普通高等教育土木与交通类"十二五"规划教材

道路桥梁与交通工程专业英语

主　编　宋云连　崔亚楠
副主编　闫景晨　胡　兵　尹春娥

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内 容 提 要

本书编写时充分吸收了最新的科技成果，使用了大量的专业词汇，内容充实，编排合理。全书分五大部分，第 1 部分重点介绍土木工程（包括道路桥梁和建筑工程）和交通工程专业基础知识；第 2 部分介绍现代道路和桥梁工程专业知识；第 3 部分介绍交通工程专业方面的内容；第 4 部分介绍结构工程方面的内容；第 5 部分介绍专业英语的翻译技巧以及英文摘要和致谢词写作的基本知识；附录部分列举了道路桥梁工程和交通工程中常用的专业词汇。

本书可作为土木工程（包括交通工程和建筑工程方向）及交通工程专业英语教材，面向高等院校土木工程、道路桥梁与渡河工程专业、交通工程专业以及相近专业学生选用，也可供有关专业技术人员学习参考。

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前言

本书是土木工程专业和交通工程专业的一门专业基础课。本书主要按照高等学校土木工程专业中的交通土建方向，即道路桥梁方向与交通工程专业教学指导委员会审定的《专业英语》教材编写大纲的要求编写的。同时作为拓展学习兼顾考虑了土木工程专业中的建筑工程方向。专业英语作为基础英语的后续课程，重点是培养学生阅读和翻译英文专业科技书刊的能力，提高阅读翻译文献资料的质量和速度。

本书编写时充分吸收了最新的科技成果，使用了大量的专业词汇，内容充实，编排合理。全书分五大部分，第1部分重点介绍土木工程和交通工程专业基础知识，涉及土力学、测量、地质、工程合同、道路类型、结构设计及交通工程简介等方面的内容。第2部分为现代道路和桥梁工程专业知识，涉及道路选线、路线交叉、道路横断面、路基路面结构、土体稳定、道路排水养护和施工、计算机在道路中的应用、各种桥梁结构形式及其应用特点。第3部分为交通工程专业方面的内容，涉及交通规划、交通管理和控制、交通设施、智能交通等。第4部分为结构工程方面（拓展学习）的内容，涉及建筑工程中的材料、荷载、钢结构、砌体结构、墙体和地面结构、挡土墙结构和高层结构设计等。第5部分为专业英语的翻译技巧以及英文摘要和致谢词写作的基本知识。附录部分主要列举了道路桥梁工程和交通工程中常用的专业词汇。

本书的课文和阅读材料参考了众多近期英文原版书刊，涵盖了道路、桥梁、建筑工程与交通工程的规划、设计、施工、管理各环节常用的专业词汇。取材时考虑难度适中，既注意英语语言的训练，又重视专业领域当代最新知识的传递。

为便于学习者使用，每课之后附有生词和形式多样的练习，目的在于帮助读者更好地掌握课文中重要的语言材料。书后附有疑难语句注释及道路桥梁工程与交通工程两个专业相关的大量专业词汇，这些是供参考和学习用的。

本书的另一个特点是课文中编排了一些与文章相关的插图和表格，对正确领会课文大有益处。本书将每篇文章以及对应阅读文献、附带习题和对应注释编写为一个知识单元。本书编写安排如下：

全书由内蒙古工业大学宋云连组织编写，其中Lessons 9～14、Lessons 42～44以及附录Ⅱ由宋云连编写；Lessons 15～21，Lesson 35由崔亚楠编写；

Lessons 1～6 由闫景晨编写；Lesson 8、Lessons 22～38 由胡兵编写；Lessons 29～32 由黄小燕编写；Lessons 33～34 由李超编写；另外，Lesson 7、Lessons 36～41 由华北水利水电学院尹春娥编写；第五部分由内蒙古大学南雪兰编写。

本书为土木工程及交通工程等专业的英语教材，面向高等院校土木工程、道路桥梁与渡河工程专业、交通工程专业，以及相近专业学生选用，也可供有关专业技术人员学习参考。

全书承蒙内蒙古大学交通学院穆怀旗教授仔细审阅，特此致谢。

由于编者水平有限，缺点和错误在所难免，热忱欢迎读者指正，并将意见寄内蒙古工业大学土木工程学院道路与交通系（邮编 010051）。

编 者

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Part Ⅰ General Knowledge for Civil Engineering and Traffic Engineering

Lesson 1 Soils and Its Properties

1 Soils in situ

Start digging with hand tools at almost any undeveloped site and the first layer of material exposed will be organic in nature—it will contain living organisms and their decomposing and arising will be mechanically weak. ① This topsoil is unsuitable for use for engineering purposes and is therefore set aside during construction, either for disposal or for reuse in planted areas upon completion of construction works.

Below the topsoil will lay an inorganic material whose properties may be reliably quantified and which is often suitable as a foundation for the pavement. This will sometimes be in the form of "rock" —such as limestone, granite, sandstone and the like—but is more often found to be the soil. A common definition of "rock" in this context is that the term shall include any hard natural or artificial material requiring the use of blasting or pneumatic tools for its removal but excluding small individual masses; "soil" is, by default, any other material found below ground level. Note that these descriptions differ from those used by the geologist, to whom all naturally occurring non-fluid materials are rock.

A further sub-division is often made in the case of soils—material may be either "suitable", that is to say, it may be used as an engineering material somewhere in the works, perhaps as fill in an embankment, or it may be unsuitable, in which case it is considered to be insufficiently stable for reuse elsewhere except for the forming of non-load bearing mounds. ② A typical application for unsuitable material is in the forming of mounds to act as visual and acoustic screening to a new road.

A naturally occurring soil will consist of particles of solid material, the voids between which are to a greater or lesser extent occupied by water. The physical properties of the soil will depend on the nature of these particles, the proportion that the volume of voids present bears to that of the whole body of material, and the amount of water present. In considering the suitability of a soil to support a pavement or other structure we are particularly concerned with the soil's ability to resist deformation caused by applied loads. Deformation may be caused by the soil tending to flow under the action of the applied load, or by its changing in volume.

Volume changes in soils resulting in settlement at the surface are caused by a limited rearrangement of the soil particles, resulting in a reduction in the proportion of voids present in the soil. Where the water or air originally present in the voids is able to leave the system quickly, as for example in the case of a coarse-grained soil with large voids between the particles, then such volume changes are not a great problem, since full settlement can be achieved by readily available techniques within a short period. In other cases, where the soil does not drain so freely, water in particular can only be expelled from the system by the continuous application of a substantial load over a long period. The first form of settlement, which may be induced by the use of compaction plant, is known as immediate settlement; and the second is known as consolidation settlement.

Immediate settlement is a property of coarse grained soils such as sands and gravels while consolidation settlement is characteristic of soils consisting of very small individual particles such as clay and silt. For this and other reasons with the range of particle sizes, the engineer is often concerned about soil.

The particle size distribution of a soil is often determined by sieve analysis. A full description of such a test is given in BS 1377 "Methods of testing soils for civil engineering purposes". The test apparatus consists of a series of sieves of gradually reducing standard sizes arranged vertically above one another with the coarsest at the top, all capable of being agitated by some mechanical means. The soil to be tested is dried and introduced to the top sieve, the whole stack of sieves shaken for some time, and the proportion retained on each sieve is determined by subtractive weighing and expressed as a proportion of the mass of the whole.

The knowledge of particle size distribution is of considerable value in assessing the likely behavior of the soil under a variety of circumstances. Soils with relatively large particles present free drainage paths for water in the soil and, are therefore capable of being easily compacted; water can leave the system early. Very fine textured soils such as clays do not share this property and so are much less suitable for use as fill material, particularly where early stability is important such as beneath pavements and other structures.

2 Cohesive soils

Very fine grained soils exhibit the property that when slightly moist and when squeezed in the hand they may readily be formed into coherent lumps; the soils particles tend to stick together. This property is not shared by granular soils. Soils which stick together in this way are said to be cohesive; the most common cohesive soil is clay.

In their natural state clay particles are laminar, strongly bonded within each particle, but only weakly bonded among one another. The lamina form of the particles tends to promote slip which is further assisted by the presence of water. Typically, clay contains water in two distinct ways—water intimately linked to the clay particles by adsorption, and as free water. As the amount of water present in the system increases, so the plasticity readiness of the clay to deform increases, wet clay is very plastic and is often unsuitable for use in or beneath the pavement.

3 The properties of soils

3.1 Liquid and plastic limits

The liquid limit of a soil is defined as the moisture content at which a soil passes from the plastic to the liquid state as defined by the liquid limit test. Liquid limit may be determined in various standard ways; these are described in BS 1377 and elsewhere. The most convenient and frequently used test is that using the cone penetrometer. The test consists of taking a sample of the soil passing a 425 micron sieve, mixing this thoroughly with water and placing it into a standard metal cup. A needle of standard shape and weight is then applied to the surface of the sample and is allowed to bear onto it for five seconds. The penetration into the sample is recorded to the nearest 0.1 mm. The moisture content of the soil sample is determined. This process is repeated several times with different moisture contents and a graph of penetration versus moisture content is drawn. The moisture content corresponding to a cone penetration of 20 mm is obtained from this graph and reported as a percentage to the nearest whole number as the liquid limit of the soil obtained by the cone penetrometer method. This method is preferred as it yields the most reproducible results.

Plastic limit is again a property of cohesive soils and is defined as the moisture content at which a soil becomes too dry to be a plastic condition as defined by the plastic limit test. The standard test consists of taking a 15 gram sample of the soil and mixing it with distilled water until it becomes plastic enough to be rolled into a ball, the material is then repeatedly rolled by hand into a thread of 3 mm diameter, the moisture content gradually being reduced by evaporation in the process. Eventually the soil becomes so dry that it crumbles when rolled into a 3 mm thread; this moisture content is reported as the plastic limit.

Thus both liquid and plastic limits are moisture contents, expressed as percentages by mass. Liquid limit of course always exceeds the magnitude of the plastic limit, and the difference between the two indicates the way in which the strength properties of the soil vary with changes in the moisture content. This numerical difference is known as the plasticity index (PI), thus:

Plasticity Index=Liquid Limit minus Plastic Limit has been found to bear an empirical relationship to the CBR of soft cohesive soils. Since the liquid and plastic limits tests have been found to give superior repeatability to the CBR test, it is this former which is used in the pavement design process. We have seen that CBR depends at least in part on the service conditions—moisture content and surcharge.

3.2 Moisture content

The moisture content of a soil has an effect on its behavior in that very dry cohesive soils are difficult to compact, very wet granular or cohesive soils lack stability and are difficult to compact, and the moisture content of a soil can influence chemical reactions taking place within it.③ Moisture content is defined as the ratio of the mass of water present in a body of soil to the mass of the dry soil particles. It is often expressed as a percentage and is measured by weighing a sample of the soil, drying it—usually in an oven at a temperature of 105 ℃, and weighing it again. The mass of water is determined by Subtraction.

New Words and Expressions

1. in situ	现场，在原位置
2. organic	*a.* 有机的
3. living	*a.* 天然的，未经开采过的
4. organism	*n.* 有机体，有机组织；结构，构造
5. granite	*n.* 花岗岩
6. pneumatic	*a.* 压缩空气推动的；汽动的；风动的
7. mass	*n.* 块，堆，团，体，质量
8. embankment	*n.* 路堤
9. bear	*v.* 支，支持；背，负担，负载，负荷；承担
10. mound	*n.* 堤；护堤；土墩，土山；小山，小丘
11. acoustic	*a.* 听觉的，声学的
12. present	*a.* 现有的，现存的
13. settlement	*n.* 沉降，沉陷；沉淀物，沉积物
14. coarse	*a.* 粗的，粗糙的
15. gain	*n.* （沙、金、盐等的）粒，颗粒，晶粒
16. expel	*v.* 射出（子弹等），排出（气体等）
17. plant	*n.* 设备，装置；（工）厂，车间；（农）场
18. gravel	*n.* 砂石，砾
19. gravel bed	砂砾层
20. clay	*n.* 黏土；泥土
21. silt	*n.* 粉性土
22. sieve	*n.* （细孔）筛
23. consolidation settlement	固结沉降
24. agitate	*v.* 搅动，摇动
25. stack	*v.* 层积，堆积；*n.* ［英］一堆（木材）等的计量单位
26. stack of sieves	套筒筛

27. subtractive　*a.* 减少的；（应）减去的，带有负号的
28. considerable　*a.* 该注意的，应考虑的，不可忽视的，重要的
29. moisture content　含水量
30. cone　*a.* 圆锥，锥形的；锥面；锥体
31. micron　*n.* 微米（100 万分之一米，符号 μm）
32. penetration　*v.* 针入，浸透；透过；贯入，贯入度
33. yield　*v.* 生出，产生（作物、报酬、利益等）
34. CBR＝California bearing ratio　加州承载比
35. surcharge　*v.* 过重，超载，附加荷载

Exercises

Ⅰ. True or False

1. Below the topsoil will lay an organic material whose properties may be reliably quantified and which is often suitable as a foundation for the pavement. (　　)

2. The liquid limit of a soil is defined as the moisture content at which a soil passes from the plastic to the liquid state as defined by the liquid limit test. (　　)

3. Moisture content is defined as the ratio of the mass of water present in a body of soil to the mass of the dry soil particles. (　　)

4. The liquid limit of the soil will be obtained by the cone penetrometer method when the moisture content of the soil sample is determined. (　　)

Ⅱ. Read and Choose the best one

1. Based on the definition of rock in this article, which one is not rock as follows. ________.

A. Limestone　　B. Granite　　C. Gravel　　D. Sandstone

2. The physical properties of the soil will not depend on ________.

A. components of the soil

B. the nature of these particles

C. the proportion that the volume of voids presents

D. the amount of water present

3. What is of considerable value in assessing the likely behavior of the soil under a variety of circumstances? ________.

A. Knowledge of particle size distribution

B. The proportion of voids present in the soil

C. The structure of the soil

D. The components of the soil

4. The liquid limit of a soil is defined as ________.

A. the moisture content at which a soil becomes too dry to be a plastic condition

B. the process in which a soil becomes too dry to be a plastic condition

C. the moisture content at which a soil passes from the plastic to the liquid state

D. the process in which a soil passes from the plastic to the liquid state

5. The difference between liquid limits and plastic limits is known as ________.

A. moisture content B. the penetration of the samples

C. liquid index D. plasticity index

6. Moisture content is defined as ________.

A. the ratio of the mass of water present in a body of soil to the mass of the soil

B. the difference between liquid limits and plastic limits

C. the ratio of the mass of water presents in a body of soil to the mass of the dry soil particles

D. the penetration of the samples

Ⅲ. Translate the following into English

1. 土的物理性质由土颗粒的性质，当前的空隙体积所占土体体积的比例和土体内现有的土颗粒含量来决定。

2. 瞬时沉降是粗颗粒土的特性，比如砂子和砾石。而固结沉降是那些由细小的独立的颗粒组成的土的特征，如黏土和粉性土。

3. 自然状态的黏土颗粒是薄片状的，结构内部连接紧密。但彼此之间的连接很弱。薄片结构的颗粒很容易引起滑动，空隙中的水可以进一步促进滑动发展。

4. 塑限试验内容是取 15 克的土样，与蒸馏水混合，直到有足够的塑性能揉搓成土团。将土团在手掌中反复揉搓成直径是 3mm 的土条，在揉搓的过程中，土条中的水渐渐蒸发变干。

5. 当搓到土条直径恰好为 3mm 时，土条自动断裂为若干段。最后，土体变得很干以至于当揉搓直径是 3mm 的土条时土条碎断，这时土的含水量就是土的塑限。

Reading Material The Soil Mechanical Tests

In order that the response of a soil to changed circumstances can be predicted, the engineer often requires physical tests to be carried out. In the context of highway engineering the tests most generally used are those for particle size distribution as previously discussed, moisture content, compaction characteristics, California bearing ratio and liquid and plastic limits.

1 Moisture condition test

The moisture condition test is devised to enable the suitability of soil for use as engineering materials to be rapidly and reliably assessed in the laboratory or on site. It has the advantage of providing results quickly and is therefore suited to quality control in processes which are expected to modify the condition of a soil—such as lime stabilization.

The test consists of applying standard blows of a falling weight to a sample of soil and monitoring the compactible effect which it has. The degree of compaction of the soil sample within the standard 100 mm diameter, mould is measured by means of a veneer

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