

## **8. Analyze Meteorological Conditions**

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Meteorological events, such as seasonal rainfall, snowfall, temperature variations, and storms, may influence design parameters of a proposed harbor site. You should analyze these conditions for a complete assessment of structural loading.

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- **Wind** **8.10**
  
- **Air Temperature** **8.20**
  
- **Precipitation** **8.30**

## 8.10 Wind

You should use wind conditions (speed, direction, and duration) to predict the sea state that will affect a proposed harbor and berthed vessels. You may need to collect data or use sophisticated computer programs to analyze past meteorological conditions and predict future events.

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**You should consider WIND condition analysis:**

- 1) **Always.** You can use statistical analysis of wind data to derive long-term frequency of extreme sustained wind speeds in a direction. This information is critical to the design of the project.
- 2) If local wind conditions deviate from the nearest site of long-term data collection.
- 3) If wind loading on vessels, floats, or structures is critical.

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**Note 1.** You may need a program of local wind data.

**Note 2.** The **period of record** for the measured data is critical.

**Note 3.** You can use a wind rose to develop a wave rose. Analyze winds over all fetches of 1,000 feet or greater.

**Note 4.** Consider using trees as a natural windbreak. Trees may also provide a visual barrier to improve aesthetics.

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### REFERENCES:

1. ASCE Manual No. 50. Task Committee on Marinas 2000. 1982. *Planning and Design Guidelines for Small Craft Harbors*. New York. Pg. 87-94, 189-190.
2. Tobiasson, B.O. & Kollmeyer, R.C. 1991. *Marinas and Small Craft Harbors*. New York: Van Nostrand Reinhold. Pg. 89-102, 337-342.
3. National Climatic Data Center, NOAA, Arctic Environmental Information and Data Center, University of Alaska, et al. 1988. Climatic Atlas.

## **8.20 Air Temperature**

Consider temperature mainly for ice formation potential both in the water and on structural surfaces. Consider the added forces for vertical, horizontal, and static ice loads. Air stability may be significant for wave prediction when water temperature is different from air temperature.

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### **Consider AIR TEMPERATURE when:**

- 1) The effect of ice, by either fresh or salt water, will influence the structural loading on the pilings, floats, vessels, or any part of the system.
  - 2) Water level fluctuations in conjunction with ice formation can result in uplifting of piles or dead weight when water level drops.
  - 3) Ice thickness or ice floes may be a concern to structures.
  - 4) Air stability is a factor in the prediction of wave climate.
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**Note 1.** Temperature differences between the water and air in excess of about 10 degrees Fahrenheit may cause waves to increase beyond acceptable limits.

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### **REFERENCES:**

1. ASCE Manual No. 50. Task Committee on Marinas 2000. 1982. *Planning and Design Guidelines for Small Craft Harbors*. New York. Pg. 220-226.
2. Tobiasson, B.O. & Kollmeyer, R.C. 1991. *Marinas and Small Craft Harbors*. New York: Van Nostrand Reinhold. Pg. 124-129, 169-171.
3. U.S. Army Corps of Engineers, Dept. of the Army. 1984. *Shore Protection Manual*. CERC. Vicksburg, Mississippi. U.S. Government Printing Office. Chapter 3.

### **8.30 Precipitation**

Knowledge of the seasonal distribution of rainfall and snowfall is needed for drainage and snow load considerations. Seasonal increases in snow load can restrict, or increase the cost of, harbor operation.

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**You should consider PRECIPITATION if:**

- 1) Flow from streams, creeks, or rivers circulate in or near a harbor, causing added seasonal discharge of fresh water and surface ice, preventing harbor operations.
  - 2) You need to modify design parameters due to dramatic increases in snow loads .
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**Note 1.** If stream discharge increases seasonally, you must consider sedimentation.

**Note 2.** Fresh water inhibits marine growth but increases potential for surface ice in winter.

**Note 3.** You must consider freezing and binding of pile collars, floats, and in extreme conditions, added ice loads on piles.

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#### **REFERENCES:**

1. National Climatic Data Center 1988 (“Climatic Atlas”).