DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, D.C. 20314-100

EC 1110-1-107

Circular
No. 1110-1-107

29 May 2015

EXPIRES 29 MAY 2017

Engineering and Design

BEACH SURVEYING METHODOLOGY

1. Purpose. This circular provides guidance on methods for beach surveying. Beach surveying includes collecting measurements of the dune systems, dry sand beach, surf zone and nearshore. Beach surveying is a fundamental requirement for managing beaches throughout the United States. Beach surveys are utilized to document compliance with state/federal regulations, determine shoreline erosion/accretion rates, assess performance of beach nourishment projects and to calculate volumes for payment associated with beach nourishment projects.

2. Applicability. This circular applies to all USACE elements of planning and executing beach surveying. It applies to all USACE contract activities related to beach surveys. This circular supersedes references 4.c. and 4.d.

3. Distribution Statement. Approved for public release; distribution is unlimited.

4. References.

a. Engineer Manual (EM) 1110-2-1003; Hydrographic Survey Manual.

b. Engineer Manual (EM) 385-1-1; Safety Manual.

c. Memorandum, USACE CECW-CE, 19 March 2012, Subject "No Swimming to Conduct Surveys."

d. Memorandum, USACE CECW-CO, 28 Dec 2011, Subject "Swimming by Contract Personnel While Conducting Surf Zone Surveys"

5. Overview. This document provides guidance for performing beach surveys. Effective management of beach and nearshore resources requires survey data for the entire active beach system to accurately quantify changes in morphology, shoreline change rates, and volumetric change associated with changes in natural coastal systems and engineering projects. The data are utilized to document and monitor the performance of beach and nearshore environments and assess the resiliency of coastal beachfront communities.

6. Background.

a. Beach survey data are routinely collected utilizing a transect-based approach that originates landward of the primary dune and extends beyond the surf zone. Survey data collected for monitoring and regulatory purposes routinely extend offshore to distances of 3,000 feet or depths of 30 feet. For monitoring and regulatory surveys, regulatory agencies routinely require that topographic and hydrographic survey data be collected within a defined time window to minimize potential morphological and volumetric inaccuracies associated changes in the active beach system due to time gaps in data acquisition. Acceptable gaps in time between collection of topographic and hydrographic data is generally on the order of 14 days.

b. Survey data collected for payment purposes (volume calculations) associated with beach nourishment projects are generally more limited in spatial extent. Offshore survey data acquisition is limited to the seaward extent of the project template or slightly beyond to ensure all material placed by the beach nourishment project is surveyed and can be quantified. Material placed on the beach and nearshore associated with a beach nourishment project is initially quite dynamic as ocean waves and currents act on the beach fill material and transport some of the fill seaward to re-establish the natural, equilibrium beach profile shape. As a result, timeliness of survey data acquisition is critical to ensure volumetric calculations of placed material are accurate.

c. Physical limitations and safety concerns with collecting topographic data on the dry portion of the beach are relatively minimal. Topographic data can be collected as long as it is safe to work in the outdoor environment. Physical limitations and safety considerations with collecting hydrographic data in the surf zone and nearshore are numerous. Limitations include but are not limited to: currents, storms, waves, wind, fixed infrastructure (e.g., breakwaters, groins, piers), irregular bathymetry, pipelines, debris and obstructions, and swimmers. Additional variables to consider when planning a hydrographic survey in the surf zone include cavitation in the water column, limited daylight during construction season, and variable tidal cycles.

d. Regulatory agencies and the coastal engineering and beach surveying communities generally require overlap of topographic and hydrographic data for beach surveys (see Figure 1). The overlap serves two important purposes. First, overlap of the two portions creates a continuous survey data set that is important for engineering design and project condition and performance analyses. Second, the overlap serves as a quality assurance check between the topographic and hydrographic portions that isolates errors such as incorrect datum conversions, tide applications, and boat offsets.

e. The standard practice for collecting complete transects with overlapping data has been to utilize a person with a survey rod to wade or swim seaward along the shore-perpendicular transect into or beyond the surf zone and collect the remaining, seaward portion of the survey transect data with a boat equipped with a hydrographic surveying system. To maximize the opportunity to acquire overlapping surf zone data, topographic surveys are run as far in the water as possible during low tide and hydrographic data is collected at high tide. More recent approaches to collecting nearshore hydrographic data have utilized smaller boats and personal

watercrafts (PWCs) that can operate in the surf zone, minimizing the need for a swimmer (see EM 1110-2-1003 Chapter 18 for summary of standard beach surveying techniques).

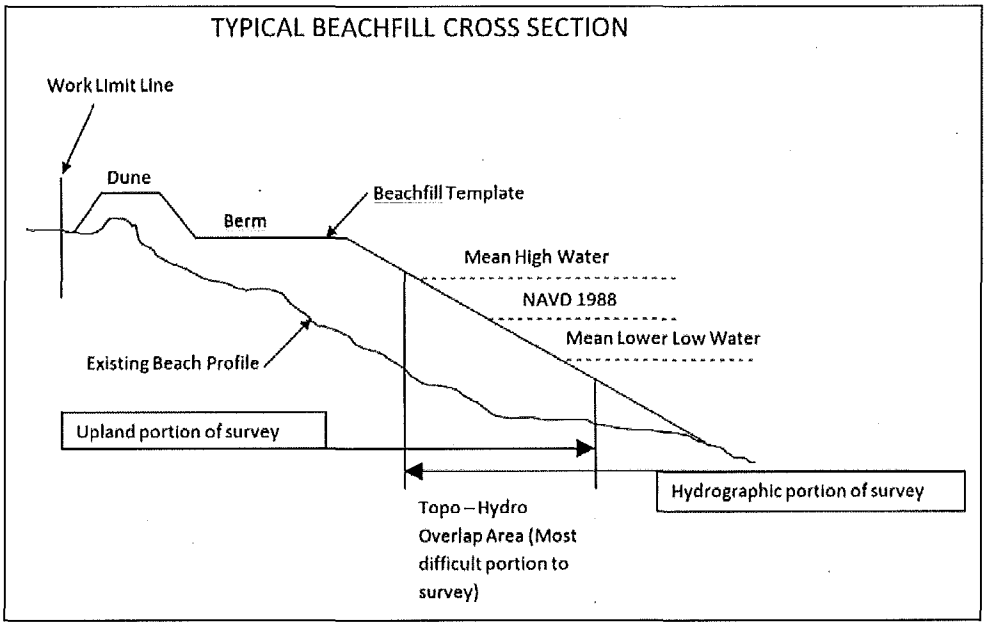

Figure 1. Example of beach profile illustrating extent of topographic (upland) and hydrographic survey reaches (EM 1110-2-1003, 30 Nov 13, Figure 11-2).

7. Collecting Surf Zone Data.

a. If sea conditions are calm deemed safe by the Site Safety Health Officer (SSHO) and other appropriate personnel, a survey boat may safely acquire data in the surf zone.

b. If conditions are not safe to operate a survey boat in the surf zone, extrapolation or interpolation techniques can be utilized to estimate beach morphology and calculate volumes seaward of the area of acquired topographic data. Considerations for applying extrapolation techniques should include information such as historical beach profile data, morphology of the native and engineered beach, and grain size. Interpolation techniques can be applied if hydrographic data was acquired offshore but overlap of topographic and hydrographic data was not achieved due to unsafe surf zone conditions. Considerations for applying interpolation techniques are similar to those of extrapolation techniques and are highly dependent on the location and size of the nearshore bars and troughs.

c. If conditions are not safe to operate a boat in the surf zone, another option to consider for beach nourishment construction projects is to initially place the material above a pre-defined elevation (e.g., mean sea level, mean high water) to minimize the need for surf zone surveys to determine volume for payment. Total volume can be

calculated via topographic survey only. Once volumes have been calculated, the material can be moved to conform to template specifications and resurveyed to ensure compliance out to wading depth. This technique can be utilized in areas where the beach is wide enough to accommodate a stockpile of material without impacts to environmentally sensitive areas on the upper beach and dune system or in the nearshore.

d. If a District's Chief of Survey determines that methods 6.a., 6.b., and 6.c. are not feasible and the sea conditions are not safe for a survey boat in the surf zone, the Chief of Survey can request permission from the District Safety Officer for surveys to be performed with a swimmer on a per project basis. If a Contractor is conducting the survey, the Contractor shall coordinate with the Contracting Officer Representative (COR) and District Safety officer to request permission to perform surveys with a swimmer on a per project basis. If swimming is to be used, the following swimmer protocol shall be adhered:

(1) No swimmer shall be in the surf zone beyond wading depth when wave heights are greater than 6 feet or deemed unsafe by the Site Safety Health Officer (SSHO) and surveying officials.

(2) Two certified lifeguards (certified by Red Cross or United States Lifesaving Association) with experience in coastal environments shall be present for all data acquisition by a swimmer. One lifeguard will swim to acquire survey data and the other lifeguard will serve as an observer. The survey swimmer will enter the water with a survey rod or light survey equipment and the other swimmer (observing lifeguard) will remain onshore, directing the survey swimmer and observing them at all times for signs of distress or danger. The standby swimmer will be equipped for immediate entry into the water and will have rescue equipment within 20 feet and ready for use. The standby swimmer will move parallel to shore and maintain visible contact with the survey swimmer to ensure the shortest distance to the survey swimmer at all times.

(3) Complete Hazard Assessment conducted daily by the SSHO for all surf zone activities.

(4) Written protocols and procedures strictly enforced.

8. Proponency. The HQUSACE proponent for this interim guidance is the Engineering and Construction Division, Directorate of Civil Works.

JAMES C. DALTON P.E., SES
Chief, Engineering and Construction
Directorate of Civil Works