高等院校专业英语系列教材

主编 王安怡 张明慧

土木工程专业英语

English for Civil Engineering

中国建材工业出版社

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内 容 提 要

《土木工程专业英语》作为高等院校专业英语系列教材之一，充分结合了土木工程各专业的专业特点，并本着覆盖面广、知识面宽以及简单介绍前沿专业知识的原则进行编写。全书共分为五个单元：建筑结构、建筑材料、建筑施工、路桥隧道工程、土木工程项目管理。

本书针对性较强，通过对各单元专业英语文献的阅读和练习，读者可基本掌握专业术语及专业知识的表达，为其阅读专业英语文献打下良好基础。另外，在每篇课文的后面还附有与本课题有关的阅读材料，供学生使用，以进一步提高学生的阅读能力，拓宽学生的专业知识视野。每篇课文后面均附有参考译文。主要内容包括：建筑基础、框架结构、钢结构、高层建筑结构、混凝土材料、钢材、新型建筑结构材料、基础施工方法、混凝土结构施工方法、钢结构施工方法、道路工程、桥涵工程、隧道工程、国际竞争性项目招标、施工成本估算、施工质量及全面质量管理、工程项目成本、时间及质量控制。

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前　言

土木工程各专业的学生在大学本科一、二年级的基础英语学习和三年级的科技英语学习的基础上，通过专业课程的学习，需要对专业英语知识有所了解，目的在于：扩大专业英语词汇和专业术语，具备一定的阅读专业英语文献的能力和翻译技巧，使学生能够以英语为工具，通过阅读去获取与本专业有关的国外前沿科技信息，了解本专业的国际动态。专业英语的学习不仅有助于巩固《大学英语》和《科技英语》所学知识，而且在很大程度上也是英语学习水平和能力的培养、补充、延伸和提高，以使英语能为所学专业服务。

《土木工程专业英语》作为高等院校专业英语系列教材之一，充分结合了土木工程各专业的专业特点，本着覆盖面广、知识面宽以及适当介绍前沿专业知识的原则进行编写。我们将本教材分为五个单元：建筑结构、建筑材料、建筑施工、路桥隧道工程、土木工程项目管理。

结合多年来本课程的教学经验，我们查阅了大量资料，在选材上做了认真的筛选，以注重专业基础内容和前沿专业知识为目标。每课所列生词表、专业术语、短语以及注释都是教学实践中学生经常提出的问题，因此针对性较强。此外，每课还安排了一定量的习题。通过对课文的阅读和练习，读者可巩固专业英语的基础知识，扩大词汇量，为其能轻松阅读专业英语文献打下良好的基础。每篇课文均附有参考译文。另外，在每篇课文的后面还选取了与本专业课题有关的阅读材料，供学生使用，以期提高学生的自学能力，并进一步拓宽学生的专业知识视野。

本教材课文和阅读材料语言规范，题材广泛，覆盖土木工程各专业的重要内容：建筑基础、框架结构、钢结构、高层建筑结构、混凝土材料、钢材、新型建筑结构材料、基础施工方法、混凝土结构施工方法、钢结构施工方法、道路工程、桥涵工程、隧道工程、国际竞争性项目招标、施工成本估算、施工质量及全面质量管理、工程项目成本和时间及质量控制。文献资料的难易程度切实结合本科学生的实际水平。本教材重视语言技能训练，突出对阅读和翻译能力的培养，以求达到《大学英语专业阅读阶段教学基本要求》所提出的目标：“通过指导学生阅读有关专业的英语书刊和文献，使他们进一步提高阅读和翻译科技资料的能力，并能以英语为工具获取专业所需的信息。”

本教材的编写得到了多位教师的协助和指正。王安怡、张明慧、陈凤山、沈璐参与了专业英文材料的收集、整理以及课文翻译和课后练习的编写工作。本书第一课～第六课由张明慧执笔编写，第七课～第十课由陈凤山执笔编写，第十一课～第十三课由沈璐执笔编写，第十四课～第十七课由王安怡执笔编写。王安怡负责教材的组织编写和统稿、审稿工作，林志伟参与了收集资料和校稿工作，崔永光为译文审定提出了许多宝贵意见并予以修正。本教材有关专业材料节选自一些原版教材和论文集，内容章节序号未做改动。我们在此特向原作者表示真诚的感谢！

本教材读者定位为高等院校本科学生，也可供本专业技术人员作为提高专业英语阅读及写作能力的参考读物使用。由于编者水平有限，时间仓促，书中如有遗漏和不妥之处，恳请广大读者批评指正。

编　者

2010 年 4 月

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Unit I Building Structures

Lesson 1 Building Foundation

Part I Text

All engineered construction resting on the earth must be carried by some kind of interfacing element called a foundation. Generally about 30 per cent of the total construction cost is spent on the foundation. The soil on which the foundation rests is called the "foundation soil". The foundation is the part of an engineered system that transmits to, and into, the underlying soil or rock the loads supported by the foundation and its self-weight. [1]

A structure essentially consists of two parts, namely the superstructure which is above the plinth level and the substructure which is below the plinth level. Substructure is otherwise known as the foundation and this forms the base for any structure. The term superstructure is commonly used to describe the engineered part of the system bringing load to the foundation, or substructure. The term superstructure has particular significance for buildings and bridges; however, foundations also may carry only machinery, support industrial equipment (pipes, towers, tanks). It is evident on the basis of this definition that a foundation is the most important part of the engineering system.

Loads to foundations are generally broken into two broad categories, gravity loads (dead and live) and lateral loads (wind and earthquake). All loads to foundations are treated as static loads. Live loads, wind loads, and earthquake loads may actually be highly dynamic, but in practice such loads are applied as equivalent static loads rather than as dynamic loads.

Environmental loads are a special type of loading that may occur on structures. Typical of such loads are snow, ice, sand accumulation, rain, and other regional environmental hazards. The proper application of such loads is highly dependent on local practices; no attempt is made here to account for all such special applications.

As one may suppose, the gravity loads acting on a building are those due to the fixed mass of the building itself (dead load) and those due to transient masses (live load). [2] Gravity loads usually act vertically, but in some cases they may act horizontally (e. g., soil loads against a basement wall). Gravity loads are usually of much longer term than the lateral loads (wind and earthquake), which, by comparison, are extremely transient and erratic.

The distinction between dead loads and live loads is an important one. Concrete structures and components, including the concrete footings, are designed for a different factor of safety for dead load than for live load. Also, earthquake loads are computed using only the dead load of the building; live load is excluded. Reasonable care must therefore be exercised in distinguishing between the two loads throughout the structural analysis in order that wasteful overdesign or dangerous underdesign does not occur. [3]

Mechanical equipment, ductwork, and other such loads are not classified as dead loads. Although they are indeed permanently present, they are subject to renewal, replacement, or alteration during the life of the building. In addition, they are not rigidly attached to the building frame; when the building undergoes earthquake motion, these items simply shift around without resisting the motion of the building.

Those loads in a building that are movable are called live loads. Or alternatively, live loads are those that occur due to the usage of the building. Over the life of the building, however, the usage of the building can change sharply as tenants change or as new owners subject the building to new functions.

The magnitude of the vertical gravity load to be supported by each footing can readily be established, based on known and accepted methods of structural analysis. Since there is no need to find moments, the complexity of the analysis is reduced considerably. It should be apparent that the overall accuracy of such a simplified analysis is limited to the accuracy of the gravity loads themselves.

For proof of the foregoing conclusions, one needs to look no further than the ACI coefficients, a commonly applied method of analysis for regular structures of any material. This widely accepted method does not require any redistribution of vertical load due to flexure. The ACI method is derived analytically and is accurate within its prescribed limits.

The following limitations apply to the simplified analysis:

(1) The building must be reasonably regular; that is, adjacent span lengths may not differ by more than 20%.

(2) Loads must be relatively uniformly distributed.

(3) Live load may not exceed three times the dead load.

(4) The building must be framed from prismatic members, although shear walls and bearing walls may of course be used.

Municipal building codes sometimes require that a beam be capable of taking a randomly placed load of 2000 lb. at any point along its span, presumably to represent a safe or other heavy concentrated load. The end result of this provision is to require an increase in the capacity of the beam in shear when the load is placed very close to the end of the beam. [4]

The title foundation engineer is given to that person who by reason of training and experience is sufficiently versed in scientific principles and engineering judgment to design a foundation. We might say engineering judgment is the creative part of this design process.

Because of the heterogeneous nature of soil and rock masses, two foundations—even on adjacent construction sites—will seldom be the same except by coincidence. Since every foundation represents at least partly a venture into the unknown, it is of great value to have access to others' solutions obtained from conference presentations, journal papers, and textbook condensations of appropriate literature. The amalgamation of experience, study of what others have done in somewhat similar situations, and the site-specific geotechnical information to produce an economical, practical, and safe substructure design is application of engineering judgment.

The following steps are the minimum required for designing a foundation.

① Locate the site and the position of load. A rough estimate of the foundation loads is usually provided by the client or made in-house. Depending on the site or load system complexity, a literature survey may be started to see how others have approached similar problems.

② Physically inspect the site for any geological or other evidence that may indicate a potential design problem that will have to be taken into account when making the design or giving a design recommendation. Supplement this inspection with any previously obtained soil data.

③ Establish the field exploration program and, on the basis of discovery (or what is found in the initial phase), set up the necessary supplemental field testing and any laboratory test program.

④ Determine the necessary soil design parameters based on integration of test data, scientific principles, and engineering judgment. Simple or complex computer analyses may be involved.

⑤ Design the foundation using the soil parameters from step ④. The foundation should be economical and be able to be built by the available construction personnel. Take into account practical construction tolerances and local construction practices, interact closely with all concerned (client, engineers, architect, contractor) so that the substructure system is not excessively overdesigned and risk is kept within acceptable levels. [5] A computer may be used extensively (or not at all) in this step.

Foundations can be classified as shallow and deep foundations, depending on the depth of load-transfer from the structure to the ground. The definition of shallow foundations varies in different publications. BS 8004 (BSI, 1986) adopts an arbitrary embedment depth of 3 m as a way to define shallow foundations. In the context of this document, a shallow foundation is taken as one in which the depth to the bottom of the foundation is less than or equal to its least dimension.

The superstructure brings loads to the soil interface using column-type members. The load-carrying columns are usually of steel or concrete with allowable design compressive stresses on the order of 140 MPa (steel) to 10MPa (concrete) and therefore are of relatively small cross-sectional area. The supporting capacity of the soil, from either strength or deformation considerations, is seldom over 1000 kPa but more often on the order of 200 to 250 kPa. This means the foundation is interfacing two materials with a strength ratio on the order of several hundred. As a consequence the loads must be "spread" to the soil in a manner such that its limiting strength is not exceeded and resulting deformations are tolerable. Shallow foundations accomplish this by spreading the loads laterally, hence the term spread footing. Where a spread footing (or simply footing) supports a single column, a mat is a special footing used to support several randomly spaced columns or to support several rows of parallel columns and may underlie a portion of or the entire building. The mat may also be supported, in turn, by piles or drilled piers. Foundations supporting machinery and such are sometimes termed bases. Machinery and the like can produce a substantial load intensity over a small area, so the base is used as a load-spreading device similar to the footing.

Deep foundations are analogous to spread footings but distribute the load vertically rather than horizontally. The terms drilled pier and drilled caisson are for the pile type member that is constructed by drilling 0.76 m diameter hole in the soil, adding reinforcing as necessary, and backfilling the cavity with concrete.

Rational design approaches require a greater geotechnical input including properly planned site investigations, field and laboratory testing, together with consideration of the method of construction. The use of rational methods to back-analyze results of loading tests on instrumented foundations or the monitored behavior of prototype structures has led to a better understanding of foundation behavior and enables more reliable and economical design to be employed.

Part Ⅱ New Words

construction/kən'strʌkʃən/*n.*	建造，建筑物，施工
foundation/faun'deiʃən/*n.*	基础
structure/'strʌktʃə/*n.* & *vt.*	结构，构造，建筑物；建筑，构成，组织
superstructure/'sju:pəˌstrʌktʃə/*n.*	上部构造，上层建筑
plinth/plinθ/*n.*	柱基
substructure/sʌb'strʌktʃə (r) /*n.*	下部建筑，下部结构
pipe/paip/*n.* & *vt.*	管，导管，管道；以管输送
lateral/'lætərəl/*adj.* & *n.*	横向的，侧面的，水平的；侧面
dynamic/dai'næmik/*adj.*	动力的，动力学的
vertically/'və:tikəli/*adv.*	垂直地
horizontally/ˌhɔri'zɔntli/*adv.*	水平地
basement/'beismənt/*n.*	地下室，建筑物的基础
erratic /i'rætik/*adj.*	反复无常的，不稳定的，不规律的
footing/'futiŋ/*n.*	基础，底座，基脚，扩展脚
concrete/'kɔnkri:t/*adj.* & *n.*	混凝土制的；混凝土
overdesign/'əuvədiˌzain/*n.*	保险设计，过于安全的设计
underdesign/ˌʌndədi'zain/*n.*	欠安全的设计
ductwork/'dʌktwə:k/*n.*	管道系统，管网
moment/'məumənt/*adj.* & *n.*	瞬间的，力矩的；瞬间，力矩
coefficient/kəui'fiʃənt/*n.*	系数
flexure/'flekʃə/*n.*	屈曲，弯曲部分

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shear/ʃiə/*v.*	剪力，剪切
prismatic/prizˈmætik/*adj.*	等截面的，棱柱形的
municipal/mju(:)ˈnisipəl/*adj.*	市政的，地方性的
heterogeneous/ˌhetərəuˈdʒiːniəs/*adj.*	不同种类的，异类的
amalgamation/əˌmælgəˈmeiʃən/*n.*	融合，合并
geological/dʒiəˈlɔdʒikəl/*adj.*	地质学的，地质的
parameter/pəˈræmitə/*n.*	参数，参量
client/ˈklaiənt/*n.*	顾客，客户，委托人
architect/ˈɑːkitekt/*n.*	建筑师
contractor/kənˈtræktə/*n.*	订约人，承包人
strength/streŋθ/*n.*	强度
deformation/ˌdiːfɔːˈmeiʃən/*n.*	变形
compressive/kəmˈpresiv/*adj.*	有压缩力的，压力的
stress/stres/*n.*	压力，应力
pile/pail/*n.* & *v.*	堆，桩，打桩，用桩支撑
drill/dril/ *n.* & *v.*	钻孔机，钻子，钻孔
pier/piə/*n.*	码头，（桥）墩，桩
backfill/ˈbækfil/*vt.*	装填，回填
prototype/ˈprəutətaip/*n.*	原型
in-house/inˈhaus/*adj.* & *adv.*	内部的；内部地

Part Ⅲ Phrases and Expressions

bearing capacity	承载能力
gravity load	重力荷载
lateral load	横向荷载，侧向荷载
static load	静荷载
live load	活荷载
dead load	恒荷载
shear wall	剪力墙
bearing wall	承重墙
basement wall	地下连续墙
ACI (American Concrete Institute)	美国混凝土学会
prismatic member	等截面杆
rock mass	岩体
shallow and deep foundations	浅基础和深基础
cross-sectional area	横截面面积
spread footing	扩展基脚，扩展底
load intensity	荷载强度
to be analogous to	类似于……，与……相似
drilled caisson	钻孔沉箱

Part Ⅳ Notes

1. The foundation is the part of an engineered system that transmits to, and into, the underlying soil or rock the loads supported by the foundation and its self-weight.

[译文] 基础是工程系统的一部分，它支撑工程系统传递的荷载并将这些荷载和基础的自重传递至下面的土体和岩石。

[分析] that 引导定语从句，the part of an engineered system 作先行词，在从句中作主语，句中 supported by…作后置定语。

2. As one may suppose, the gravity loads acting on a building are those due to the fixed mass of the building itself (dead load) and those due to transient masses (live load).

[译文] 正如人们假设的，作用在建筑上的重力荷载是那些由于建筑物自身的固定质量（恒荷载）和那些瞬时质量（活荷载）产生的荷载。

[分析] mass 是指质量，due to…意思是由于……，those 指代荷载。

3. Reasonable care must therefore be exercised in distinguishing between the two loads throughout the structural analysis in order that wasteful overdesign or dangerous underdesign does not occur.

[译文] 因此，为了不出现浪费的超安全标准设计或危险的欠安全设计的情况，必须合理、谨慎地区分整个结构分析中的两类荷载。

[分析] 本句主语是被动语态，这里翻译成主动语态，therefore 翻译时提前。

4. The end result of this provision is to require an increase in the capacity of the beam in shear when the load is placed very close to the end of the beam.

[译文] 这一规定的最终结果是，当荷载位于距梁的末端非常近的位置时，需要提高梁的抗剪能力。

[分析] capacity of the beam in shear 翻译成梁的抗剪承载力。

5. Take into account practical construction tolerances and local construction practices, interact closely with all concerned (client, engineers, architect, contractor) so that the substructure system is not excessively overdesigned and risk is kept within acceptable levels.

[译文] 重视实际的施工容许误差和当地的施工实践，还应与相关方面（业主，工程师，建筑师，承包商）充分交换意见，使得地下结构体系避免过度设计，且风险也被控制在容许范围内。

[分析] take into account 意思是重视、考虑，construction tolerances 意思是施工容许误差。

Part Ⅴ Exercises

Exercise 1 Answer the following questions according to the text:

1. What is the foundation?
2. List the loads on building foundations.
3. List typical environmental loads.
4. What is the difference between shallow foundation and deep foundation?

Exercise 2 Fill the blanks according to the text:

A ________ is the ________ between the buildings and earth. Foundation subsystems serve to transmit ________ from the ________ subsystems of a building to the earth. As seen in plans, the vertical (columns, ________, and shafts) are distributed in some manner as points or ________ of load concentration. But the ________, which must ultimately ________ a structure, offers a more-or-less distributed bearing ________ .

Exercise 3 Translate the following phrases into Chinese or English:

1. field explration program ________________
2. plinth level ________________
3. construction site ________________
4. municipal building code ________________
5. 地基土 ________________
6. 钻孔墩 ________________
7. 地震荷载 ________________
8. 岩体 ________________

Part Ⅵ Homework

1. Make sentences with the phrases below:

a) …be capable of…

b) …apply to…

c) …take into account…

d) …on the basis of…

2. Translate the sentences into Chinese or English:

a) For a starting point, ranges of live loads which include a reasonable latitude for future changes are prescribed by the various codes.

b) These ranges of live loads are based on rather broad categories for the intended usage of the building, over the years, they have been found by the industry to be generally satisfactory.

c) Dead loads cannot be changed during the life of the building except by additional construction or remodeling of the building.

d) 从最小的住宅房屋到最高的高层建筑以及桥梁等结构物的基础都是用来传递上部结构荷载的。

e) 通常对于任何合理的结构只要有足够的经费，总是可以建造得很安全。

Part Ⅶ 参考译文

第1课 建筑基础

所有放置在大地上的工程建筑都必须通过称为基础的界面连接构件进行连接。通常，约占建筑总造价的百分之三十的费用使用在基础建设上。位于基础下的土壤称为“地基土”。基础是工程系统的一部分，它支撑工程系统传递的荷载并将这些荷载和基础的自重传递至下

面的土体和岩石。

一个结构主要由两部分组成，即上层建筑——柱基水平面以上的结构和底层结构——柱基水平面以下的结构。底层结构也被称为基础，构成了任何结构的基础。专业术语上层建筑通常是指把荷载传递给基础或是底层结构的建筑部分。上层建筑一词对于建筑工程和桥梁工程尤为重要，而且，基础还可以支撑机械设施，并可作为工业设备（管道、塔、蓄水池）的支撑结构。正是基于这一定义，基础显然是工程系统最重要的部分。

地基荷载一般分为两大类，重力荷载（恒荷载和活荷载）和横向荷载（风和地震）。所有的基础荷载作为静态荷载处理。活荷载、风荷载和地震荷载实际上都是动态的，但在实践中这些荷载作为静态荷载用于方程式中，而不是作为动态载荷使用。

环境荷载是作用在结构上的荷载中特殊的一类荷载。这类荷载包括雪荷载、冰荷载、沙聚积荷载、雨荷载和其他区域的环境危害产生的荷载。这类荷载的具体作用主要依靠当地的实际情况，试图用明确的作用情况来进行说明是不可能的。

正如人们假设的，作用在建筑上的重力荷载是那些由于建筑物自身的固定质量（恒荷载）和那些（活荷载）瞬时质量产生的荷载。通常重力荷载的作用方向是竖直的，但在有些情况下可能作用方向是水平的。重力荷载的作用时间要比横向荷载（风和地震）的作用时间长得多，与重力荷载相比，横向荷载是非常短暂的和不稳定的。

区分恒荷载和活荷载是一个重要问题。混凝土结构和构件，包括混凝土基脚，对恒荷载和活荷载在进行设计时采用不同的安全系数。此外，地震荷载仅作为恒荷载进行计算，而不作为活荷载计算。因此，为了不出现浪费的超安全标准设计或危险的欠安全设计的情况，必须合理、谨慎地区分整个结构分析中的两类荷载。

机械设备、管道系统和其他类似荷载都不属于恒荷载。虽然它们确实是一直存在的，但是在建筑物的使用期间它们受到更新、移位或改造的影响。此外，它们不是硬性附加在建筑框架上的；当建筑受到地震作用时，它们并不抵抗建筑运动，而是在周围移动。

在建筑中，这些变动的荷载称为活荷载。或者，活荷载也可以指那些由于建筑的使用而产生的荷载。然而，不考虑建筑的使用寿命，建筑的使用方法也可能会因为租户变化或新业主使建筑有了新的功能而急剧改变。

根据已知的和公认的结构分析方法，就可以确定由每个基脚支撑的垂直重力荷载的数值。由于没有必要求出力矩的数值，因此大大地降低了分析工作的复杂程度。

为了证明上述结论，我们需要注意不能比 ACI 系数更大，这是对于任何材料的正规结构进行分析的普遍适用的方法。这种被广泛接受的方法不要求由于弯曲作用而使竖向荷载重新分布。ACI 方法通过分析得来，并且在给定极限内这种方法是精确的。

以下限制适用于简化分析：

（1）建筑必须有一定的规整性，即相邻跨度的距离相差不能超过 20%。

（2）荷载必须相对均匀分布。

（3）活荷载不得超过恒荷载的三倍。

（4）虽然采用剪力墙和承重墙，但是建筑物的框架必须由等截面杆构成。

有时地方建筑规范规定，一个 2000 磅的荷载可以沿着跨度方向作用于梁上任意位置，大概可以表示这是一个安全荷载或是其他大型集中荷载。这一规定的最终结果是，当荷载位于距梁的末端非常近的位置时，需要提高梁的抗剪能力。

基础工程师的头衔，是给那些通过培训并掌握经验、精通丰富的科学原理和工程判断进

行基础设计的人们。我们可以说，工程判断是这一设计过程中富有创造性的部分。

由于土壤和岩体的不同性质，任意的两个基础——即使在邻近的施工场地——几乎都是不同的，除非碰巧。由于每个基础至少部分地都会进入未知的地下，从会议介绍、期刊论文和教科书中提炼的精华部分获得别人的解决方案具有非常重要的价值。融合经验，研究其他人在类似情况下已经取得的成果和特殊场地的地质资料，用以设计一种经济、实用、安全的底层结构是工程判断的应用。

下面的步骤是设计一个基础的最低要求：

①确定场址和负荷的位置。通常，通过委托人提供的或者内部制作的资料，粗略地对基础荷载进行评估。根据场地或承载系统的复杂程度，通过了解其他人在遇到类似情况时是如何解决问题的，来进行文献调查工作。

②视察场地的地质或其他资料，当在进行设计或提供设计建议书的时候，必须重视由于那些地质或其他资料引起的潜在设计问题。检查任何以前获得的土壤数据作为补充材料。

③建立现场勘探计划，并在已发现的资料基础上建立必要的补充场地测试和任何实验室测试计划。

④基于对试验数据、科学原理和工程判断的综合结果，确定必要的土壤设计参数。可能涉及简单或复杂的计算机分析。

⑤使用步骤④得到的土壤参数设计基础。该基础应该是经济的，并能由现有的建筑人员进行施工。重视实际的施工容许误差和当地的施工实践，还应与相关方面（业主、工程师、建筑师、承包商）充分交换意见，使得地下结构体系避免过度设计，且风险也被控制在容许范围内。在这一步骤中可能会广泛地使用计算机，也可能根本不需要。

根据从结构到地基的荷载传递深度，基础可分为浅基础和深基础两类。不同的出版物对浅基础的定义也是不同的。英国标准 8004（英国标准协会，1986）规定用埋置深度 3m 的方法定义浅基础。在本文件中，浅基础是指基础底部深度小于或等于其截面最小尺寸。

上层建筑使用柱形构件传递荷载给土壤界面。传递荷载的支柱通常采用钢材（容许设计抗压应力达 140MPa）或者混凝土（容许设计抗压应力达 10MPa）进行建造，并且横截面面积相对较小。土壤的支持承载力无论从强度还是变形考虑，很少超过 1000kPa 而多在 200～250kPa 之间。这意味着基础连接“强度比”相差数百倍的两种材料。因此必须展开传递给土壤的荷载，使得不会超过土壤的极限强度，并且产生的变形在容许范围内。浅基础通过横向扩展荷载建造，因而得来专有名词扩展底座（扩展基脚）。扩展底座上支撑单柱，也可以用底板作为扩展底座支撑多个任意间距的柱或是支撑数排平行支柱，并且底板位于整个建筑结构的底部。底板也可以由桩基或钻孔柱支撑。支撑机械设备的基础，有时用术语“base”表示。由于机械设备和类似的装置产生的荷载分布面积较大，所以在基础中采用比扩展底座小的结构形式。

深基础类似于扩展基础，但是分布的荷载是垂直方向而不是水平方向。术语钻孔柱和钻孔沉箱作为桩类基础，是通过在土壤中钻探 0.76m 直径的孔洞，其中放入所需的钢筋，并用混凝土回填孔洞建造的。

合理的设计方法需要大量的岩土数据-----包括全面地调查规划地点、场地和实验室测试结果，还要考虑施工方法。合理使用器具作用于基础上的荷载试验或是监控原型结构的后分析方法，可以更好地理解基础性能，更可靠更经济地进行设计工作。

Part Ⅶ Reading Paragraphs

Reading Paragraph A Controlling Excavation

The base of an excavation has usually to be trimmed level and cleared of disturbed or loose material so that it forms a solid base for concrete foundations, pipes or earthworks, etc. Specifications often call for the last 100mm of excavation to be 'carried out by hand'—a costly procedure for the contractor which he usually seeks to avoid. The resident engineer is then faced with the problem of what alternative he will allow in lieu of hand excavation. In some types of ground, such as sandy or gravelly clay, it should be possible for the contractor to machine excavate to formation level if he uses a plain edged bucket to his machine, operates it with care, and uses the back of the bucket to re-compact any small amounts of loose material. Large open areas excavated by scraper or dozer have to be graded, and re-compacted using appropriate compaction machinery.

A formation in soft clay can be severely disrupted by tracked or wheeled excavating machinery. No amount of re-compaction of disturbed, over-wet clay will prove satisfactory; it has to dry out to a suitable moisture content before it can be rolled and compacted back. If a contractor uses a D8 to excavate down to formation level in such material, the formation surface will be so churned up by the grips of the D8 tracks that it will be rendered useless as a formation. If the contractor does not use the right method on soft clays, the resident engineer must warn him that all disturbed material will have to be removed and the excavation refilled with suitable other material or concrete at the contractor's expense. The excavation should be undertaken by using an hydraulic hoe working backwards so that it does not have to stand on the formation. As it works backwards, suitable hardcore or other blinding material can be dozed progressively forward onto the exposed formation and compacted. Alternatively it may be possible to use a flat tracked loader shovel to skim off the last 150～225mm of excavation, any loose material being either removed by hand labour or rolled back with a light roller before placing of the base course for a road or blinding concrete.

The presence of springs in a soft formation material exacerbates formation finishing problems. Usually the specification will require spring water to be led away by grips or drains to a pump sump which is continuously dewatered to prevent softening of the formation. If springs are encountered and have not been anticipated, or the method of dealing with them is not specified or shown on the drawings, the resident engineer should report the situation to the engineer. Special measures are often required to deal with springs to ensure safety, of the structure to be built on a formation containing them.

For large open excavations, such as when road cuttings have to be made and the material tipped to form embankments, or for building an earth dam from open borrow pit areas, the motorscraper is the most economical machine for excavating, transporting and placing clays and clay-sand mixes. But the gradients traversed need to be gentle and the

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