CHAPTER 2
DATA ACQUISITION

2-1. Data required.

The information required for a given site varies considerably according to the size and importance of the proposed installation, its geographical location, and whether the facilities to be provided are in an unmapped area or are merely extensions of existing facilities. Important considerations are discussed in the following paragraphs.

a. Climate. Data should be obtained on temperature, precipitation, humidity, wind direction and velocity, and on the frequency and magnitude of severe storms. Temperature information should be obtained so that freezing and thawing indexes can be computed, so that depths of freeze and thaw can be estimated and the possibilities of degradation or aggradation of permafrost can be determined (see TM 5-852-6/AFR 88-19, Vol.6).

b. Topography. Accurate topographic information is always necessary, including data on surface features and vegetative cover. Information necessary for planning drainage, roads, and camp layouts must be obtained. In investigations for potential airbases, topographic information must be obtained for the determination of flight hazards, for locating runways in positions involving a minimum amount of earthwork, for future snow removal operations, and for providing good flight approach angles. For structures adjacent to bodies of water, information on shorelines, harbor lines, high-water marks, and wave action is important.

c. Access. The availability of existing commercial and military ground, water, and air routes for the transportation of personnel and materials, and the location of way stations and terminals, as well as prospective sites for such facilities, must be determined. Information on existing or abandoned access roads should be obtained. Controlling navigable depths of rivers, lakes, and harbors should be determined where water transportation is contemplated. Data on the beginning and end of shipping seasons should be obtained where shipment of materials, equipment, and supplies by oceangoing vessels may be scheduled. Availability of smooth water for the landing of float planes should be determined. Data required for the selection of vehicles to be used for overland transportation during winter and summer should be evaluated.

d. Hydrology. Where a structure is to be located near a river, information on stream-flow variations throughout the year and on levels and frequency of flooding are of substantial importance for proper selection of the site. Information on ice-forming characteristics of the stream and on locations of previous ice jams should be obtained. In any structure or installation, drainage is an important consideration. The usefulness of existing drainage courses for the removal of excess storm water and wastes should be defined. Where applicable, the position of the water table and patterns of subsurface flow should be determined (see TM 5-852-7/AFR 88-19, Vol.7).

e. Geology. Accurate surface and subsurface information is of great importance, and in many instances may be the determining factor in the selection of a site. Well-drained gravels and sands are frequently found in coastal plains, river terraces, glacial deposits, and outwash plains. Such soils are generally ideal for almost any type of construction in arctic and subarctic regions since they are generally free of ground ice, and thus thawing is not a major problem. Any type of construction is arctic and subarctic regions will be potentially troublesome if located on frost-susceptible soils, such as clays and silts, unless ground-water conditions are exceptionally favorable. Where such foundation materials must be built upon, it is usually necessary to employ special precautions to maintain structural stability. These precautions are discussed in TM 5-852-4/AFR 88-19, Vol. 4, TM 5-852-5/AFR 88-19, Vol.5, and TM 5-852-6/AFR 88-19, Vol.6. Soils information must be obtained to a degree commensurate with the importance and size of the proposed structures. The usual tests, such as mechanical analysis, density, moisture content, and Atterberg limits for various horizons are minimum requirements, and additional tests such as permeability, consolidation, shear, and compaction tests are frequently desirable. Knowledge of the extent and nature of the permafrost where ice segregation occurs is vital. The depth and thickness of the permafrost layer, the depth of the annual frost zone, and the nature of the soils present in the permafrost and in the active layer must be determined. Information as to whether the permafrost in the active layer contains massive ground ice and whether it is homogeneously or heterogeneously frozen must also be obtained. Seismic design of buildings will be determined in accordance with TM 5-809-10/NAVFAC P-355/AFM 88-3, Chap 13.

f. Water supply and sanitation. Information

should be obtained on the feasibility of developing a water supply for the needs of the installation. Pumping tests and water analyses should be made for potential wells. In some instances a dam site may have to be selected for impounding water. In addition to determining sources of potable water supplies and possible means of waste disposal, location conditions and regulations should be examined to avoid conflict. If water supply is to be developed from surface water, possible pollution sources should be examined. It may prove necessary in the Arctic to develop water supplies from two different sources, one for summer and one for winter. For example, where ground-water supplies cannot be developed and surface sources freeze in the winter, the surface source may be used during the summer, while melted snow or ice or storage tanks may have to be the source of supply in winter. The ability of a stream or a body of water to dilute sewage should be investigated to determine the degree of waste treatment that may have to be provided (see TM 5-852-5/AFR 88-19, Vol. 5).

g. Construction materials. Knowledge of the location of suitable sources of rock or rock deposits, gravel and sand for aggregates, and of stands of usable timber is normally essential. The nearest points at which non-native materials and supplies can be obtained should also be determined.

2-2. Data sources.

In the selection of a suitable site for military installations, information is usually available for the identification of general areas that may be suitable as potential sites (maps, aerial imagery). To identify the specific site within a general area, more detailed information is required, which may or may not be available.

a. Reports and records. Reports published by various government agencies, engineering firms, and researchers, etc., that give information on the characteristics of the terrain and on the climate, hydrology, and geology should be thoroughly examined. If no records of streamflow exist, quantities of flow will have to be estimated on the basis of climatic conditions and basin characteristics. In the absence of recorded climatic data, approximations will be prepared based on the best evidence.

b. Maps. The availability of adequate maps is essential to the selection of the site for any structure. In the more populated areas a wide variety of maps can be found. Among these are U.S. Geological Survey quadrangle sheets, which are prepared at convenient scales and contour intervals; U.S. Geological Survey base maps, which show the general features of regions; geological maps prepared by the Geological Survey and by local government agencies; agricultural soil survey maps; controlled airphoto mosaics; military maps of various types; and Federal Aviation Agency aeronautical charts. In unmapped areas, site selection is more difficult because of the additional reconnaissance and surveys required.

c. Aerial imagery. Airphotos and satellite imagery can be used to locate boundaries of soils having different characteristics and the extent of frozen and unfrozen soils, and to predict the engineering characteristics of soils in a given area. Airphotos can also be used to eliminate selection of totally undesirable areas and to suggest possible usable sites. Because of the constant advances in the techniques of acquiring and analyzing aerial imagery and the increased availability of this imagery, a significant amount of work in the site selection procedure can now be accomplished by using these types of data. Therefore, in this manual considerable emphasis has been placed on the acquisition and use of aerial imagery in the site selection process.

d. Aerial reconnaissance. Reconnaissance flights are especially valuable in initial regional studies to obtain data on such factors as flooding and icing conditions, presence of flight hazards, possible temporary construction camp locations, possible access route locations, suitability of lakes and clearings for landing small aircraft, and military considerations, such as logistics and defense. Large areas can be covered in a relatively short time and the least desirable sites eliminated.

e. Ground reconnaissance. The purpose of ground reconnaissance is to check all information previously collected, to obtain data that are not otherwise available, and to select the best site if more than one potential site is available.

f. Subsurface explorations. The primary objectives of foundation explorations in arctic and subarctic regions are to obtain data on, first, the boundaries of frozen and thawed zones within the depth influenced by construction activities, second, the amount and mode of occurrence of ice in frozen soil, and, third, the composition and properties of the soil itself. The type of explorations is dictated to a large extent by the relative inaccessibility of many northern areas and climatic limitations. In addition, special techniques are frequently required for explorations in frozen ground because the strength of frozen soils decreases rapidly with an increase in temperature toward the 32°F isotherm.