

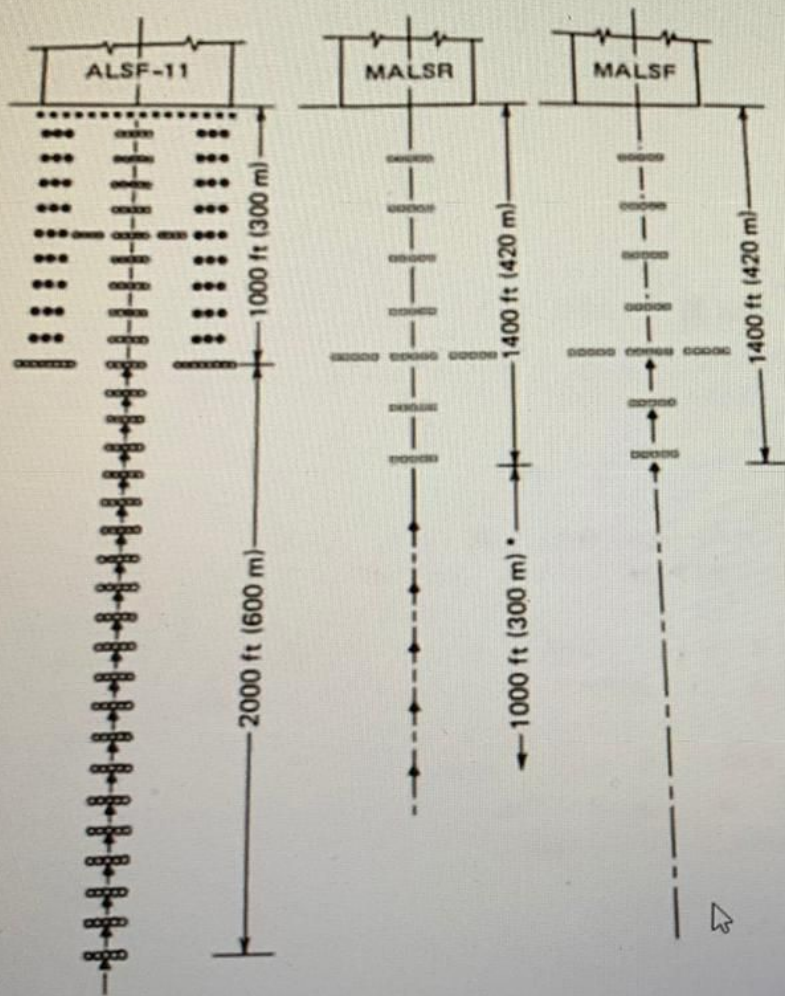
- 12 ->

200°
 $\frac{200^\circ}{10} = 20$
2L 2R
 LCR (24) 6
 20
 20

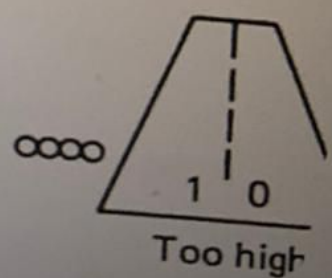
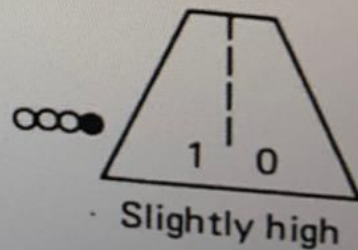
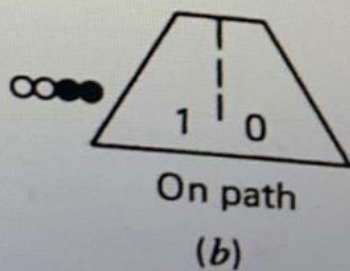
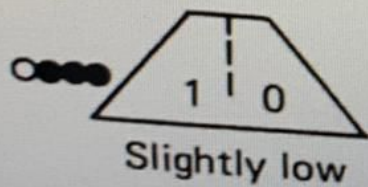
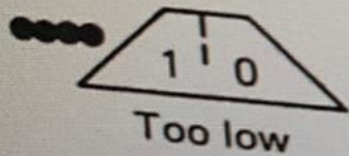
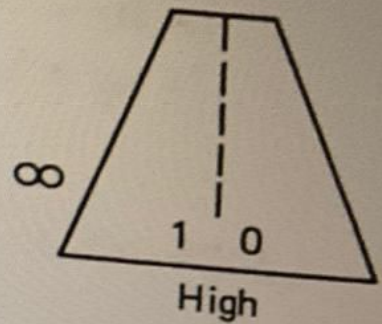
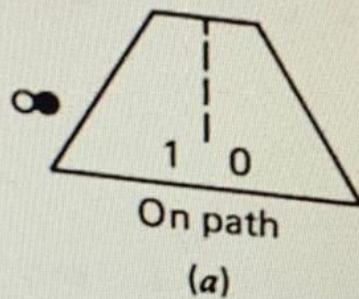
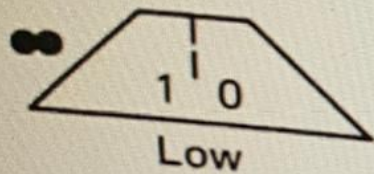
Figure 18-16 Runway and taxiway marking. (Source: Reference 9.)

Airport Lighting:

- Obstruction light: red, flashing, seldom rotating
- Airport beacon: rotate at 6 rpm with two beams 180 degree apart green & clear
- Approach lighting (provide distance, height, and alignment): see fig 18.17 & 18.18, pp. 874 – 875
- Runway lighting: edge (centerline only on some major airports) are white, except for last 600 m are yellow (caution of nearing end of runway for landing only), threshold light is green across the runway width (for landing), in addition centerline lights (in major airports) are white except last 900 meter they alternate red and white lights (bidirectional).
- Taxiway lighting: Omni-direction blue lights located on both sides (or centerline)



- High-intensity steady burning white lights.
- ◻ Medium-intensity steady burning white lights.
- Steady burning red lights.
- ▲ Sequenced flashing lights.
- ALS threshold light bar.

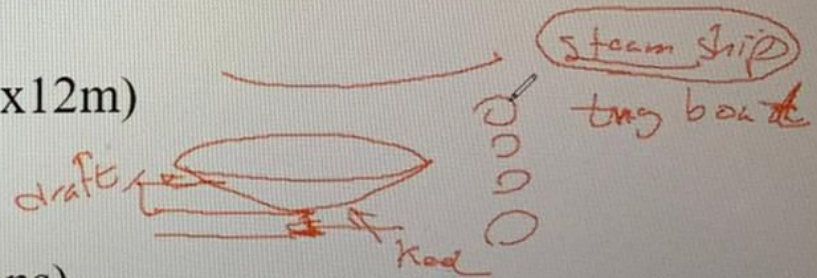


- White light
- Red light

Figure 18-18 PAPI signal display. (a) Two-light
FAA Advisory Cir

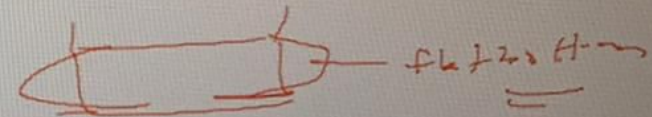
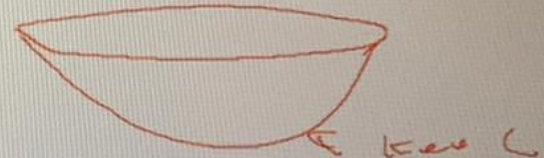
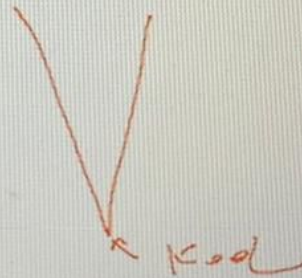
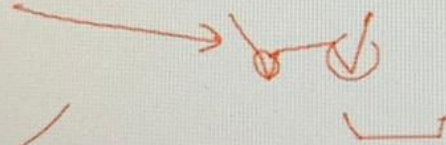
General remarks:

- The only mode of passenger transport for cross seas and oceans until 1920's (1927 1st solo flight across the Atlantic) and the most important until mid 20th century
- The most important mode for freight transport across oceans and sea to date and one of the most important inland freight transport to date for industrial nations especially Europe.
- Water transport is mostly bulk and heavy commodities such as petroleum, coal, iron and ores, grain, sand and gravel, chemicals, sugar and other food products
- Container ships are the dominant method of transport of most commodities via water transportation.
 - standard dimensions (8'x 8'x 40' or 2.4x2.4x12m)
- Water transport mostly suitable for
 - bulk, heavy, and inexpensive materials
 - over long distances (especially cross oceans)
 - where time of transport is not critical



Type of ships

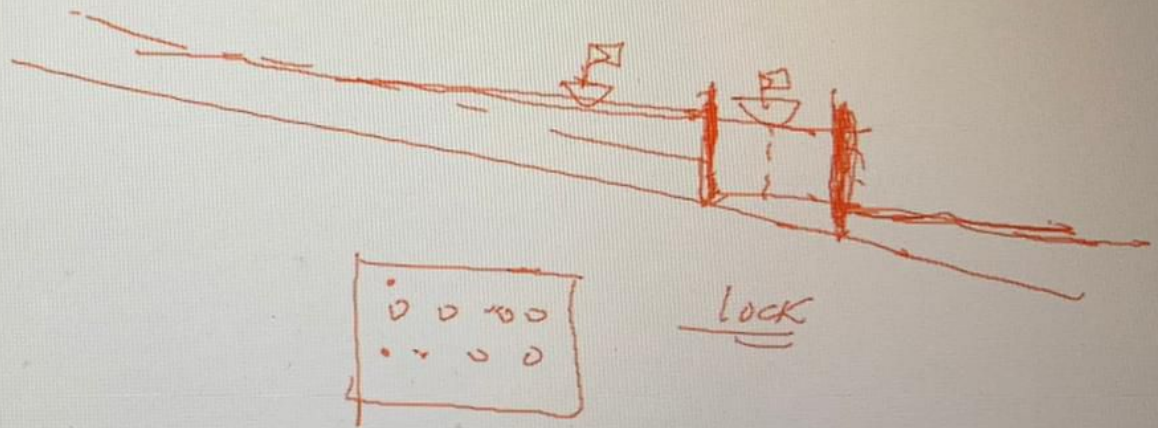
- Tree logs, rafts in rivers propelled by current, slaves, oars, sails
- Steamboat invented in 1807
- Barges (for inland waterways) pushed or pulled by tugboats
- Tugboats are used in ports for smooth and slow movement of ships
- Regular ships (keel ships)
- Catamaran
- Ferries
- Submarine
- Hydrofoils and cushion boats
- Speed boats and jet-skis and other sport boats
- Yachts



Type of water transport:

- Coast and sea shipping
- Inland waterways: rivers, canals, lakes

Locks:



The Coastal Environment

- Wind: caused by change of temperature which corresponds to changes in air densities and thus change in atmospheric pressure

$$F = C_D A \frac{\rho v^2}{2} \quad N \quad (19-1)$$

where

C_D = aerodynamic drag coefficient

A = frontal cross-sectional area, m^2

ρ = air density, kg/m^3 , typically about $1.3 kg/m^3$

v = wind velocity, m/sec

- **Waves:** Mostly formed by wind (also may be formed by earthquakes (tsunami), tides, man-made disturbances. There are two type of waves:
- Deepwater waves (trochoidal movement). Water rotate in circular vertical motion but such movement moves in a certain direction.
 - Shallow water waves or translation waves (influenced by the friction of the seabed).

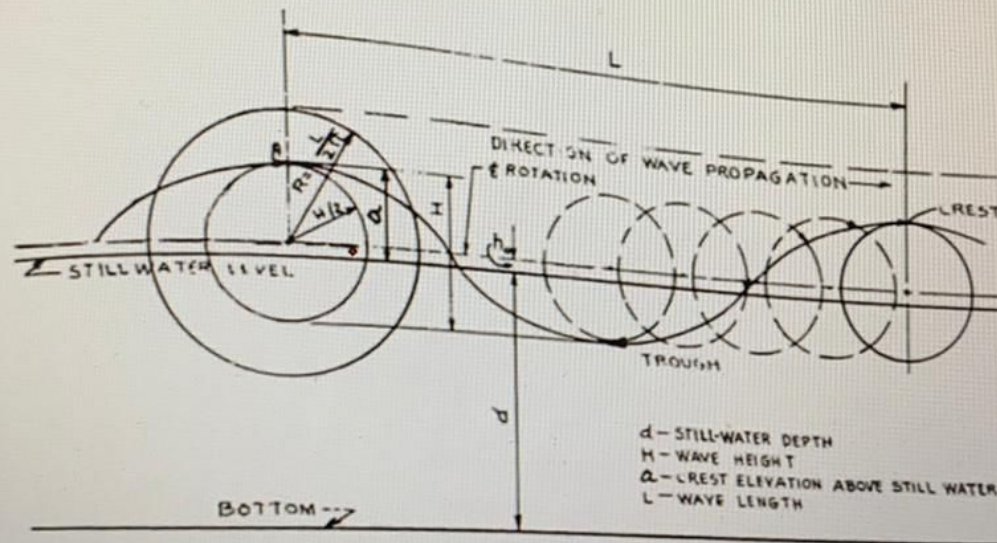


Figure 19-2 Deep-water wave characteristics. (Source: Alonzo Quinn, *Design and Construction of Ports and Marine Structures*, Second Edition, McGraw-Hill, 1972. By permission of the publisher.)

$$v = \sqrt{2g \frac{1}{2} \frac{L}{2\pi}} = \sqrt{\frac{gL}{2\pi}}$$

$$v = \sqrt{gd}$$

$$d < \frac{1}{25} L$$

$$v =$$

$$\frac{L}{T}$$

length of
wave
long λ

wave
period

$$v = \sqrt{\frac{gL}{2\pi} \tanh \frac{2\pi d}{L}}$$