高等学校水利类专业教学指导委员会等 共同组织编审

全国水利行业规划教材

Professional English for Harbor , Waterway and Coastal Engineering

# 港口航道与海岸工程专业英语

【港口航道与海岸工程专业】

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## 内 容 提 要

本书主要分为港口工程、航道工程、海岸工程、合同管理4个主要单元，每个单元包含3～5篇课文，每篇课文另外配有一篇相关的课后阅读材料，包括三峡工程、南水北调工程等世界瞩目的大型工程的介绍。在每个单元最后还设计了相关的课堂讨论话题，以助于同学们的口语练习。本书覆盖了港口、航道、海岸工程和工程商务等方面的内容，每一章节的内容简单易懂，并配有相应的图片和照片说明。特别是，每一章节都有对该章节的一些专业词汇和句子作了专门的解释说明，供教师指导学生阅读和学习。

本书是为高等院校港口航道与海岸工程专业、海洋资源开发技术专业的本科生和研究生编写的专业英语教材，对高等院校相关专业研究生的专业英语阅读能力有较大帮助。本书也可作为从事港口航道与海岸工程的专业人员了解专业知识、提高英语水平的辅助阅读材料。

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# 序

随着全球经济发展和国家战略深化，近年来港口航道与海岸工程领域的重点逐渐向内河水运开发、远岸岛礁建设、绿色低碳建养、修复加固技术等方向发展，并积极拓展近海可再生能源利用工程方向，这对港口航道与海岸工程专业的学生培养也提出了新的要求。同时，在教育部高教司和中国工程教育认证协会的领导与组织下，从2012年到2015年，教育部高等学校水利类专业教学指导委员会港口航道与海岸工程专业建设指导组先后对港口航道与海岸工程专业的核心知识领域、专业认证补充标准、教学质量国家标准等进行了修订。

为了便于在新形势下各相关高校组织教学，教育部高等学校水利类专业教学指导委员会组织编写出版港口航道与海岸工程专业“全国水利行业规划教材”。为了保证教材质量，我们通过多次专业建设指导组会议讨论，专家咨询组审议、遴选，相关院、系认定等步骤，对教材的选题及其主编、主审和教材编写大纲进行了严格把关。为了把本套教材组织好、编著好、出版好、使用好，我们还成立了教材编审委员会，对教材编纂与使用的全过程进行组织、把关和监督。

许多人为本套教材建设做出了许多努力，付出了许多心血。由于参照新的教学质量国家标准组织教学还需要通过实践，不断总结提高，加之一些教材是第一次编写，因此这套教材一定会有各种不足与缺点，恳请使用这套教材的师生提出宝贵意见。本套教材还将出版配套的多媒体教材，以利于教、便于学，更希望师生们对此提出建议和积极参与。

**教育部高等学校水利类专业教学指导委员会**

**港口航道与海岸工程专业建设指导组**

**2015年9月**

# 前　言

专业英语不仅是大学英语教学的重要组成部分，也是专业课教学不可或缺的内容。专业英语是促进学生完成从基础英语、到使用英语学习专业知识、再到应用英语进行专业交流的有效途径，尤其对专业基础课程和专业课程的双语教学至关重要。专业英语的学习可以培养学生用英语交流专业知识的能力，以应对日趋国际化的学术交流和经济社会发展。

本书精选了港口航道与海岸工程领域目前较为关心的研究内容和我国的重大工程介绍，内容具有系统性、知识性和实用性。本书既可用作高等院校本科生、研究生教材，也可供相关专业的教师、研究人员和工程技术人员参考。

本书总体由河海大学季小梅负责选材和框架的设计，编写了课文及其翻译、注解，并设计了各单元的讨论话题；河海大学陈伟参与了部分课文的翻译工作和讨论话题的编写工作；加拿大 Dalhousie 大学申锦瑜对英文和翻译文字进行了润色提高。全书由季小梅负责统稿和校对。

主审人河海大学郑金海教授，英国 Aberdeen 大学郭亚昆教授对教材提出了宝贵意见和建议，河海大学徐福敏教授也提供了支持。另外河海大学研究生曹向明、王宗旭参加了书稿的整理工作，在此一并表示衷心感谢！限于编者的学识，书中难免会有疏漏和不足之处，敬请广大读者不吝赐教。

编　者

**2019 年 5 月**

# Contents

# Unit 1 Harbor Engineering

A harbor is a bay, cove, inlet, or recess of the sea or a lake, or the mouth of a river in which ships can enter and be sheltered from wind and waves. A port is a harbor with facilities for the docking of ships, cargo handling and storage, and transfer of passengers between land and water-borne transportation. Harbor engineering is concerned with the design of navigable waterways in harbors, protective structures, docks, and the facilities for servicing boats or ships.

# Lecture 1　Some Basic Definitions of Waves

To conveniently describe the wave phenomena in the ocean, we introduce several basic concepts with brief definitions (Figure 1-1).

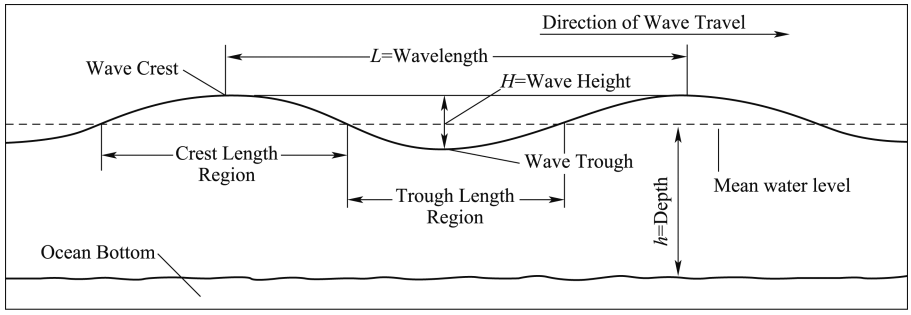


Figure 1-1　Basic definitions of wave

A periodic surface gravity wave propagating[1] over a flat ocean bottom can be characterized by the wave height $H$, the wave length $L$, and the mean water depth $h$ that is the distance from the bottom to the mean water level (MWL). The MWL is defined as the sea level with the total area between the wave crest[2] and the MWL equals the total area between the wave trough and the MWL. The crest height is the distance from MWL to the top of the wave crest, which is also called the wave amplitude above the MWL. Similarly, the trough depth is the wave amplitude below the MWL. For small-amplitude waves (linear theory) these amplitudes[3] are equal, and the wave amplitude is given as $a = H/2$.

The wave steepness $S$ is defined as the ratio of the wave height to wave length, i. e. $S = H/L$. The time interval between the passage of two successive crests at a fixed station is denoted as the wave period $T$. At a fixed station if the phase (or phase angle[4]) is zero at the wave crest, the wave phase of the next crest increases by 360° after a wave period, and the phase angle of the trough between two crests is 180°.

If a wave motion in the horizontal dimension is considered, a wave front can be identified from a curve line with the constant phase angle. Less general but easier to visualize, a wave front is a curve line in the horizontal plane through adjacent crest points. The direction of the wave propagation is described by the vector which are normal to the wave fronts.

A progressive wave is a wave train with no (or almost no) reflection, i. e. it is 'unidirectional'. The wave front propagates with the phase velocity[4] in the direction normal to the wave fronts. For small-amplitude waves, the wave energy $E$ (potential plus kinetic) propagates with the group

velocity $C_g$ in the same direction. The mean energy flux[5] is given by the product of $E$ and $C_g$. In deep waters ($h/L > 1/2$) the group velocity is half the phase velocity, while in shallow waters ($h/L < 1/20$) these two velocities are almost equal. If ocean currents are present, the situation is more complicated than the cases discussed above.

A progressive wave transports both energy and momentum, but not necessarily mass. In deep waters the particles move in circles, while in shallow waters the ellipses are very much 'stretched' horizontally. The particle velocity is in the direction of wave propagation under the wave crest, oppositely under the wave trough. It is a maximum under the crest.

## New Words

1. **phenomenon** (复 phenomena) Thing or being, event or process, perceptible through senses; or a fact or occurrence thereof.
   n. 现象
2. **permanent** Lasting for an indefinitely long time.
   adj. 永久的
3. **distinction** A discrimination between things as different and distinct.
   n. 区别
4. **interval** A period of time.
   n. 间隔
5. **denote** To indicate; to mark.
   vt. 表示
6. **distinguish** To see someone or something as different from others.
   vt. 区别,识别
7. **unidirectional** Pertaining to only one direction.
   adj. 单向的
8. **propagate** To cause to spread to extend; to impel or continue forward in space.
   vt. 推进
9. **orthogonal** Of two objects, at right angles; perpendicular to each other.
   adj. 正交的,波向线
10. **trajectory** The path of a body as it travels through space.
    n. 常角轨道,轨迹线
11. **product** A quantity obtained by multiplication.
    n. 乘积
12. **literally** Word for word; not figuratively; not as an idiom or metaphor.
    adv. 确切地
13. **superficial** Of or pertaining to the surface.
    adj. 肤浅的,粗浅的

14. **orbit** A circular or elliptical path of one object around another object, particularly in astronomy and space travel.
    n. 轨迹
15. **viz.** ( = namely)
    adv. [拉]即
16. **semi-axis** A line segment, joining the centre of a figure to an edge, that forms half of an axis of symmetry.
    n. 半轴
17. **degenerate** Having lost good or desirable qualities.
    vt. 退化
18. **exception** The act of excepting or excluding; exclusion; restriction by taking out something which would otherwise be included, as in a class, statement, rule.
    n. 例外

## Phrases and Expressions

1. wave height 波高
2. mean water level 平均水深
3. wave crest 波峰
4. wave trough 波谷
5. wave amplitude 波幅
6. wave period 波周期
7. two dimension 二维,二向
8. wave front 波前
9. progressive wave 推进波
10. wave train 波列
11. potential energy 势能
12. particle path 迹线
13. stream line 流线
14. wave steepness 波陡

## Notes

1. propagating 为现在分词作定语,修饰 wave。

2. crest 为波顶,是波峰(peak)的最高点。trough 是波谷,与 hollow 同义,本不该解释为波底,波底应用 bottom 才妥。但由于许多书上均将 trough 作波底用,此处姑且随俗。

3. these amplitudes 指 positive and negative wave amplitude 故译为两振幅。

4. phase angle 为相角,phase velocity 为相速度。

5. energy flux 常译为能通量,按海洋工程中的习惯,译为波能流。

# Reading Material

## Wind-generated Wave and Significant Wave Height

Surface waves one sees every day in the ocean[1], and those primarily responsible for coastal erosion, are generated by winds blowing over the ocean surface. There are, of course, other ocean waves such as the tsunami that are not generated by winds. Although these non-wind-generated ocean waves can be extremely destructive, their occurrence is too rare for them to be a significant factor for coastal erosion and therefore will not be considered here.

Wind-generated waves are important as energy-transfer agents; first obtaining their energy from winds, transferring it in the open ocean, and then delivering it[2] to the coastal zone where it can be the primary cause for erosion or can generate a variety of nearshore currents and sand transport patterns[3]. The wave generation in the ocean is primarily dependent upon three storm factors: the speed of the wind, the duration of the storm, and the fetch area over which the storm occurs. The storm duration is important in that the longer the winds have been blowing, the greater the amount of energy can be transferred to the growing waves. The fetch area has a similar effect, once the waves travel out of the storm area they no longer acquire additional energy, so that the larger the fetch area, the more energy the waves can potentially obtain.

The simplest type of surface waves in the ocean can be described by the wave height, $H$, length, $L$, and period, $T$. Waves in the storm area, however, do not fit this simple type, and they are instead a complex pattern of wave crests and troughs, with no two waves seen to have the same wave height or period. If an individual wave crest is followed, it is often observed to progressively decrease in wave height and eventually disappear. This complex pattern of waves is due to the fact that a storm does not simply generate waves with the same wave heights and periods, but instead a whole range of spectrum of wave heights and periods is generated. When the wind first blows across the ocean water at the rest initially, only small ripples are formed with periods of less than 1 second and wave heights of only a couple of centimeters. As time passes, waves with longer and longer periods will be formed[4], but small ripples will continue to be present and waves with a range of periods will now exist. The longer-period waves have longer wave lengths, which allows waves to achieve greater heights without breaking for losing energy. Concomitant with the progressive increase in wave periods present in the area of generation is an increase in wave heights.

Characterizing the waves in the area of generation is obviously more difficult than in the case of a simple sinusoidal wave which could be defined by one height and period. Once a record is obtained of the water-surface elevations, observed by a variety of techniques including water pressure sensors, wave buoys, surface "glitter" and other remote sensing methods. Analyses of wave obser-

vations usually take one of two possible paths. A statistical analysis of wave heights can be performed, noting the maximum wave height in the record[5], the average height, or a root-mean-square wave height. A commonly used statistical wave height is the significant wave height, $H_s$, defined as the average of the highest one third of the wave heights. Its choice was based on the impression that in many applications the larger waves are more important than the small waves, and $H_s$ thereby provides a more representative wave measure than, for example, the average wave height. It has also been shown that $H_s$ roughly corresponds to a visual estimate of a representative wave height in that the observer naturally tends to weight his observation toward the larger waves. It has been demonstrated theoretically and by measurement that under fully developed storm waves these statistical wave heights form well-defined ratios.

For example, the ratio of $H_s$ to the average wave height is approximately 1.56, and its ratio to the root-mean-square wave height is 1.42. The maximum wave height observed in a wave record depends on the length of the record, so there is no fixed value for its ratio with the other wave statistics. One can also define a significant wave period or average wave period, but these have somewhat less physical reality than the corresponding wave heights, and as we can see, their use can lead to some error results.

## New Words and Expressions

1. tsunami 海啸
2. destructive 破坏性的
3. wind-generated wave 风成波
4. energy-transfer 能量传递
5. expanse 浩瀚,广阔
6. coast-zone 海岸带
7. duration 历时
8. fetch area 受风水域
9. acquire 获得
10. a range of 一系列的
11. spectrum 谱
12. ripple 细波,涟漪
13. concomitant with 与……相伴
14. sinusoidal 正弦的
15. a variety of 种种
16. water-pressure sensor 水压传感器
17. wave staff 测波杆
18. glitter 闪烁装置
19. remote sensing 遥感

20. root-mean-square 均方根

21. significant wave height 有效波高

22. spectral analysis 谱分析

23. impression 观念

## Notes

1. Surface waves one see every day in the ocean 中的 one see every day 为定语从句,连词 that 在从句中作宾语,故可省略。

2. Obtaining…, transferring it …, delivering it to the coast zone where it…三个分词短语均做状语用,句中的 it 均代表 energy。

3. 接上句 where it can be …or can…这里关系副词 where 引起的是定语从句,where 在从句中作状语。Or 连接两个 can,它们的主语均是 it(energy)。

4. Waves with longer and longer periods will be formed。其中介词短语 with longer and longer period 作定语,修饰 waves。

5. Noting the maximum wave height…为分词短语作状语。

# Lecture 2　Water Depth in Harbor

Water depth is one of the important technical characteristics in a port design, which should be sufficiently deep for safe maneuvering and mooring of ships inside it. Generally, the larger water depth under the keel of ships which call at the port, the more convenient and safer conditions would be provided for ship's navigation. But unduly large water depth would increase the port's construction and maintenance costs. Therefore, an appropriate water depth would be for safe navigation of ships and not too much to cause extra costs. That means a suitable depth clearance should be defined.

## 1. Components of Water Depth Clearance and Determinants

When designing water depth, two main conditions should be considered for depth clearance:

(1) The minimum under-keel clearance for ships not to go aground when sailing or berthing;
(2) Clearance required for reducing the maneuvering difficulties of ships.

For the former condition, the factors resulting in the grounding of ships may include: ①sounding error; ②additional draught increased by ship movement. While the latter should take two factors into account: one is depth clearance required for ship maneuvering, and the other is clearance needed to protect the cooling water opening for the main engine's condenser from being blocked up.

## 2. Sounding Error and Barriers under Water

Change of water level. There exists a difference between actual water level and measured water level, which may be resulted from tidal height measurement error or prediction error. The prediction error of water level is usually about 0.2 m, nevertheless, on the basis of the data of tidal observations from each port's tidal station, this kind of error could not be more than 0.01-0.02 m.

The chart measurement error. In accordance with the Code of Port Engineering Survey, it is defined that the chart tolerance error is 0.5 m when the water depth is within 10 m; 0.2 m with water depth under 20 m, and 1/50 of water depth with water depth more than 20 m.

Clearance caused by anchor cast by ship. When a ship under sail needs to stop in emergency, it always drops its anchors on both sides at the same time of running astern to help to come to a full stop. At this point, the casting anchors would act as barriers on the channel, and in this regard there should be under-keel clearance to avoid the anchors bumping into the ship's bottom. How much the anchor protrudes from the bottom depends on the anchor's type, weight, and size,

and characteristics of bed materials etc (e. g. the anchors for a 100,000 DWT ship is about 13 tons, which would protrude out 1.3 m from the sea bottom during the emergency of anchoring).

## New Words

1. **keel** A large beam along the underside of a ship's hull from bow to stern.
   n. 龙骨
2. **unduly** Undeservedly; in a way that is not warranted.
   adv. 过度地
3. **grounding** The collision of a ship with ground beneath the surface of the water.
   n. 搁浅
4. **draught** The distance from waterline to keel of a vessel.
   n. 吃水
5. **condenser** A device or unit used to condense vapor into liquid.
   n. 冷凝器
6. **tidal** Relating to tides.
   adj. 潮汐的
7. **observation** The active acquisition of information from a primary source.
   n. 观测
8. **anchor** A device, normally made of metal, used to connect a vessel to the bed of a body of water to prevent the craft from drifting due to wind or current.
   n. 锚
9. **cast** To throw.
   vt. 投掷
10. **emergency** A situation which poses an immediate risk and which requires urgent attention.
    n. 紧急情况
11. **astern** At, or any distance behind, the stern; further in that direction; backward.
    adv. 向后,向船尾
12. **protrude** To extend from, above or beyond a surface or boundary; to bulge outward; to stick out.
    vt. 突出

## Phrases and Expressions

1. depth clearance 富余深度
2. result in 导致
3. sounding error 探测误差
4. tidal station 验潮站
5. tolerance error 容许误差

# Reading Material

## Layout of Breakwater

Nowadays, breakwaters at great water depths of more than 20 m are no longer unusual in port constructions. The relatively high cost of breakwater construction greatly influences the site selection and the layout of a port. In some ports, therefore, whether the layout of breakwaters is reasonable or not is of crucial importance in the master plan of the port. Many factors affect the layout of breakwaters such as natural conditions like winds, waves, currents, sediments, topographic and geological conditions, operational requirements, construction investment etc. In this section, the principles of the breakwater layout are discussed.

### Principles for Breakwater Layout

The layout of breakwaters should adapt to the berthing line, and meet the requirement of preserving the tranquility of the harbor basin.

(1) Long period waves are risk to the operation of ship handling and mooring. The waves with periods more than 30s or 1 minute, even with small wave heights, could lead to great movements of mooring ships, sometimes even result in the rupture of the mooring rope. Therefore, the breakwater should be carefully designed to avoid the resonance of waters in the harbor with long period waves, and prevent the waves entering the harbor over the breakwater.

(2) There should be an adequate water area with sufficiently deep water depths protected by breakwaters for ship maneuvering, mooring and handling.

(3) Development of the maximum insurance coverage and the total number of ships with extremely large dimensions which the port could accommodate should be considered for the port future development.

(4) The water area surrounded by the breakwater should be carefully assessed. It is not always better to have a larger area to be protected by the breakwaters. It must be kept in mind that if a harbor is too large, it may permit the generation of local waves within the harbor, which will make berthing difficult.

In ports over silty coastal areas, it is easy for sediments which enter into the harbor mainly in suspension to deposit at calm water areas. Therefore, the larger the water area and capacity to accept the tide of a port are, the greater the volume of deposition would happen. From this point of view, the unused water area should be reduced as much as possible to decrease the tide and sediments entering into the port.

(5) A breakwater should be built on available advantageous grounds such as the submerged reef, shoal, bar, and shallow water areas to reduce the construction cost as much as possible.

## New Words and Expressions

1. master plan 规划总图
2. topography 地形
3. geology 地质
4. adapt to 适应
5. tranquility 平静
6. harbor basin 港池
7. rupture 断裂
8. margin paid 保证金支付
9. accommodate 容纳
10. silty 淤泥的
11. deposit 沉积,沉淀
12. submerge 淹没
13. shoal 浅滩
14. bar 沙坝
15. shallow 浅水

# Lecture 3 Harbor Layout

The size of a harbor size is determined by the number and size of ships using it to a large extent, but existing site conditions also have important influence. Generally, unless the harbor is a natural one, its size will be kept as small as feasible for safe and reasonably comfortable operations to take place. Use of tugs to assist maneuvering of ships in docking may also affect the size of the harbor (Figure 3-1).

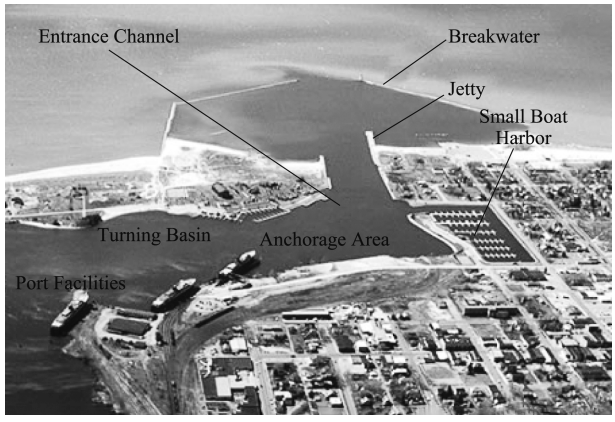


Figure 3-1 Harbor layout of Ludington Harbor, Michigan

## 1. Turning Basins

A turning basin is a water area inside a harbor or an enlargement of a channel to permit the turning of a ship. If space is available, the turning basin should have a radius of at least twice the length of the ship to permit either free turning or turning with the aid of tugs, for the wind and water conditions permitting. If space is limited, the ship may be turned by warping around the end of a pier or turning dolphin, either with or without the use of its lines. In those cases, the turning basin will be much smaller and normally in a triangular or rectangular shape. The minimum diameter should be at least 20% greater than the length of the largest ship to be turned.

## 2. Arrangement of Breakwaters

Breakwaters are required for protection of artificial and semi-natural harbors. Locations and sizes of breakwaters depend on the direction of the maximum waves, configuration of the shoreline, and the minimum size of the harbor required for the anticipated traffic in the port. Breakwaters may consist of two "arms" out from the shore, together with a single breakwater which is more or less parallel to the shore, thereby providing two openings to the harbor. The harbor may also be protected with a single arm out from shore, or by two arms converging near their offshore ends and overlapping to form a protected entrance to the harbor.

Selection of the most suitable arrangement of breakwaters depends principally on the direction of the maximum waves. The effectiveness of the selected arrangement in quiet harbor may be assessed by model tests. For comfortable berthing, the wave heights should not exceed 2 ft and winds should not exceed 10 to 15 mile/h. But wave heights up to 4 ft have been allowed in the past where bulk cargo was handled and the wind directions were such as to hold docked ships off the dock. In general, harbor waves with small ratios of winds to currents are great risk for docking a unloaded vessel, and docking in these cases may require use of a tug.

**3. Using of Moorings and Anchorages**

An offshore mooring is provided usually where it is not feasible or economical to construct a dock or provide a protected harbor. An anchorage consists of a number of anchorage units. Each unit consists of one or more anchors, chains, sinkers, and buoys to which the ship can attach its mooring lines. These anchorages are supplemented in most cases by the ship's bow anchors. Bulk cargo is usually transported to or from the ship by a pipeline or trestle conveyor, and other cargo may be transferred by a lighter.

An anchorage area is a place where ships are held for quarantine inspection, or awaiting for docking space (sometimes removing ballast in preparation for taking on cargo), or awaiting for favorable weather conditions. Special anchorages are sometimes provided for ships carrying explosives or dangerous cargo and are usually so designated on harbor maps with name and depth of water.

**4. Harbor Channel**

The harbor and approach channel for ideal operating conditions should be sufficiently deep to allow navigation at the lowest low water when ships are fully loaded. The water depth requirement should include an allowance for the surge of the ship, which is about one-half the wave height, the out-of-trim or squat when in motion, and from 2- to 4-ft clearance under the keel. Greater allowance should be used when the bottom is of hard material such as rock. When there is a very soft mud bottom, a keel may at times touch bottom because of surge and squat without damaging the ship, but it would be disastrous to have its fully loaded weight bump a hard rock bottom. Therefore, greater allowances must be made in computing the water depth when the bottom is hard. The harbor and approach channel or approach sea lanes must also be carefully swept to make sure there are no obstructions, such as reefs or rocky pinnacles, boulders, or sunken ships, above the required depth for safe navigation.

Width of a channel may be measured between the toes of the bordering side slopes or at the design depth. The minimum nominal width required for a channel depends on many factors. The following are the most important:

(1) The maximum beam of traversing ships;
(2) Length and maneuverability of the longest vessels;
(3) Accuracy and reliability of navigational aids;
(4) Speed, volume, and nature of traffic;
(5) Nature, intensity, and variation of currents along the channel;
(6) Ability and experience of pilots;
(7) Channel depth and curvature;
(8) Whether ships are to pass each other.

**5. Port Structures**

A marine terminal is part of a port or harbor that provides docking, cargohandling, and storage facilities. When only passengers embark and disembark along with their baggage and miscellaneous small cargo, generally from ships devoted mainly for carrying of passengers, it is called a passenger terminal. If the traffic is mainly cargo carried by freighters, even although many of these ships may also carry a few passengers, the terminal is commonly referred to as a freight or cargo terminal. In many cases, it is known as a bulk cargo terminal, where such products such as petroleum, cement, and grain are stored and handled.

Docking facilities may consist of a single pier or as many as 1000 piers. The number of berths depends on the anticipated number of ships that will use the port and the time it will take to discharge and take on cargo or passengers. This will vary for different kinds of cargo, but usually a vessel will not be in port more than 48 h. Many bulk cargo ships are loaded in 24 h or less.

Wharves and piers should be located in the most sheltered part of the harbor or along the lee side of the breakwaters. Where possible, piers should be oriented to allow ships alongside headed as nearly into the wind and waves as possible. This is particularly important if the harbor is not well-protected.

Onshore marine-terminal facilities may consist of one or more of the following, depending on the size of the port and the service it renders: transit sheds, warehouses, bulk storage, terminal buildings, guardhouses, Stevedores' warehouses, and miscellaneous buildings.

## New Words

1. **anchor** A device, normally made of metal, used to connect a vessel to the bed of a body of water to prevent the craft from drifting due to wind or current.
   n. 锚;抛锚停泊 vt. 抛锚;使固定 vi. 抛锚
2. **anchorage** A portion of a harbor or area outside a harbor suitable for anchoring or in

which ships are permitted to anchor.

n. 锚地;下锚

3. **apron** An outer protective garment that covers primarily the front of the body.

n. 挡板;码头前沿

4. **ballast** Materials that are used to provide stability to a vehicle or structure.

n. 压舱物 vt. 给……装压舱物

5. **berth** A designated location in a port or harbor used for mooring vessels when they are not at sea.

n. 锚位 vt. 使……停泊 vi. 停泊

6. **buoy** A floating device that can have many purposes.

n. (水运)浮标;浮筒;救生圈;航标 vt. 使浮起;支撑

7. **disembark** To remove or unload (cargo or passengers) from a ship, aircraft, or other vehicle.

vt. 使……登陆;使……上岸 vi. 登陆, 下车;上岸

8. **dock** Group of structures involved in the handling of boats or ships, usually on or close to a shore, or the structures themselves.

n. 码头;船坞 vt. 使靠码头 vi. 入船坞

9. **embark** To put or receive on board a ship, aircraft, or other vehicle.

vi. 上船 vt. 使上船

10. **freight** Goods, cargo, or lading transported for pay, whether by water, land, or air.

n. 货运;运费;船货 vt. 运送;装货

11. **keel** A structural element that sometimes resembles a fin and protrudes below a boat along the central line.

n. 龙骨;平底船

12. **mooring** Any structure to which a vessel may be secured by means of cables, anchors, or lines.

n. 下锚;停泊处;系船具 v. 停泊(moor 的 ing 形式)

13. **pier** A raised structure, including bridge and building supports and walkways, typically supported by widely spread piles or pillars.

n. 码头,直码头;桥墩

14. **sinker** A weight used in conjunction with a chain to increase its rate of sink, anchoring ability.

n. 铅锤;铅坠

15. **tug** A boat that maneuvers vessels by pushing or towing them.

n. 拖船 vt. 用拖船拖

16. **wharf** A structure on the shore of a harbor or on the bank of a river or canal where ships may dock to load and unload cargo or passengers.

n. 码头;停泊处 vt. 使靠码头;把货卸在码头上 vi. 靠码头

17. **warehouse** A commercial building for storage of goods.
n. 仓库;货栈 vt. 储入仓库

## Phrases and Expressions

1. to a large extent 在很大程度上
2. with the aid of 借助于(用、通过)
3. lee side 背(下)风面,下风舷
4. quarantine inspection 检疫
5. with respect to 关于,至于
6. out of trim (船)纵倾失衡

# Reading Material

## Area Requirements in Site Selection

The choice of a particular location for the establishment of a port depends upon many factors including land requirements and requirements for depth and space and for protection of the harbor against wave action, current action and sedimentation to any extent possible[1].

Area requirements for a new port depend upon its character and the corresponding needs for areas for transportation, storage (dry and open) and industry. No general rules for land requirements can be given but a modern container berth generally needs about 8 hectares of a land area. Recent developments have increased to 10-12 hectares. The use of harbors for industry is often a main factor in planning. Many harbors have a considerable part of their income from lease of industrial areas, while port operations themselves may run at a deficit. Consequently, many factors are involved in planning of land facilities.

It is possible to plan, with a reasonable degree of accuracy, the transportation and storage areas and facilities after the expected inputs-outputs and throughputs are defined based on basic criteria. Such analyses are now common in all comprehensive port planning.

The site selection and layout of port structures take basic considerations that are discussed in detail by the Permanent International Association of Navigation Congresses (PLANC) in its Committee for the Reception of Large Vessels (ICORELS). Results have been published in various reports.

PIANC ICORELS Group 1, 1979, reported on "Methods for Analyzing Wind, Wave, and Swell Data to Estimate on an Annual Basis the Number of Days and the Maximum Duration of Periods During Which Port and Ship Operations Will Be Impeded by These Elements".

Group IV established general guidelines for the dimension of channels; turning basins including turning circles and safety requirements; navigational aides; and ship handling problems. In addition, dredging problems for construction and maintenance were also discussed by Group IV, and environmental effects of dredging and disposal were reported on by the PIANC Committee on "Study of Environmental Effects of Dredging and Disposal of Dredged Materials" published as an annex to Bulletin No. 27 (Vol. II, 1977) of the PIANC.

The site selection is also related to waves, currents, and sediment transport. A marine structure should be placed in a sheltered area as much as possible such as:

(1) Behind an island or shoal.
(2) In a deep natural bay or fiord on the coast.
(3) In a sheltered lagoon, tidal entrance, or estuary.

With respect to littoral drift problems, allowance must be given for gradual modifications of the sea bottom and shoreline that may result from building a structure on the coast.

Because of the vast capital investment involved in the construction of large marine structures, it is important that planning considers future developments, including the general increase in ship sizes, with particular reference to drafts of bulk, and container vessels.

The site selection is highly dependent upon a variety of environmental parameters as dealt with in detail by PIANC's ICORELS Committee No. 1. The so-called "operational limit conditions" depend on the following site conditions:

(1) Astronomical tides.
(2) Winds.
(3) Changes of water levels caused by meteorological conditions, in particular storm surges and the so-called negative surges.
(4) Ocean waves (amplitude, period, direction).
(5) Ocean currents.
(6) Visibility.
(7) Sea ice.
(8) Sediment transport.

The operational limit conditions are established in each case after a comparative economic survey of the different possibilities in which investment costs, maintenance costs, and the necessary requirements for safe navigation are taken into account[2].

In order to determine these requirements, it is necessary to make a statistical survey of the site conditions mentioned above[3]. The resulting operational limit conditions are affected by the environmental conditions in general, as well as by economical considerations, certain practical aspects, for example the availability of tug assistance, and other necessary services.

## New Words and Expressions

1. site selection 选址

2. to the extent possible 在尽可能的范围内
3. container berth 集装箱泊位
4. hectare 公顷
5. income 收入
6. lease 出租
7. deficit 亏损
8. be involved in 包括
9. input-output 吞吐量
10. throughput 中转量
11. layout 布置
12. congress 会议
13. impede 阻碍
14. guideline 准则
15. turning circle 回转圆
16. navigation aids 助航设施
17. annex 附录
18. bulletin 公告
19. exposure 方位
20. shelter 掩蔽
21. fiord = fjord 峡湾(尤其指挪威海岸边的)
22. lagoon 环礁湖
23. with respect to 关于
24. littoral drift 沿岸流
25. allowance 余地,容许量
26. modification 改变
27. capital 资本
28. investment 投资
29. with reference to 与……有关的
30. bulk vessel 散装货船
31. container vessel 集装箱船
32. astronomical 天文的
33. storm surge 风暴潮(涌波)
34. visibility 能见度
35. comparative 相当的
36. availability 有效性
37. tug 拖轮

## Notes

1. 本段第一段句子虽长,但是个简单句,掌握了主语是 choice,谓语是 depends upon 就不难译出。

2. in which investment costs…costs, and the…requirements…are taken into account 为限制性定语从句,修饰 possibilities。

3. mentioned above 意为:上述的,在文章和信件中常见。