

APPENDIX A
To
Technical Requirements Section 01 80 00.12 10

Topographic Survey

Scope of Work

Kandahar Air Field,
Kandahar, Afghanistan

1. Project Description. The services described hereinafter pertain to surveying and mapping services for the Troop Housing site at Kandahar Airfield, Kandahar, Afghanistan.

2. Work to be Performed. Establish horizontal and vertical control for project site construction for the duration of the contract. Secure vertical and horizontal benchmarks for the project length to survive all construction activities.

Conduct a topographic as-built survey of the project sites upon completion of construction. This is to include all areas where work is to take place. See Attachment 1 for survey requirements.

3. Submittal Requirements.

a. Final Survey and Mapping - All drawings shall be at 1:500 scale and provided in diskettes or CD ROM. Each sheet shall cover an area approximately 250 x 300 meters and shall include a north arrow, legend, survey data, datum data and sheet index plan showing its relationship with the entire project area. In addition, one drawing, at a conventional scale shall show the entire survey area.

b. All field books with computation sheets and sketches for every survey control level loop and traverse.

c. One bound booklet with adjusted coordinates, elevations and detailed descriptions with plots of each concrete survey monument established on site.

d. Diskettes or CD ROM containing digital file(s) of the final adjusted survey, in the format specified in Attachment 2. Files shall contain the individual sectors used to create the 1:500 reproducible sheets.

e. Topographic survey drawings shall be submitted to the Contracting Officer field office representative, for field verification of the survey prior to final submittal to the Corps of Engineers Winchester office.

4. Attachments.

1- Survey Requirements

2- Digital Format

ATTACHMENT 1

SURVEY REQUIREMENTS

1. General. The following paragraphs describe the Scope of Work for establishing control, performing as-built surveys and the digitization of the topographic data.

2. Survey Requirements.

2.1 Coordinate Systems. The survey shall be based on the Universal Transverse Mercator Grid Zone 41N, World Geodetic System (WGS84) and the elevation should be height above ellipsoid (WGS84) and sea level (Geoid96). If there has been gravitational surveys performed nearby, these shall be noted. A survey database file for all features should show both ellipsoid height and Geoid height and WGS84 latitude/longitude as well as UTM coordinates. GPS benchmarks shall be documented at ITRF2000 coordinates referenced to the latest epoch year. Basic project control surveys will be performed using precise differential carrier-phase tracking Navstar GPS measurement procedures or electronic data collection total stations.

2.2 Accuracy Requirements. Differential GPS baseline vector observations will be made in strict accordance with the criteria contained in EM 1110-1-1003, except as modified or amplified herein. Conventional survey observations shall be made in accordance with criteria contained in EM 1110-1-1005, except as modified or amplified herein.

The primary level loop shall have an accuracy of second-order class II. The secondary loops shall have an accuracy of third-order class I

2.3 Control Systems. Install a minimum of three survey monuments for every 1,000 meters of survey site following the requirements contained in EM 1110-1-1002. A minimum of two benchmarks must be visible by line of site at each station. Monumentation placed on project site shall be designed to survive proposed construction operations by use of proper location and construction techniques.

Following criteria found in EM 1110-1-1005, Topographic Survey Control, a passive benchmark system shall be established that will survive construction and link existing project datums of airfields and current building construction together using primary and secondary level loops. Level loop benchmarks may utilize traverse control points described above.

Primary and secondary level loop benchmarks systems shall be maintained by the contractor for the duration of the contract. Before completion of the contract is certified, the contractor shall submit to the CO proof of a surviving benchmark system.

2.3.1 All Topographic survey point sets produced with conventional survey instruments shall be referenced directly to horizontal and vertical control points by level loop and closed traverse.

2.3.2 The location of the survey sites shall be shown to the contractor by the Contracting Officer's Representative (COR). The limits of the survey shall then be identified by temporary markers and a sketch, with

coordinates, of the area to be surveyed shall be submitted for approval by the COR before proceeding with the survey.

2.3.3 Install and maintain aerial photography panels at four locations on base. It is suggested that the remaining two be maintained at the approach stripping of the runway.

3. Topography Requirements.

3.1 A sufficient quantity of horizontal and vertical control data shall be established to provide a detailed topographic survey at 1:500 scale with fifteen (15) centimeter contour interval. Intermediate elevations shall be provided as necessary to show breaks in grade and changes in terrain.

3.1.1 The contours shall accurately express the relief detail and topographic shapes. There must be a Root Mean Squared Error (RMSE) no greater than 4 cm for 95% of the points ("A foot print on dry earth is 2 cm deep").

3.1.2 The projection grid (which shall be a metric rectangular coordinate system with a grid spacing of fifty (50) meter intervals) and the control points shall be plotted correctly to the nearest three tenths (0.3) of a millimeter. The horizontal position of 90 percent of definitely recognizable points shall be plotted correctly with reference to the nearest control point within six tenths (0.6) of a millimeter.

3.1.3 Where applicable, spot elevations and or finish floor elevations of structures or facilities shall be provided. Specifically, show all break points or control points in grades of terrain such as tops of hills, top and bottom of curbs, bottoms of ditches and gullies, high bank elevations, etc. Ground elevations shall be read to the closest three (3) centimeters. Road elevations shall be read to the closest three (3) millimeters.

3.1.4 All surface and known sub-surface features, buildings, structures, etc. within the area to be surveyed shall be shown, spot elevations provided and identified on the topographic maps. In addition, these features shall be located by sufficient distance ties and labeled on the topographic sheets to permit accurate scaling and identification.

3.1.5 Manholes and sanitary lines within the survey boundaries shall be located and invert elevations obtained. Water, sanitary, electrical and mechanical utilities within the survey site shall be located and shown on the survey map. Invert elevations will be on the bottom lip of each pipe in the manhole to include the depth of the manhole must be taken also. Water, sanitary, electrical and mechanical utilities within the survey site shall be located and shown on the survey map and provided digitally in the database.

ATTACHMENT 2

DIGITAL FORMAT
SURVEY/MAPPING

1. General Design File Requirements:

a. The topographic data for the entire project, shall be compliant according to the COE Tri-Services Spatial Data for Infrastructure and the Environment Version 2.4 (SDSFIE), and placed into a single AutoCAD Map 3D Version 2005 and ESRI ArcGIS 9.1 personal geodatabase or ESRI ArcGIS 9.1 shapefile format and ASCII text format.

b. Only the topographic feature data (spot elevations and contours) are required to be placed into 3D AutoCAD Map drawing file at their proper elevation. Surface and subsurface features shall be placed in the 3-D file(s) at elevation zero (0). All of the control points established at the site shall be plotted at the correct coordinate point and shall be identified by name or number, and adjusted elevations.

c. A Digital Terrain Model shall be furnished compatible with Trimble Terramodel 10.4.0 and ArcGIS ArcINFO Triangulated Interpolated Network (TIN) file. (AF standard is Trimble, AutoCAD and ESRI GIS). A sufficient number of field acquired data points and breaklines are required to generate the contours of the mapping area through the .DTM file.

d. All information should be included in the AutoCAD Map drawing file and included in the ArcGIS ArcINFO 9.1 geodatabase or shapefile.

e. Each 3-D file shall be checked by viewing a front or side view to detect errors in element elevation.

f. The ASCII text file shall be conveyed including all data points shown in the preceding items of this attachment and the horizontal and vertical control points captured during level loops and closed traverses associated with them.