

## **9. Determine Instrumentation Needs**

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Instrumentation is extremely useful in optimizing a harbor design.

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- **Anemometer** **9.10**
- **Wave Gauges** **9.20**
- **Tide Gauges** **9.30**
- **Video Camera Monitoring** **9.40**

### 9.10 Anemometer

Accurate wind data can be critical to selection of harbor sites. You may overlook complex or multiple fetches if you haven't fully developed an analysis. The obvious fetch may not be the only critical fetch. Proper placement of instruments is important for reliable data collection. Wind data collected in offshore open-water areas may not apply to conditions inside a coastal inlet or fiord-like area or in mountainous inland locations.

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**Use ANEMOMETER data analysis when:**

- 1) Design waves are generated over short local fetches.
  - 2) The project is large and the cost of data collection is comparatively small.
  - 3) You deem data collection, rather than standard numerical evaluation, necessary to obtain a reasonable level of confidence.
  - 4) Existing instrumentation is not located near enough to the proposed site to be useful.
  - 5) The project is in mountainous terrain where local, rather than regional, conditions dictate design.
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**Note 1.** Normally, the analysis of recurrence intervals should not exceed two times the period of record. For example, use a 25-year wind record to estimate a 50-year recurrence event. You may use a minimum of a one-year period of data collection for analysis of long-term events, providing you can correlate the data with other longer-term records.

**Note 2.** Always be aware that wave calculations are based on the wind field that (one assumes) extends over the entire fetch, not just the wind at the project site.

**Note 3.** You must evaluate the cost of obtaining better information against the risk of uncertainty.

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**REFERENCES:**

1. Tobiasson, B.O. & Kollmeyer, R.C. 1991. *Marinas and Small Craft Harbors*. New York: Van Nostrand Reinhold. Pg. 96-97.
2. U.S. Army Corps of Engineers, Dept. of the Army. 1984. *Shore Protection Manual*. CERC. Vicksburg, Mississippi. Vol. 1, Chapter 3.

## 9.20 Wave Gauges

You must perform a detailed analysis of the wave climate to design or plan inner harbor wave disturbance and protective structures. You can conduct analysis of the design wave either numerically or in conjunction with data collected from wave gauges.

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**Use WAVE GAUGE data analysis if:**

- 1) Existing sources of numerical data are not adequate for design confidence.
- 2) The project complexity and cost warrant a wave gauge analysis.

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**Note 1.** Existing docks or piles near the proposed site are well suited for mounting staff or transponder type gauges.

**Note 2.** Wave Rider buoys and bottom-mounted pressure gauges are limited in accuracy for short period waves.

**Note 3.** Tide elevation may affect waves if they propagate over reefs or shallows before arriving at the point of interest.

**Note 4.** As numerical models become more sophisticated, the need for wave measurements will become less.

**Note 5.** It is generally necessary to correlate measured waves with long-term wind records to develop a design wave.

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**REFERENCES:**

1. You may use discretionary references for wave gauge analysis.

### 9.30 Tide Gauges

Accurate tidal data are necessary to establish proper design criteria. You may collect the data by using tide gauges.

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**Use TIDE GAUGE data when:**

- 1) Understanding extreme tides and their frequency.
- 2) Determining the need for dredging of the basin or entrance channel.
- 3) Evaluating tides in reference to mean lower low water, or other appropriate datum, for suitable placement of harbor basin.
- 4) No other tide data are available.
- 5) Long term records are necessary.

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**Note 1.** You may place a simple tide board on a fixed dock or pile to provide boat operators with depth information as they enter a harbor.

**Note 2.** The relationships between perigee-spring or seasonal tides and strong storms that develop together have a potentially hazardous impact on coastal structures. You should identify and monitor them carefully.

**Note 3.** One month of tidal data is normally sufficient to determine the harmonic constituents on which you can base long-term predictions.

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**REFERENCES:**

1. Tobiasson, B.O. & Kollmeyer, R.C. 1991. *Marinas and Small Craft Harbors*. New York: Van Nostrand Reinhold. Pg. 141-157 & 156.
2. Quinn, A.D. 1972. *Design and Construction of Ports and Marine Structures*. New York: McGraw-Hill. Pg. 129-131.

## 9.40 Video Camera Monitoring

The use of video cameras is becoming commonplace. Good video coverage can document crucial information concerning storm progression and wave forces for a proposed site.

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### Use VIDEO CAMERA documentation when:

- 1) A resident living near a proposed site is willing to photograph storm events. Often a video camera is available, but you may need to provide one to the local community. Provide simple, yet thorough, guidelines to the residents and make certain they understand the camera and your needs. However, allow them the flexibility to add additional information to the tape that they feel is useful or necessary.
  - 2) You can observe evidence of unusual wave, tide, or wind activity against a known dimensional reference such as a piling of known diameter or a tide gauge.
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- Note 1.** It is critical to provide good direction to the photographer. The key is to get sufficient **duration** of waves against a known scale.
- Note 2.** Have the observer hold the camera on a fixed target for a minimum of 30 waves; up to five minutes is better if there is a tripod available. A pile of known diameter is a good target, but a calibrated scale, such as a 2 X 8 board with alternating colors every foot, or a survey rod, works well.
- Note 3.** If documenting inner harbor wave disturbance or vessel motions, hold the camera on target for two to five minutes with a fixed object in view.
- Note 4.** The **date and time** are critical! A shot of a watch face or a written note with the date and time are easy means for recording this information. Record this information in writing also. If using the internal clock in the video camera, make certain it is accurate and switched on.
- Note 5.** You may tape waves at more than one site. Additionally, a slow panoramic of the area can be useful in design.
- Note 6.** The frequency of taping will vary with the project intent. Recordings may be limited to storm events, or taken daily. Daily recordings will provide information on littoral processes.
- Note 7.** If boat wakes are of concern, you can also record their size and impact using this method.
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### REFERENCES:

1. Alaska Department of Transportation, Coastal and Harbor Engineering Section.
2. U.S. Army Corps of Engineers, Littoral Environment Observation (LEO) programs.