English on Civil Engineering

（土木工程英语）

姚仰平　惠宽堂　王泽军　王辉家　编

科学技术文献出版社

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前　言

为了适应高等学校土木工程类专业英语教学的需要，我们根据1985年国家教委审定的高等理工科“英语教学大纲”的要求，编写了《**English on Civil Engineering**》（土木工程英语）教材。使用对象为已学完基础英语的土木工程类专业的大学生，以在第5—7学期学习为宜。教学目的是以培养专业英语阅读能力为主，并适当考虑写作训练，本教材可适合于100—120学时的教学安排，各校在使用时可根据自己的实际情况灵活掌握。本书在选材上还选用了少量具有一定难度的内容，可供土木工程技术人员和研究生作为进一步提高专业英语阅读能力的参考读物，也可作为土木工程技术人员晋升高级职称英语学习的阅读材料。

《**English on Civil Engineering**》题材广泛，涉及工程力学、工程地质、土力学与地基基础、建筑材料、钢结构、钢筋混凝土结构、房屋建筑学、建筑经济、计算机应用、建筑施工技术和施工组织等学科。在吸取我国专业英语教材的优点和公共英语教学经验的基础上，采用了较为新颖的结构形式。本教材共包括23个教学单元（**Unit**），每个单元包括课文（**Text**）、生词（**New Words**）、词组（**Phrases and Expressions**）、练习（**Exercises**）、阅读材料（**Reading Material**）和问题（**Problem**）。在练习中，除设有英译汉、汉译英内容外，还配有较大份量的多项选择和填空内容，以确保基础英语和专业英语间的衔接和过渡，可提高学生的学习兴趣。

本教材正式出版前已在西安建筑科技大学（原西安冶金建筑学院）等高校的建筑工程专业使用过三届，另外该校也有十多年的专业英语教学经验，这些均为本教材的修订和完善积累了一定的经验。本教材由西安建筑科技大学姚仰平（第2，6，9，11，13，17，20，21单元）、惠宽堂（第1，3，5，7，15，18，23单元）、王泽军（第4，8，14，19，22单元）和王辉家（第10，12，16单元）编写。陈慧仪教授、丰定国教授等为本书的修改提出了很多宝贵意见，孙鹏云老师为本书的出版给予了大力的支持和帮助，李斌副编审在本书插图的整理加工中作出了大量的工作，同时还对本书的格式编排提出了有益的建议，在此一并表示深切的谢意。

由于我们水平有限、收集资料不多，所编教材一定存在不少的缺点和错误，恳请读者提出宝贵的批评和建议。

编　者

1994年5月

CONTENTS

Unit 1

Text

Stress and Strain

The concepts of stress and strain can be illustrated in an elementary way by considering the extension of a prismatic bar (see Fig. 1. 1a). A prismatic bar is one that has constant cross section throughout its length and a straight axis. In this illustration the bar is assumed to be loaded at its ends by axial forces P that produce a uniform stretching, or tension, of the bar. By making an artificial cut (section mm) through the bar at right angles to its axis, we can isolate part of the bar as a free body (Fig. 1. 1b). At the right-hand end the tensile force P is applied, and at the other end there are forces representing the action of the removed portion of the bar upon the part that remains. These forces will be continuously distributed over the cross section, analogous to the continuous distribution of hydrostatic pressure over a submerged surface. The intensity of force, that is, the force per unit area, is called the stress and is commonly denoted by the Greek letter σ . Assuming that the stress has a uniform distribution over the cross section (see Fig. 1. 1b), we can readily see that its resultant is equal to the intensity σ times the cross-sectional area A of the bar. Furthermore, from the equilibrium of the body shown in Fig. 1. 1b, we can also see that this resultant must be equal in magnitude and opposite in direction to the force P. Hence, we obtain

$$\sigma = \frac{P}{A} \tag{1.1}$$

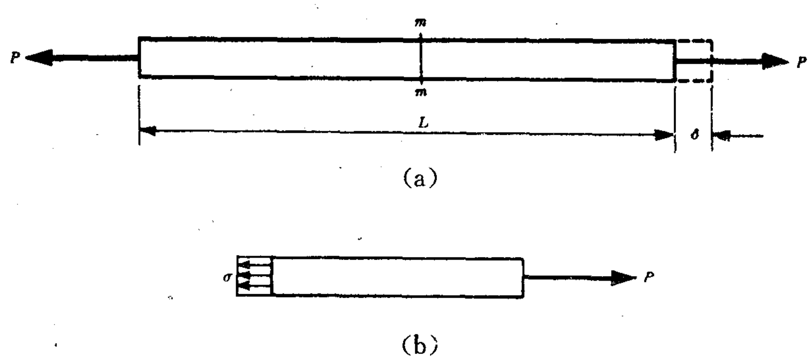

Fig. 1. 1 Prismatic bar in tension

as the equation for the uniform stress in a prismatic bar. This equation shows that stress has units of force divided by area —— for example, Newtons per square millimetre (N/mm^2) ① or pounds per square inch (psi). When the bar is being stretched by the forces P, as shown in the figure, the resulting stress is a tensile stress; if the forces are reversed in direction, causing

① Altermative units (identically equivalent to N/mm^2) are MN/m^2 and MPascal.

the bar to be compressed, they are called compressive stresses.

A necessary condition for Eq. (1. 1) to be valid is that the stress σ must be uniform over the cross section of the bar. This condition will be realized if the axial force P acts through the centroid of the cross section, as can be demonstrated by statics. When the load P does not act at the centroid, bending of the bar will result, and a more complicated analysis is necessary. For simplicity, however, it is assumed that all axial forces are applied at the centroid of the cross section unless specifically stated to the contrary. Also, unless stated otherwise, it is generally assumed that the weight of the object itself is neglected, as was done when discussing the bar in Fig. 1. 1.

The total elongation of a bar carrying an axial force will be denoted by the Greek letter δ (see Fig. 1. 1a), and the elongation per unit length, or strain, is then determined by the equation

$$\varepsilon = \frac{\delta}{L} \qquad (1.2)$$

where L is the total length of the bar. Note that the strain is a nondimensional quantity. It can be obtained accurately from Eq. (1. 2) as long as the strain is uniform throughout the length of the bar. If the bar is in tension, the strain is a tensile strain, representing an elongation or stretching of the material; if the bar is in compression, the strain is a compressive strain, which means that adjacent cross sections of the bar move closer to one another.

Hooke's Law

When a material behaves elastically and also exhibits a linear relationship between stress and strain, it is said to be linearly elastic. This is an extremely important property of many solid materials, including most metals, plastics, wood, concrete, and ceramics.

The linear relationship between stress and strain for a bar in tension can be expressed by the simple equation

$$\sigma = E\varepsilon \qquad (1.3)$$

in which E is a constant of proportionality known as the modulus of elasticity for the material. For most materials the modulus of elasticity in compression is the same as in tension. In calculations, tensile stress and strain are usually considered as positive, and compressive stress and strain as negative. The modulus of elasticity is sometimes called Young's modulus, after the English scientist Thomas Young (1773 — 1829) who studied the elastic behaviour of bars. Equation (1. 3) is usually referred to as Hooke's law, because of the work of another English scientist, Robert Hooke (1635 — 1703), who first established experimentally the linear relationship between load and elongation.

Poisson's Ratio

When a bar is loaded in tension, the axial elongation is accompanied by a lateral contraction, that is ,the width of the bar becomes smaller as its length increases. The ratio of the strain in the lateral direction to the strain in the longitudinal direction is constant within the elastic range and is known as poisson's ratio , thus

$$\gamma = \frac{lateral\ strain}{axial\ strain} \tag{1.4}$$

This constant is named after the famous French mathematician S. D. Poisson (1781 — 1840), who attempted to calculate this ratio by a molecular theory of materials. For materials having the same elastic properties in all directions, called isotropic materials, Poisson found $\gamma = 0.25$. Actual experiments with metals show that γ is usually in the range 0. 25 to 0. 35.

New Words

1. stress [stres]
   n. 应力,受力(状态,作用)
2. strain [strein] n. 应变,变形
3. prismatic [priz' mætik]
   a. 棱柱形的,棱柱的
4. uniform [' ju:nifɔ:m] a. 均匀的,统一的
5. tension [tenʃən]
   n. 张力,拉力;伸展,拉伸
6. tensile [' tensail] a. 拉力的,拉伸的
7. distribute [dis' tribju:t]
   v. 分布;区分,分类
   distribution [distri' bju:ʃən] n. 分布
8. analogous [ə' næləgəs] n. 类似的,相似的
   analogue [' ænəlɔg] n. 类似物,相似物
9. hydrostatic [haidrou ' stætik]
   a. 流体静力学的
   hydrostatics [haidrou' stætiks]
   n. 流体静力学
10. submerge [səb' mə:dʒ] v. 浸没,淹没
11. intensity [in' tensiti] n. 强度,集度
12. denote [di' nout] v. 表示,指示
13. resultant [ri' zʌltənt] n. 合力,结果
    a. 合成的,组合的,总的
14. equilibrium [i:kwi' libriəm]
    n. 平衡,均衡,相称
15. compression [kəm' preʃən] n. 压缩
    compressive [kəm' presiv]
    a. 压缩的,加压的
16. centroid [sentrɔid] n. 质心,重心,形心
17. bending [bendiŋ] n. 弯曲
18. elongation [ilɔ:ŋ' geiʃən]
    n. 伸长,拉长,延长(部分)
19. nondimensional [nʌndi' menʃənl]
    a. 无量纲的,无因次的
20. adjacent [ə' dʒeisənt]
    a. 附近的,相邻的,毗连的
21. ceramics [si' ræmiks]
    n. 陶瓷(学,器,制品,工艺)
22. isotropic [isou' trɔpik]
    a. & n. 各向同性(的),匀质的

Phrases and Expressions

1. in a elementary way 以基本方法
2. at right angles 成直角
3. be analogous to 类似于
4. constant cross section 等截面
5. axial force 轴向力
6. tensile strain 拉应变

tensile stress 拉应力
7. be in tension 受拉
8. be in compression 受压
9. to the contrary 意思相反的(地)
10. compressive stress 压应力
11. bending moment 弯矩
12. linearly elastic 线弹性的
13. modulus of elasticity 弹性模量
14. Young's modulus 杨氏模量
15. Hooke's law 虎克定律
16. Poisson's ratio 泊桑比

Exercises

1. For each of the incomplete sentences below you are to choose the one answer (A, B, C, or D) that best completes the sentence. Mark your answre by blackening the corresponding letter.

(1) A prismatic bar ______ constant cross section throughout its length and a straight axis.

A. have　　B. is

C. is one that has　　D. is one what has

(2) By making an ______ cut (section mm) through the bar at right angles to its axis, we can isolate part of the bar as a free body (Fig. 1. 1b).

A. artifical　　B. man made

C. fictions　　D. imagine

(3) These forces will be continuously distributed over the cross section, ______ the continuous distribution of hydrostatic pressure over a submerged surface.

A. analogous　　B. analogous to

C. is equal to　　D. familar with

(4) ______ the stress has a uniform distribution over the cross section (see Fig. 1. 1b), we can readily see that its resultant is equal to the intensity σ times the cross-sectional area A of the bar.

A. Assuming which　　B. Assuming that

C. Supposed　　D. Grant

(5) The equation (1. 1) shows that stress has units of force ______ area.

A. divided by　　B. multiplied

C. above　　D. times

(6) If the bar ______ in tension, the strain ______ a tensile strain, representing an elongation or stretching of the material.

A. will be … will be　　B. is … is

C. is … will be　　D. is … should be

(7) ______ most materials the modulus of elasticity in compression is the same as in tension.

A. In　　B. Within

C. About　　D. For

(8) If the bar is in compression, the strain is a compressive strain, which ______ that adjacent cross sections of the bar move closer to one another.

A. represent　　B. mean

C. means　　D. representing

(9) Also, unless stated otherwise, it is generally ______ that the weight of the object itself is neglected, as ______ when discussing the bar in Fig. 1. 1.

A. assuming … is doing　　B. assuming … was done

C. assumed … is doing　　D. assumed … was done

(10) When a bar is loaded in tension, the axial elongation is accompanied by a lateral contraction, ______ the width of the bar becomes smaller as its length increases.

A. that is,　　B. which is

C. that is　　D. which is

2. Translate the following phrases into English.

(1) 等截面　　(2) 均匀拉伸或压缩

(3) 横截面的形心　　(4) 应力—应变关系

(5) 相邻横截面　　(6) 虎克定律

(7) 线弹性的　　(8) 弹性模量

(9) 泊桑比　　(10) 各向同性材料

3. Translate the following sentences into Chinese, paying attention to the underlined parts.

(1) The concepts of stress and strain can be illustrated in an elementary way by considering the extension of a prismatic bar (see Fig. 1. 1a).

(2) By making an artificial cut (section mm) through the bar at right angles to its axis, we can isolate part of the bar as a free body(Fig. 1. 1b).

(3) Furthermore, from the equilibrium of the body shown in Fig. 1. 1b, we can also see that this resultant must be equal in magnitude and opposite in direction to the force *P*.

(4) This condition will be realized if the axial force *P* acts through the centroid of the cross section, as can be demonstrated by statics.

(5) For simplicity, however, it is assumed that all axial forces are applied at the centroid of the cross section unless specifically stated to the contrary.

(6) It can be obtained accurately from Eq. (1. 2) as long as the strain is uniform throughout the length of the bar.

(7) When a material behaves elastically and also exhibits a linear relationship between stress and strain, it is said to be liearly elaslic.

(8) For most materials the modulus of elasticity in compression is the same as in tension.

(9) The modulus of elasticity is sometimes called Young's modulus, after the English scientist Thomas Young (1773—1829) who studied the elastic behaviour of bars.

(10) This constant is named after the famous French mathematician S. D. Poisson (1781 — 1840), who attempted to calculate this ratio by a molecular theory of materials.

4. Fill in the blanks with the given words below.

over, for, by, in, for, at, to, for, by, between

(1) The concepts of stress and strain can be illustrated __①__ an elementary way __②__ considering the extension of a prismalic bar (see Fig. 1. 1a).

(2) A necessary condition __③__ Eq. (1. 1) to be valid is that the stress σ must be uniform __④__ the cross section of the bar.

(3) __⑤__ simplicity, however, it is assumed that all axial forces are applied __⑥__ the centroid of the cross section unlesss specifically stated __⑦__ the contrary.

(4) The linear relationship __⑧__ stress and strain __⑨__ a bar in tension can be expressed __⑩__ the simple equation $\sigma = E\varepsilon$.

5. Translate the following sentences into English.

(1) 力的集度，即单位面积上的力，称为应力。

(2) 单位长度的伸长量称为应变，常用下列公式来确定，$\varepsilon = \frac{\delta}{L}$。

(3) 在计算时，拉应力和拉应变通常以正值考虑，而压应力和压应变以负值考虑。

(4) 在公式（1.3）中，E是比例常数，称为材料的弹性模量。

(5) 在弹性范围内，横向应变与纵向应变的比是常量。

(6) 在所有方向弹性性质相同的材料称为各向同性材料。

Reading Material

Plane Stress

Both uniaxial and biaxial stresses are special cases of a more general stress condition known as plane stress. An element in plane stress may have both normal and shear stresses on the x and y faces, as shown in Fig. 1. 2a, but no stresses on the z face of the element. The shear stress on the x face of the element will be denoted by τ_{xy}, in which the first subscript denotes the plane on which the stress acts, and the second subscript denotes the direction of the shear stress. when using this notation for identifying shear stresses, it is customary to assume that the shear stress is positive when it acts in the positive direction of the y axis. Thus, τ_{xy} is positive in the direction shown in the figure. Similarly, the shear stress on the upper face of the element is denoted by τ_{yx}, indicating that the stress acts on the y face of the element and is posltive in the x direction. This sign convention for shear stresses τ_{xy} and τ_{yx} is followed here because it is a widely used convention in the theory of elasticity.

In mechanics of materials, however, we used a sign convention for the shear stress τ_θ which was based upon whether the shear stress acted clockwise or counterclockwise against the element. We continue to use that convention for τ_θ in our consideration of plane stress;

therefore, we see that on the plan for which $\theta=0°$ (the x face of the element), we have $\tau_\theta=-\tau_{xy}$, and on the plane $\theta=90°$, we have $\tau_\theta=\tau_{yx}$. Also, from the equality of shear stresses on perpendicular planes, it is obvious that

$$\tau_{xy}=\tau_{ys} \qquad (1.5)$$

Let us now consider an inclined section having its normal at the angle θ with the $x$axis (Fig. 1. 2b).

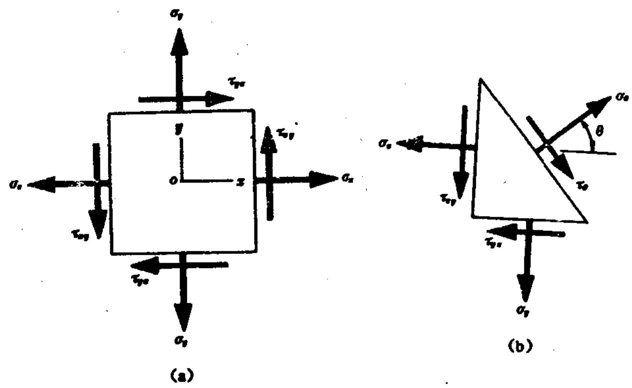

Fig. 1. 2 Element in plane stress.

The normal stress σ_θ and the shear stress τ_θ acting on this section can be found from the equilibrium conditions of the triangular element. In writing the equations of equibrium, it must be kept in mind that the areas of the faces of the element are not all the same, and each stress must be multiplied by the area of the face on which it acts in order to get the total force. Equilibrium of forees in the direction of σ_θ(Fig. 1. 2b) gives

$$\sigma_\theta = \sigma_x cos^2\theta + \sigma_y sin^2\theta + 2\tau_{xy} sin\theta cos\theta \qquad (1.6a)$$

and equilbrium of forces in the direction of τ_θ Yields

$$\tau_\theta = (\sigma_x\text{-}\sigma_y) sin\theta cos\theta + \tau_{xy}(sin^2\theta\text{-}cos^2\theta) \qquad (1.6b)$$

Introducing the appropriate trigonometric relations, we can express Eqs(1. 6)in the following alternate forms:

$$\sigma_\theta = \frac{1}{2}(\sigma_x+\sigma_y) + \frac{1}{2}(\sigma_x-\sigma_y)cos2\theta + \tau_{xy}sin2\theta \qquad (1.7a)$$

$$\tau_\theta = \frac{1}{2}(\sigma_x-\sigma_y)sin2\theta - \tau_{xy}cos2\theta \qquad (1.7b)$$

These equations give the normal and shear stresses on any inclined plane in terms of the stresses σ_x, σ_y and τ_{xy}, Note that when $\theta=0$, the equations give $\sigma_\theta=\sigma_x$ and $\tau_\theta=-\tau_{xy}$; when $\theta=\pi/2$, the equations give $\sigma_\theta=\sigma_y$ and $\tau_\theta=\tau_{xy}$. Also, it can be observed that when $\tau_{xy}=0$, the reduced equations are for biaxial shress.

When using the foregoing equations for σ_θ and τ_θ, the sign conventions for stresses must be carefully observed: (a)all normal stresses are positive when in tension; (b)the shear stress $\tau_{xy}$is positive when in the direction of the $y$axis (Fig. 1. 2a); and (c) the shear stress τ_θ is positive when it acts clockwise on the material (Fig. 1. 2b). The reason for choosing this sign convention for τ_θ is that it causes the angle 2θ in Mohr' s circle to be measured counterclockwise when positive, whick is the same positiine sense used for measuring θ.

The stresses σ'_θ and τ'_θ on a plane at an angle $\theta+\pi/2$ from the x axis can be found by replacing θ by $\theta+\pi/2$ in Eqs. (1. 7). If this is done, we will find that

$$\sigma'_\theta + \sigma'_\theta = \sigma_x + \sigma_y \text{ and } \tau_\theta = -\tau'_\theta$$

as was shown previously for biaxial stress. Thus, we again see that the sum of the normal stresses on perpendicular planes remains constant and that shear stresses on perpendicular planes are equal in magnitude and opposite in direction

Problem Indicate if each of the following statements is true (T) or false (F).

(1) Both uniaxial and biaxial stresses are special cases of plane stress.

(2) An element in plane stress may have both normal and shear stresses on the x and y faces, as shown in Fig. 1. 2a, and strsses on the z face of the element.

(3) The normal stress σ_θ and the shear stress τ_θ acting on an inclined section having its normal at the angle θ with the x axis (Fig. 1. 2b) can not be found from the equilibrium conditions of the triangular element.

(4) The sum of the normal stresses on perpendicular planes remains constant and that shear stresses on perpendicular planes are equal in nagnitude and opposite in diredtion.

(5) The shear stress τ_θ is positive when it acts clockwise on the material.

Unit 2

Text

Soil Aggregates

Soil Structure

The soil structure refers to the geometric configuration of the particles in a soil aggregate and has a profound effect on the physical properties of the soil. Unfortunately, no satisfactory quantitative measure has yet been devised to describe the structure.

The structure of natural soils is the net product of the interaction between the forces of sedimentation, surface forces of the soil particles, and subsequent geologic forces. If particles of sand are allowed to settle from a suspension in water, the particles tend to take up stable positions to form a single-grained structure. Very loose sand or silt may have a honeycomb structure. If the fine particles consist of clay minerals, the surface forces play an important part. If strong attractive forces exist between the edge or corner and the face of clay plates, a flocculent structure develops. Otherwise, the clay plates may occupy nearly parallel positions as they settle from suspension. This is called a dispersed structure.

Soils with flocculent and honeycomb structures have large voids between solid particles and are held together by surface forces at the contact points. Such structures are generally not very stable. When a load is applied to the soil, the contacts may be broken and part of the structure destroyed, thus compressing the voids to form a more stable structure that can withstand the load. Some soils may be so unstable that the structure collapses with small disturbances. If the void space is filled with water, the soil-water mixture may lose the stability and flow as a viscous liquid. Examples include the spectacular flow slides of very sensitive clays in Scandinavia and the St. Lawrence Valley (Sharpe, 1938). Occasionally very loose deposits of fine sand or silt have been observed to flow after small disturbances such as a seismic tremor, an adjacent slide, or even tidal action (Peck and Kaun, 1948; Terzaghi, 1957). *Sensitivity*, which is the ratio of the strength of an undisturbed soil to that of a soil completely remolded at constant volume, reflects the loss in strength experienced by a soil when its original structure is destroyed by remolding.

Weight—Volume Relationships

In this section we consider the relationships that are used to describe the component parts of a soil aggregate. Solis are three—phase systems that consist of air, water, and solids. The components are illustrated schematically in Fig. 2.1. The volumes of air, water, and solids are designated by V_a, V_w, and V_s, respectively, and their weights by W_a, W_w, and W_s, respectively. In addition, the part occupied by air and water is called voids and its volume is denoted by V_v.

The relative amount of voids in a given soil is a most useful quantity. It is closely related to many aspects of soil behavior. One measure of the relative amount of voids is the *porosity* n, which is the ratio of the voids volume to the total volume of the soil, or

$$n = V_v/V \tag{2.1}$$

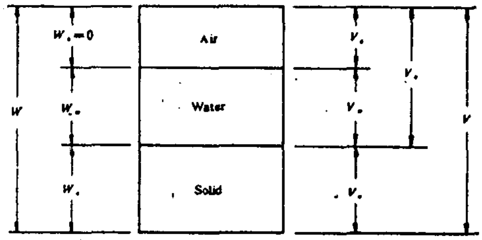

Fig. 2. 1 Components of soil aggregate.

The *void ratio* e is the ratio of the volume of voids to the volume of the solids, or

$$e = V_v/V_s \tag{2.2}$$

To express the quantity of water in a soil aggregate, we use the *water content or moisture content* w, which is the ratio of the weight of water to that of the solids expressed as a percentage, or

$$w = (W_w/W_s) \cdot 100 \tag{2.3}$$

The *degree of saturation* S_r is the percentage of voids that is occupied by water, or

$$S_r = (V_w/V_v) \cdot 100 \tag{2.4}$$

The *unit weight* or *density* of a material is defined as the weight of a given piece of the material divided by its volume. Since a soil aggregate contains three different phases, it is important to identify clearly the phase or phases to which the density refers. We have the density of the soil γ, which contains all three phases, or

$$\gamma = \frac{W}{V} = \frac{W_s + W_w}{V_s + V_w + V_a} \qquad (W_a = 0) \tag{2.5}$$

When measuring the degree of compaction of a soil, use is often made of the *dry density*, which is the density of the soil with the weight of water removed while the volume remains constant. This, of course, is not easily accomplished in reality, as soils usually shrink upon drying. The dry density is therefore a fictitious quantity used as a measure of the amount of solids in a unit volume of soil aggregate. This quantity has the same significance as void ratio or porosity, in that it indicates the relative amount of solids in a given soil. The dry density γ_d is

$$\gamma_d = W_s/V \tag{2.6}$$

Finally, there is the density of the solid particles γ_s, which is

$$\gamma_s = W_s/V_s \tag{2.7}$$

The density of the solid particles does not vary a great deal, since it represents the density of the minerals. With few exceptions the specific gravity G_s of the solid particles ranges between 2. 60 and 2. 80. The average value is 2. 65 for sand and silt and 2. 75 for clay.

The quantities defined above can be readily calculated if the weight and volume of the various components are known. However, this is not often the case. In practical problems, certain ratios such as water content or unit weight are more easily determined than the volumes of air, water, and solids. It is therefore necessary to calculate ratios such as porosity from other ratios such as water content. This again presents no problems, as long as the unit weights of the components are known. The unit weight of water is known (1.0g/cc) and the specific gravity of the solids may be readily determined. The air may be taken as weightless. The unit weight allows us to convert volume to weight and vice versa. To completely determine the quantity of the three components, proportions relating all three must be known. Hence the water content itself is insufficient, because the amount of air remains undetermined. If the degree of saturation is also known, the proportions of all three quantities are established and all other ratios may be calculated from these two.

New Words

1. aggregate [ˈægrigit] *n.* 集料，集合体 *v.* (使)聚集
2. cofiguration [kənfigjuˈreiʃən] *n.* 外形，结构，组合
3. devise [diˈvaiz] *v.* 设计，作出
4. interaction [intərˈækʃən] *n.* 互相作用
5. honeycomb [ˈhʌnikoum] *n.* 蜂窝，蜂窝状物
6. flocculent [ˈflɔkjulənt] *a.* 絮凝的
7. dispersed [disˈpəːst] *a.* 分散的，胶态的
8. void [vɔid] *n.* 空隙
9. withstand [wiðˈstænd] *v.* 抵抗，经得起
10. collapse [kəˈlæps] *v.* 坍下，崩溃
11. seismic [saizmik] *a.* 地震的
12. tremor [ˈtremə] *n.* 振动
13. tidal [ˈtaidl] *a.* 潮汐的
14. sensitivity [sensiˈtiviti] *n.* 灵敏度
15. schematically [skiˈmætikəli] *ad.* 示意地，大略地
16. respectively [risˈpektivli] *ad.* 分别地
17. aspect [ˈæspekt] *n.* 方面
18. porosity [pɔːˈrɔsiti] *n.* 孔隙率
19. shrink [ʃriŋk] *v.* 收缩

Phrases and Expressions

1. flow slide 滑坡
2. in addition 此外
3. void ratio 孔隙比
4. moisture content 湿度含量
5. water content 含水量
6. degree of saturation 饱和度
7. dry dansity 干重度
8. vice versa 反之亦然

Exercises

I. For each of the incomplete sentences below you are to choose the one answer (A, B, C, or D) that best completes the sentence. Mark your answer by blackening the corresponding letter.

(1) No satisfactory quantitative measure ________ to describe the structure.

A. have yet been devised B. has yet been devised

C. devises D. are devised

(2) If particles of sand ________ to settle from a suspension in water, the particles tend to take up stable positions to form a single-grained structure.

A. is allowed B. are allowed

C. was allowed D. were allowed

(3) If the fine particles ________ clay minerals, the surface forces play an important part.

A. consist of B. consist from

C. consist in D. consist with

(4) Some soils ________ so unstable that the structure collapses with small disturbances.

A. should be B. are able to

C. can be D. may be

(5) Its original structure is destroyed by ________

A. remolding B. to remold

C. the remold D. the remould

(6) In this section we consider the relationships that ________ the component parts of a soil aggregate.

A. are used to describing B. are used to describe

C. used to describing D. using to describing

(7) The volumes of ________ are designated by V_a, V_w, and V_s, respectively, and their weights by W_a, W_w, and W_s, respectively.

A. air, water and solids, B. air and water and solids

C. air, water, and solids D. air, water, solids

(8) As ________ in succeding part, it is closely related to many aspects of soil behavior.

A. is demonstrated B. demonstrating

C. to demonstrate D. to be demontrated

(9) This again presents no problems, ________ the unit weights of the components are known.

A. so long so B. as long as

C. as long so D. a long as

(10) To completely determine the quantity of the three components, ________ relating all three must be known.

A. proportions B. proportional

C. proportionality D. proposition

2. Translate the following phrases into English.

(1) 土的集合体 (2) 滑坡

(3) 含水量 (4) 饱和度

(5) 干重度 (6) 蜂窝结构