravel beds, and available cement, water, and lumber.

SOUNDINGS

A survey is made to determine the relief of the bottom of the stream along the centerline and along lines on each side of the centerline. The surveyor must make soundings and determine the depth of each sounding in relation to the datum used for vertical control.

Location

The location of each sounding is referenced to control stations onshore. The design engineer specifies the distance from the centerline and intervals between soundings. Unless otherwise specified, intervals between soundings are 25 feet for a fairly uniform streambed and 10 feet for an irregular streambed. For more accurate location of soundings, the surveyor should use the intersection method. This would include setting instruments on the ends of a baseline on shore and reading simultaneous angles.

Procedures

Figure 5-1 shows one method of taking soundings. The instrument is set up over C and sighted on F. A sounding boat travels on the range line, CF, from the far shore toward the near shore. The instrumentman signals the sounding crew until they are online at the proper distance as measured by tape or stadia. The sounding crew proceeds along the centerline, CF, taking readings at the specified intervals. In shallow water, direct rod readings can be taken for profile elevations by setting the

instrument near the river's edge. In deeper rivers, the depth of water is measured directly from the boat, using the most suitable measuring device.

The surveyor records the data obtained by the sounding and ground crews in order to provide a complete set of profile notes for the construction design. To establish profiles on each side of the centerline, stakes are set at a specified distance from the centerline at B, D, E, and G. Using the same procedure as for the centerline soundings, the surveyor sets up the instrument at B, then at D, and sights on E and G, respectively.

FOUNDATION INVESTIGATION

Data on foundation investigations serve as the basis for determining bearing capacities and substructure design. Subsurface investigations are made by borings, test pits, trenches, and field tests. The surveyor must often make measurements incident to these investigations. The surveyor's duties include investigations. The surveyor's duties include instrument stations and recording elevations of strata encountered at the various sites. These data are used in preparing a profile illustrating subsurface conditions.

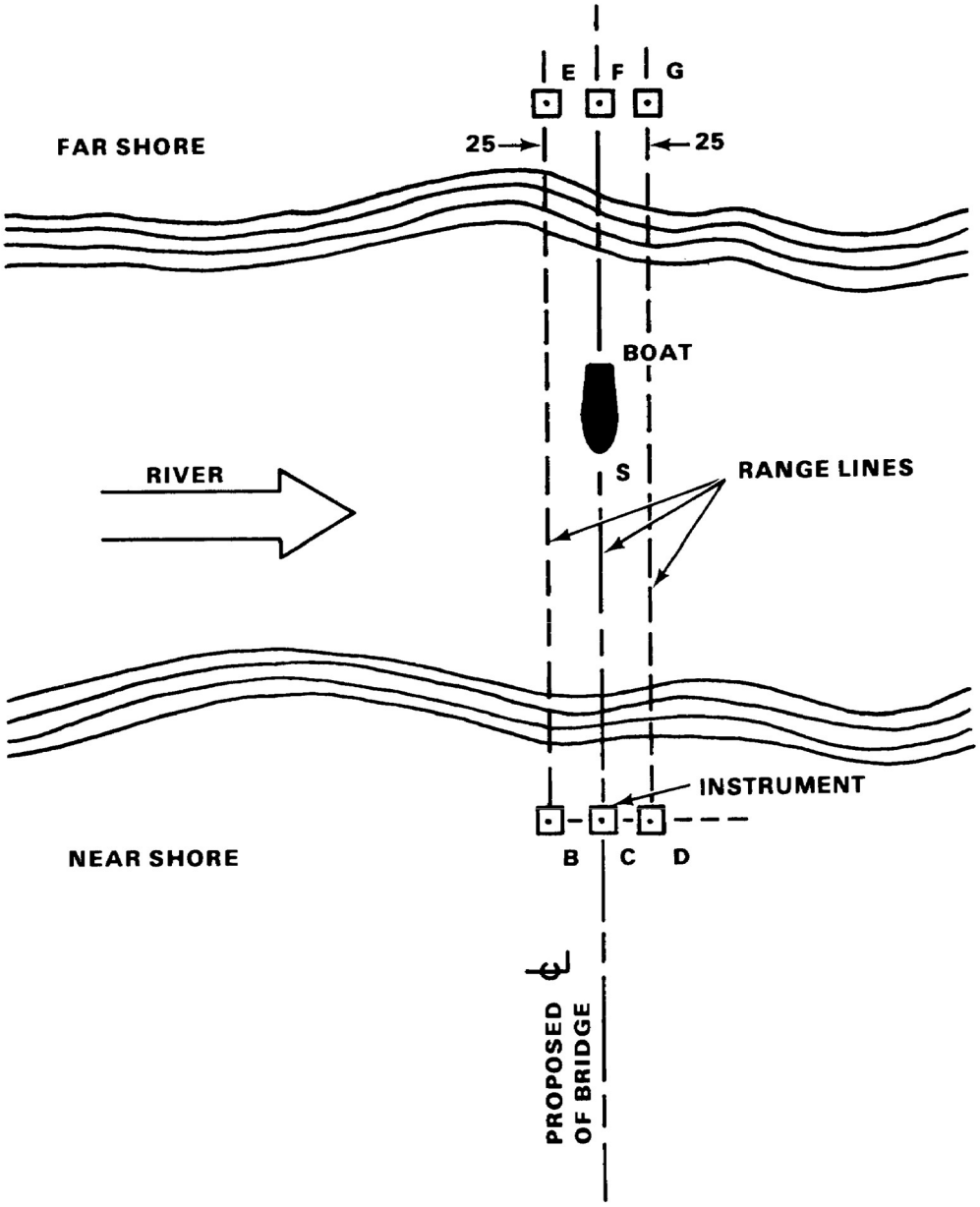

Figure 5-1. Taking soundings

Section II. BRIDGE SITE LAYOUT ABUTMENTS

Construction plans show whether the abutments are pile-bent or crib-bent. The surveyor checks the layout after excavation and before any concrete is poured. The surveyor must also check abutment elevations and, in the case of concrete, establish lines for setting forms. Care must be taken to stake abutments according to the construction plans. The distance between abutments must be within steel fabrication limits, especially for prefabricated sections. The surveyor then ties abutment stakes to a horizontal control system.

The survey procedure for setting an abutment at right angles to the bridge centerline is illustrated in figure 5-2. The foundation, ABCD, is shown in the plan. AB is the face, and points J and K are established near the site on the centerline of the bridge. The staking is done as follows:

(1) Set the instrument at point H (station 40+97.5). Sight on point J. Invert the instrument and use a tape to locate point F.

(2) Turn 90-degree angles and use a tape to locate points C and D.

(3) Move the instrument to point F (station 41+37.5), sight on H, and turn 90-degree angles to locate points A and B. Locate points E and G in line with points A and B, respectively, and use as horizontal control points.

Purchase this course to see the remainder of the technical materials.