Best Practices for Berthing Area Surveys

There is a variety of information that can be collected to determine the underwater characteristics of a berthing area. This information can be used to make financial decisions on how to operate a wharf with maximum efficiency given the funds available to the owner. All recommendations herein, are suggestions **for operators to use as they see fit**. These are **not** mandatory regulations, however, an understanding of the benefits and risks associated with the decision to follow or to not follow these recommendations should be understood.

Applications:

Dredging: When the decision has been made to dredge a berth, performing a survey before dredging begins and after each phase of a dredging project is complete is suggested. The more accurate the surveys are, the more accurately wharf operator can be invoiced for the project. Most large dredging companies have their own fleet of survey vessels and can provide these surveys for billing and constructed depth verification purposes if requested. Third party hydrographic surveyors can be contracted to conduct these surveys when the contractor cannot provide survey services or when additional impartiality is desired. Note that survey requirements may vary depending on where the dredged sediment will be disposed and the organizations or companies that manage the placement area selected for use.

Storm: It is suggested that a survey of all berths be collected before storm season begins. This survey, along with an after storm survey, will be helpful when reopening your berth and when seeking financial relief from federal and state organizations or private insurance companies.

After a storm passes, operators should be prepared to provide proof that their berths are clear of sediment and debris. The current severe weather related hydrographic survey suggestions from the USCG can be found in MSIB 05-17 section 7. Additionally, you can find the latest USCG marine safety information at the Sector Houston-Galveston website.

Operations: Only a wharf operator can decide on how to best manage their business. The closer the draft of the target vessel is to the operational depth of a berth, the more important it becomes to accurately know the current water depth at that berth. Over estimating the maximum draft a vessel can be loaded to, can have consequences legally and financially. Wharf operators must decide the level of risk they are willing to accept when deciding whether or not to survey and with what method the data will be collected. When the wharf operator has recent accurate information, the shallowest known depth in a berthing area can be reported with a high level of confidence when requested.

It is suggested that each operator maintain a regular survey schedule that is based on the historical shoaling rate they have experienced. It is also suggested that these be acoustic hydrographic surveys to be conducted by an experienced hydrographic surveyor. Operators may elect to conduct these hydrographic surveys without an experienced hydrographic surveyor or on their own with acoustic equipment or lower tech options. When a conditional survey is complete, the results should be shared and discussed with the local Pilots to notify them of the current berthing area conditions. It is

recommended that a reporting form similar to the attached example "Dock Clearance Statement" should be made available for wider distribution.

Under-keel Clearance:

When a wharf operator is planning for the arrival and loading or discharging of vessels, consideration should be given to determining an appropriate under-keel clearance (UKC). Determination and use of an appropriate UKC will help ensure that the **vessel remains afloat at all times**. Though the UKC during the entire journey must be taken into consideration by the Master of the vessel, the wharf operator has the most input in determining an appropriate UKC alongside their facility. Recommended safe UKC alongside a facility are generally considered to be1-ft / 0.3m for vessels less than a 108-ft / 33m breadth and 1.5% of the ship's beam for vessels greater than or equal to a 108-ft / 33m breath.

It may be necessary to factor in an additional safety margin to make an appropriate allowance for some or all of the following variables[1]:

- Suggested information to be collected from the local Pilots if relevant
    - Increase in draft due to heaving, pitching and rolling motions
    - Increase in draft due to change of water density
    - The predicted minimum tide during the arrival window
    - Sea state
    - Changes in the predicted tidal height, (A winter seasonal reduction of up to 2-ft / 0.6m may be applicable to water depth & draft values between December and April in the Houston-Galveston area)
- Suggested information to be collected from the wharf operator if available
    - Minimum charted depth available
    - The accuracy and age of the survey data
    - The nature and stability of the seabed found alongside the facility

Once an appropriate UKC has been determined, it can be included in the "Dock Clearance Statement" discussed above.

Methods:

This document is meant only to discuss the most commonly used methods for collecting hydrographic data. There are a variety of methods that can be employed for determining horizontal location and vertical depth, however, global positioning systems (GPS), using differential or real time kinematic (RTK)

[1] http://shipsbusiness.com/shallow-water-navigation.html

corrections, used with an electronic echosounder, singlebeam or multibeam, is the most common method for collecting hydrographic data. The next most common method of hydrographic surveying is to use a weighted line and a survey tape. For the purpose of this document, the discussion will be limited to these three methods:

- Multibeam echosounding with GPS
- Singlebeam echosounding with GPS
- Leadline and survey tape

Multibeam: Multibeam echosounders, like other sonar systems, transmit sound energy and analyze the return signal (echo) that has bounced off the seafloor or other objects. Multibeam sonars emit sound waves from directly beneath a ship's hull to produce fan-shaped coverage of the seafloor. These systems measure and record the time for the acoustic signal to travel from the transmitter (transducer) to the seafloor (or object) and back to the receiver. Multibeam sonars produce a "swath" of soundings (i.e., depths) to ensure full coverage of an area. The coverage area on the seafloor is dependent on the depth of the water, typically two to four times the water depth.[2]

Multibeam surveys are the most expensive survey method but offer the clearest picture of the conditions of a berthing area. These surveys can provide enough data density to be used to identify sunken vessels, lost equipment and debris. Though more expensive, the price of these surveys will continue to drop as the cost of setting up a multibeam survey boat decreases. This is the quickest collection method for large areas however more processing time is required than singlebeam surveying.

Singlebeam: With single beam echosounders, the sound is transmitted straight down in a focused beam, typically a 3-20° cone. This yields a single depth measurement from somewhere inside the cone. Taken in a continuous string, a single beam echosounder produces a seafloor profile.

One misconception about single beam echosounders is that they somehow record the average depth within the area of the cone on the seafloor. Actually, the first sound return for each "ping" is used as the depth. Therefore, the shallowest depth within the cone is recorded. In areas with a rough seafloor and/or large relief, this means that the "least depth" within the cone of transmitted sound is recorded, not the average depth.[3]

Singlebeam surveys are the most cost effective way to obtain an accurate survey of a berthing area. These surveys can be collected and processed quickly when the equipment is available.

Leadline: Leadline surveys have a long history in the maritime industry. This kind of manual survey has been replaced by echosounding for the most part, due to the improvements in data collection speed, accuracy and point density. Leadline surveys will generally require a boat, a surveyor's tape to measure range along a station, a weighted line marked in tenths of a foot to measure depth and an accurate tide gauge. Leadline surveys may be a good alternative in situations when there is no experienced professional surveyor available when needed, your budget is insufficient to hire an outside company or the area to be surveyed is small.

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[2] https://nauticalcharts.noaa.gov/learn/hydrographic-survey-equipment.html
[3] http://www.meted.ucar.edu/oceans/hydrography/print.htm#page_6.2.1

Debris Reconnaissance:

When objects are known or suspected to be lost off of a vessel or dock, terminal operators may be interested in conducting a reconnaissance survey to identify any obstructions that may pose a navigation hazard or to locate a lost item before developing a recovery plan. The method chosen will depend on the size and material makeup of the items to be located. For the purpose of this document, the discussion will be limited to these three methods:

- Side scan Sonar
- Magnetometer
- Multibeam echosounding

Side Scan Sonar: Side scan surveys are a quick and effective way to locate underwater items in a berthing area. This survey method is best for locating items made of any solid material that are located above the mudline.

Magnetometer: Magnetometer surveys are a quick and effective way to locate metallic items suspected to be in a berthing area. A magnetometer can locate items above or below the mudline.

Multibeam echosounding: As mentioned earlier in this document, multibeam surveying can accomplish both a quantity survey as well as be used to locate underwater items. A multibeam survey can only see items located above the mudline.

Further information:

This document is not intended to be a surveying instructional tool. If there are legal concerns about the survey accuracy at your facility, it is recommended that an experienced professional surveyor be hired. If you do intend on conducting a survey of your facilities, your staff should familiarize themselves with the basics of hydrographic survey data collection and record keeping. A good free reference is the US Army Corps of Engineers Hydrographic Surveying Manual:

EM 1110-2-1003 "Hydrographic Surveying"

Conducting your own survey with echosounding equipment is not recommended. Extensive training is required to properly set up and calibrate the required equipment and to collect and process the electronic data. The only method suggested for self-surveying is to use the leadline method. Information on how to do this can be found in Appendix B of the EM 1110-2-1003 (30 Nov. 2013).

EXAMPLE FORM *Use information appropriate to your specific location*

"Terminal X" Draft Information

Berth	Maximum Draft	Included UKC	Controlling Datum	Effective Date
1	x.xx-ft / x.xx-m	x.xx-ft / x.xx-m	MLLW	dd month yyyy
2	x.xx-ft / x.xx-m	x.xx-ft / x.xx-m	MLLW	dd month yyyy
3	x.xx-ft / x.xx-m	x.xx-ft / x.xx-m	MLLW	dd month yyyy

Notes:

1. Maximum acceptable draft figures are subject to ongoing evaluation and may be affected by seasonal variations and status of maintenance dredging or additional silting.
2. Vessels scheduled to arrive at, or load to, maximum drafts should review latest weather and tide conditions to insure adequate water levels are available for safe operations.
3. The information in this document will remain in effect until dd month yyyy or a newer one is published.
4. Helpful Information:
    a. Terminal Information: https://www.terminalx.xyz/docks
    b. Terminal Operations: +1 713-555-5555 or operations@terminalx.xyz