Comparison Of Anchoring Requirements
Of The Traditional Navy And Of Offshore Operations

Aspect considered	Traditional Vessel	Offshore Operations
Forces in lines	Modest: (a) A few t to a few dozen t, (b) Exceptionally greater than 100t (supertankers)	Very high: often greater than 100 t, about 400 to 500 t for production structures.
Positioning tolerances	Mooring on a site: ship free in the swinging zone (only one anchor line) or more rarely riding with two anchors (on two lines).	Accurate Positioning: support movement strictly limited owing to seabed/surface connections (drill string, riser etc.): immobilization on 4, 6, up to 12 lines.
Safety concept	Mooring on a site in calm weather: anchoring resumed in case of drag. Storm: (a) Shelter in a port. (b) Use of the anchor as an emergency brake in case of damage and accidental drift. (notion of continuous dragging force: in these conditions, an anchor with excessively high holding power could cause breakage of the lines by dynamic overtension)	The anchoring system plays a dual role: (a) To limit the movements of the support in service conditions in order to guarantee the service life of seabed/surface connections: drag not permissible. (b) To keep the structure on the site in survival conditions (links disconnected).
Water depth	Mooring in shallow waters: limited chain length.	Anchoring in water depths of several hundred meters. Use of lines employing cables, chains, combinations (cable + chain).
Seabed data	Possibly nil.	Anchoring operation generally preceded by geophysical / geotechnical survey of the seabed.
Handling problems	Deploy and retrieval of anchors by the ship itself: must be easy to perform.	Anchors are deployed and retrieval by specialized auxiliary vessels: the available traction capacities are considerable.

Anchor

Marine Anchor	Anchor for Offshore Operations
Guaranteed minimum holding power whatever the soil encountered. High mechanical strength (continuous dragging forces). Easy handling and raising	Very high holding power in a given soil. Perfectly rigid positioning of the structures (no drag). Guaranteed long service life.

Minimum Length of an Anchoring Line

The holding power of an anchor may only be assured if the force applied by the line to the shank is horizontal. Accurate knowledge of the relationship between the force in the line and its geometry is therefore necessary.

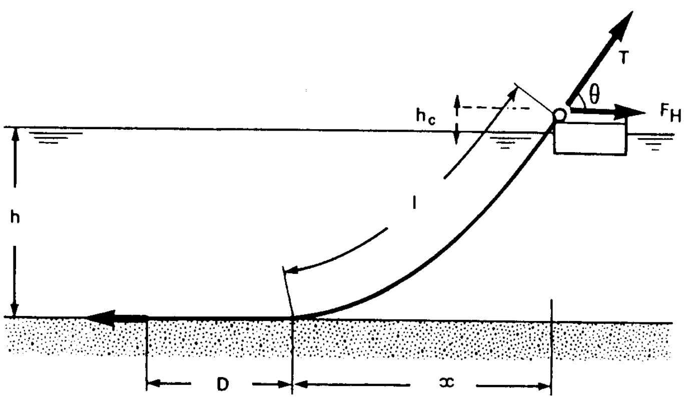
Calculating the Minimum Length of an Anchoring Line

The minimum length of an anchoring line may be obtained from a formula related to the properties of the catenary:

$$\frac{l}{h}=\sqrt{\frac{2F_H}{ph}+1} \quad \text{or} \quad \frac{l}{h}=\sqrt{\frac{2F}{ph}-1}$$

where

- l = minimum length of anchoring line,
- h = $h_m + h_c$,
- h_m = water depth,
- h_c = height of fairlead above water level,
- p = weight of submerged line per unit length,
- F_H = horizontal force in the line at the fairlead,
- T = tension in line at the fairlead,
- q = angle made by the line with the horizontal at the fairlead level,
- D = safety length resting on the seabed.



Length of anchor lines.

Units. These formulas must be used with consistent units: that is, the same units of length and weight for all lengths and forces in the formula.

For each lay barge, it is necessary to calibrate the corresponding curves as a function of the actual weight of the line and the water depth of the site. These curves must be available in the control room, or rapidly calculable by computers.