土木工程专业英语

主编　李丰

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土木工程专业英语

English for Civil Engineering

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内 容 提 要

本书结合本科生教学特点和土木工程专业培养应用型人才的需要，从专业文章出发，介绍专业英语的常见范畴、词汇，以及其在土木工程领域中的应用和技巧。全书共分18个单元，内容涵盖土木工程总论、建筑材料、建筑结构形式、钢筋混凝土、应力分析、基础工程、钢结构、混凝土工程施工、隧道工程、高层建筑、桥梁工程、工程事故、经典中国建筑、造价工程、项目管理、进度控制、计算机辅助设计和建筑经济。每个单元由正文、阅读材料和常用口语句型三部分组成，正文后附有疑难词汇、填空、翻译等练习题，阅读材料后附有简答及口语练习题，附录内容包括常见专业词汇和专业文献翻译技巧。

本书可作为高等院校土木工程、工程管理、建筑环境、工程造价和工程测量等专业的教材，也可供广大土木行业工程技术人员参考。

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前言

随着社会生活的信息化和经济的全球化，英语的重要性日益突出。英语作为最重要的信息载体之一，已成为国际社会各个领域中使用最广泛的语言。英语运用能力已被提升到了必备技能的范畴。同样，专业英语是拓展本专业知识面的工具，是引领进入本学科知识领域世界前沿的钥匙。

2015年教育部颁布了《普通高等学校本科专业目录》，各个专业基本都对大学英语水平提出明确要求。根据大学英语教学大纲要求，大学英语分为基础英语和专业英语两个学习阶段。其中，第一学年和第二学年完成基础英语学习，第三学年或第七学期完成专业英语学习。专业英语教学注重应用，本科开设时间一般为最后一个学年的上学期，此时学生已经具备一定的专业理论知识。因此，专业英语的教学更加强调专业性、应用性和灵活性。教学目的以大学英语为基础，进行专业方向的实践应用，进一步掌握科技英语技能。

编者通过对土木工程专业英语教材市场考察，参考土木工程基础理论的国外文献，结合多年专业英语教学工作中积累的丰富经验，潜心研究，编写本教材。本教材不仅专注土木工程知识的针对性，而且注重从调动学习主动性、激发学习兴趣着手。本教材章节划分及内容具有以下特点：

1. 本教材阅读和口语部分由18个单元、36篇文章和18组口语句型组成。每个单元由正文、阅读材料和常用口语句型三部分组成，正文后附有疑难词汇、填空、翻译等练习题，有助于进一步理解文章。36篇文章内容涉及土木工程总论、建筑材料、建筑结构形式、钢筋混凝土、应力分析、基础工程、钢结构、混凝土工程施工、隧道工程、地铁工程、高层建筑、桥梁工程、工程事故、工程防火减灾、经典中国建筑、造价工程、工程招投标、合同管理、项目管理、进度控制、计算机辅助设计、BIM技术应用和建筑经济。常用口语句型与该节单元文章内容相对应，有助于加强专业英语的实际应用。

2．本教材附录由六部分组成，包括常用数学符号的英文表达、常用计量单位的英文表达、常用土木工程专业术语、常用建筑设计专业术语、常用项目管理专业术语和课文常用词汇与表达，以提供写作词汇帮助。

3．本教材实用性强、针对性强。提供的文章对应插图，激发学习的兴趣，逐步启发读者学习和使用专业英语。例如，教学初期，教师可以引导学生阅读简单易懂的Text文章，帮助其理解专业英文词汇，逐步形成英文阅读习惯。然后，通过每个单元的课后题练习和Reading Material的阅读训练，帮助学生掌握阅读方法和技巧，再辅以口语句型练习，最终使学生能够比较熟练地查找和阅读相关国外专业文献，并将其转化为实际应用能力。

本书由李丰担任主编，王虹、朱奎胜、石彬彬担任副主编。具体编写分工如下：第1、2、4、6、8、13、16单元由李丰编写，第9、14、15、17单元由王虹编写，第3、10、11单元由朱奎胜编写，第5、7、12、18单元由石彬彬编写。

本教材的编写受到河南省教育厅科学技术研究重点项目13A560018、河南省教育厅自然科学研究重点项目12A560004和河南工程学院博士基金项目D2014003的支持。此外，在编写和出版过程中得到曹丰导师严谨专业的指导。特此致谢！

在编写过程中，参阅国内外大量专业相关文献与书籍，在此对各参考文献的作者表示衷心的感谢。同时，由于编者水平有限，书中错误和不妥之处在所难免，恳请使用本教材的师生提出宝贵意见。

编　者

目 录

Unit 1

1. Text

Civil Engineering

Civil engineering, the oldest of the engineering specialties, is the planning, design, construction, and management of the built environment. This environment includes all structures built according to scientific principles, from irrigation and drainage systems to rocket-launching facilities.

Civil engineers build roads, bridges, tunnels, dams, harbors, power plants, water and **sewage** systems, hospitals, schools, mass transit, and other public facilities essential to modern society and large population concentrations. They also build privately owned facilities such as pipelines, skyscrapers, and other large structures designed for industrial, commercial, or residential use. In addition, civil engineers plan, design, and build complete cities and towns, and more recently have been planning and designing space platforms to house self-contained communities.

The word civil derives from the Latin for citizen. In 1782, Englishman John Smeaton used the term to differentiate his nonmilitary engineering work from that of the military engineers who predominated at the time. Since then, the term civil engineering has often been used to refer to engineers who build public facilities, although the field is much broader.

Scope. Because it is so broad, civil engineering is subdivided into a number of technical specialties. Depending on the type of project, the skills of many kinds of civil engineer specialists may be needed. When a project begins, the site is surveyed and mapped by civil engineers who locate utility placement—water, sewer, and power lines. Geotechnical specialists perform soil experiments to determine if the earth can bear the weight of the project. Environmental specialists study the project's impact on the local area, the potential for air and groundwater pollution, the project's impact on local animal and plant life, and how the project can be designed to meet government requirements aimed at protecting the environment. Transportation specialists determine what kinds of facilities are needed to ease the burden on local roads and other transportation networks that will result from the completed project. Meanwhile, structural specialists use preliminary data to make detailed designs, plans, and specifications for the project. Supervising and coordinating the work of these civil engineer specialists, from beginning to end of the project, are the construction management specialists. Based on information supplied by the other specialists, construction management civil engineers estimate quantities and costs of materials and labor, schedule all work, order materials and equipment for the job, hire contractors and subcontractors, and perform other supervisory work to ensure the project is completed on time and as specified.

Throughout any given project, civil engineers make extensive use of computers. Computers are used to design the project's various elements (computer-aided design, or CAD) and to manage it. Computers are a necessity for the modern civil engineer because they permit the engineer to efficiently handle the large quantities of data needed in determining the best way to construct a project.

Structural engineering. In this speciality, civil engineers plan and design structures of all types, including bridges, **dams**, power plants, supports for equipment, special structures for offshore projects, the United States space program, **transmission** towers, giant astronomical radio telescopes, and many other kinds of projects. Using computers, structural engineers determine the forces a structure must resist: its own weight, wind and hurricane forces, temperature changes that expand or contract construction materials, and earthquakes. They also determine the combination of appropriate materials: steel, concrete, plastic, stone, **asphalt**, **brick**, aluminum, or other construction materials. See Fig.1-1.

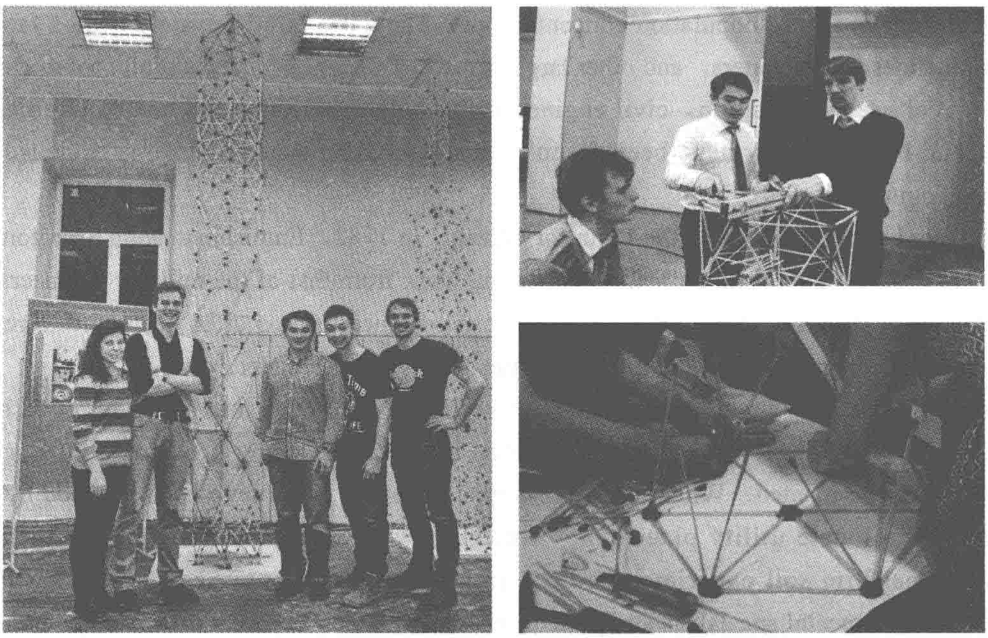

Fig.1-1 Students of the civil structural engineering

Water resources engineering. Civil engineers in this specialty deal with all aspects of the physical control of water. Their projects help prevent floods, supply water for cities and for irrigation, manage and control rivers and water runoff, and maintain beaches and other waterfront facilities. In addition, they design and maintain harbors, canals, and locks, build huge hydroelectric dams and smaller dams and water impoundments of all kinds, help design **offshore** structures, and determine the location of structures affecting navigation.

Geotechnical engineering. Civil engineers who specialize in this field analyze the properties of soils and rocks that support structures and affect structural behavior. They evaluate and work to minimize the potential settlement of buildings and other structures that stems from the pressure of their weight on the earth. These engineers also evaluate and determine how to strengthen the stability of **slopes** and fills and how to protect structures against earthquakes and the effects of groundwater.

Environmental engineering. In this branch of engineering, civil engineers design, build, and supervise systems to provide safe drinking water and to prevent and control pollution of water supplies, both on the surface and underground. They also design, build, and supervise projects to control or eliminate pollution of the land and air. These engineers build water and wastewater treatment plants, and design air scrubbers and other devices to minimize or eliminate air pollution caused by industrial processes, incineration or other smoke-producing activities. They also work to control toxic and hazardous wastes through the construction of special dump sites or the **neutralizing** of toxic and hazardous substances. In addition, the engineers design and manage sanitary landfills to prevent pollution of surrounding land.

Pipeline engineering. In this branch of civil engineering, engineers build pipelines and related facilities which transport liquids, gases, or solids ranging from coal slurries (mixed coal and water) and semi-liquid wastes of water, oil, and various types of highly **combustible** and noncombustible gases. The engineers determine pipeline design, the economic and environmental impact of a project on regions it must **traverse**, the type of materials to be used—steel, concrete, plastic, or combinations of various materials—installation techniques, methods for testing pipeline strength, and controls for maintaining proper pressure and rate of flow of materials being transported. When hazardous materials are being carried, safety is a major consideration as well.

Construction engineering. Civil engineers in this field oversee the construction of a project from beginning to end. Sometimes called project engineers, they apply both technical and managerial skills, including knowledge of construction methods, planning, organizing, financing, and operating construction projects. They coordinate the activities of virtually everyone engaged in the work: the surveyors; workers who lay out and construct the temporary roads and ramps, **excavate** for the foundation, build the forms and pour the concrete; and workers who build the steel framework. These engineers also make regular progress reports to the owners of the structure.

Transportation engineering. Civil engineers working in this specialty build facilities to ensure safe and efficient movement of both people and goods. They specialize in designing and maintaining all types of transportation facilities, highways and streets, mass transit systems, railroads and airfields, ports and harbors. Transportation engineers apply technological knowledge as well as consideration of the economic, political, and social factors in designing each project. They work closely with urban planners, since the quality of the community is directly related to the quality of the transportation system. See Fig.1-2.

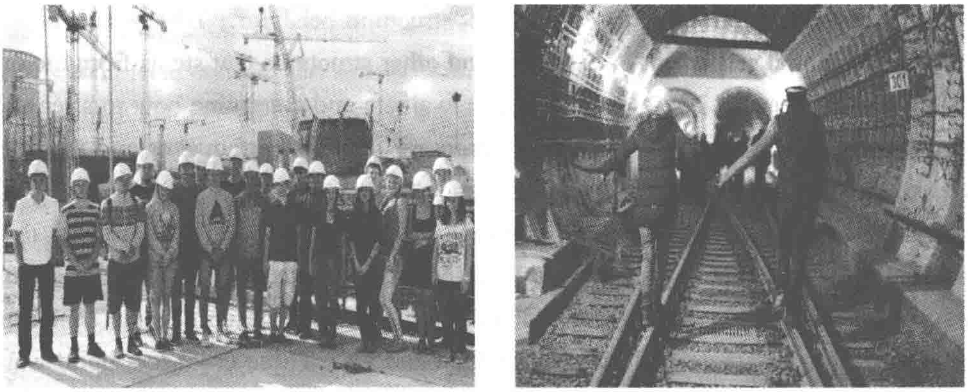

Fig.1-2 Students of construction engineering and transportation engineering

Community and urban planning. Those engaged in this area of civil engineering may plan and develop communities within a city, or entire cities. Such planning involves far more than engineering consideration. Environmental, social, and economic factors in the use and development of land and natural resources are also key elements. These civil engineers coordinate planning of public works along with private development. They evaluate the kinds of facilities needed, including streets and highways, public transportation systems, airports, port facilities, water-supply and wastewater-disposal systems, public buildings, parks and recreational and other facilities to ensure social and economic as well as environmental well-being.

Photogrametry, surveying, and mapping. The civil engineers in this specialty precisely measure the Earth's surface to obtain reliable information for locating and designing engineering projects. This practice often involves high-technology methods such as satellite and **aerial** surveying, and computer-processing of photographic imagery. Radio signals from satellites, scans by laser and **sonic** beams, are converted to maps to provide far more accurate measurements for boring tunnels, building highways and dams, plotting flood control and irrigation projects, locating subsurface geologic formations that may affect a construction project, and a host of other building uses.

Other specialties. Two additional civil engineering specialties that are not entirely within the scope of civil engineering but are essential to the discipline are engineering management and engineering teaching.

Engineering management. Many civil engineers choose careers that eventually lead to management. Others are able to start their careers in management positions. The civil engineer-manager combines technical knowledge with an ability to organize and coordinate worker power, materials, machinery, and money. These engineers may work in government—municipal, county, state, or federal; in the U.S. Army Corps of Engineers as military or civilian management engineers; or in semiautonomous regional or city authorities or similar organizations. They may also manage private engineering firms ranging in size from a few employees to hundreds.

Engineering teaching. The civil engineer who chooses a teaching career usually teaches both graduate and undergraduate students in technical specialties. Many teaching civil engineers engage in basic research that eventually leads to technical innovations in construction materials and methods. Many also serve as consultants on engineering projects, or on technical boards and commissions associated with major projects. See Fig.1-3.

Fig.1-3 Students in surveying, and mapping

Vocabulary and Expressions

sewage ['sju(:)idʒ] *n*. 下水道
scope [skəup] *n*. 范围；余地；视野；眼界；导弹射程 *vt*. 审视
dam [dɑːm] *vt*. 控制；筑坝 *n*. [水利] 水坝；障碍
transmission [trænz'miʃən] *n*. 传动装置，[机] 变速器；传递；传送；播送
asphalt ['æsfælt] *n*. 沥青；柏油 *vt*. 以沥青铺 *adj*. 用柏油铺成的
brick [brik] *n*. 砖，砖块；砖形物
offshore ['ɔ(:)fʃɔː] *adj*. 离岸的
slope [sləup] *n*. 斜坡；倾斜；斜率
neutralize ['njuːtrəlaiz] *vt*. 中和
combustible [kəm'bʌstəbl] *adj*. 易燃的；易激动的 *n*. 可燃物；易燃物
traverse ['trævə(:)s] *vt*. 穿过；横贯 *n*. 横木
excavate ['ekskəveit] *vt*. 挖掘；开凿
aerial ['ɛəriəl] *adj*. 空中的，航空的
sonic ['sɔnik] *adj*. 声速的；声音的；音波的

Exercises

1.1 Fill in the blanks with the information given in the text.

① Civil engineers build roads, bridges, __________, ____________, harbors, power plants, ______________systems, hospitals, schools, _________, and other public facilities essential to modern society and large population concentrations.

② Structural engineers determine the______________a structure must resist: its own weight, wind and_____________________, temperature changes that expand or contract construction materials, and ________.

③ Civil engineers who specialize in geotechnical engineering field analyze the properties of ____________and____________that support structures and affect structural behavior.

④ Transportation engineers apply technological knowledge as well as consideration of the___________, political, and______________factors in designing each project. They work closely with ___________planners, since the quality of the community is directly related to the quality of the transportation system.

⑤ ______________, surveying, and mapping practice often involves high-technology methods such as satellite and___________, and computer-processing of__________imagery.

1.2 Translate the following passages from English into Chinese.

In structural engineering speciality, civil engineers plan and design structures of all types, including bridges, dams, power plants, supports for equipment, special structures for offshore projects, the United States space program, transmission towers, giant astronomical radio telescopes, and many other kinds of projects. Using computers, structural engineers determine the forces a structure must resist: its own weight, wind and hurricane forces, temperature changes that expand or contract construction materials, and earthquakes. They also determine the combination of appropriate materials: steel, concrete, plastic, stone, asphalt, brick, aluminum, or other construction materials.

2. Reading Material

Structural Engineering

Structural engineering is a branch of civil engineering concerned with the designing and execution of all types of structures. Its applications are extremely diverse. A great deal of what structural engineers do involves designing things to be built, and then helping to build them. The architect comes up with a building design, and then it's the structural engineer's responsibility to fit the structure to the architecture, and decide on what structural system is best suited to that particular building. Structural engineers design the beams, the columns, the basic members to make the building stand up.

The designing starts with the understanding of the project. The structural engineer must design structures to be safe for their users and make sure what they designed to be serviceable.

A structural engineer needs to know about the forces that act on stucture: the stress put on a bridge by heavy traffic or on every structure by seasonal temperature changes or earthquake, or on a high building by strong winds. They must first calculate the dead loads, live loads, earthquake and wind loads, and their combination, then select structural system and construction materials. Finally, the designer analyzes structures and designs. The live loads are usually provided by load code for the design of the building structure. Due to the nature of some loading conditions, sub-disciplines within structural engineering have emerged, including wind engineering and earthquake engineering. Design considerations will include strength, stiffness, and stability of the structure when subjected to loads which may be static or dynamic.

The same structure in different locations, exhibits different designs, because of ground water levels, soil characteristics. Foundation is particularly important in the whole structure design. If the soil is soft, it should be strengthened. If the substructure is below the ground water level, methods such as well points, or pumping from sumps should be taken to remove water. Other considerations include cost, constructability, safety, aesthetics and sustainability.

Analysis of structures aimed at determining the forces and deformations existed in members. These forces such as tension, compression, bending shear and torsion could make structures destroyed. Excessive lateral sway may cause recurring damage to partition, ceilings, and other architectural details and may cause discomfort to the occupants of the building. This deformation must be kept within acceptable limits.

Structural design and structural analysis are components of structural engineering and a key component in the structural design process. They are interlocked subjects. The structural engineering has the objective of proportioning a structure such that it can safely carry the loads to which it may be subjected. Structural analysis provides the internal forces, and structural design utilizes those forces to proportion the members or systems of members. Without structural analysis, design is impossible. See Fig.1-4.

Fig.1-4 Analysis of structures' aim and design

Member sizes designed are often from experience and comparison to some similar design and use of available empirical rules combined with some rough calculations. Most designs are initially based on the strength and stability criteria, while other criteria are used to carry out checks at a later stage. To arrive at an optimum and economical design, it is usually to repeat the analysis with the revised sizes and shapes. In this stage, computer is a useful tool.

Structural engineers should know the whole process of the project. The speedy execution of the project requires the ready supply of all materials, equipment and labor when needed. The construction engineer must control the whole operations. These operations include: excavation, foundation and superstructure construction, electrical and mechanical installation. Excavation follows preparation of the site, it may be done by special excavator, and the soil excavated can be used for landscaping and fill. If the excavation areas are wet, dewatering and stabilizing of the soil become major operation; if the materials encountered hard, blasting will be needed. There are several types of foundation in different structures. If defects exist, the foundation must be strengthened. In superstructure construction, it generally consists of several operations: forming, concrete production, placement and curing. Electrical and mechanical systems need ancillary space to provide a comfortable environment. All these constructions must be proceeded according to drawings.

Structural engineers also inspect buildings, both during and after construction, and oversee the use of the concrete, steel and timber of which they are made. They must also be aware of both obvious uses for the structures and how these uses affect its design. For example, if they're putting in sensitive computer equipment or doing pharmaceutical work, you have to use a floor system that's very stiff and doesn't move much.

Like all engineers whose work may affect life, health or property, new structural engineers go through a rigorous training process during their first few years of work. This training involves several years of work experience under the supervision of experienced engineers and one or more state examinations, and results in a license as a professional engineer. This is one profession where an advanced degree is more of a necessity than an option. If you are really committed to structural engineering, you should get your master's degree in structural engineering or civil engineering as quickly as possible, the basic courses at the undergraduate level just can't touch on all the necessary aspects of structural engineering. Your advance in the profession is greatly impaired by not having a master's degree.

Along with specialized knowledge, a structural engineer needs a host of other skills to be able to interact with professional and nonprofessional partners. The abilities for sale, public speaking and time management are very important when we have to make contact with clients as a structural engineer, and problem resolution is a skill that isn't typically taught in engineering schools. But when there's an enormous amount of work, the skills to solve problems go on as quickly as possible.

For structural engineers, like other civil engineers, all the responsibilities they've assumed over the years are not just the professional responsibilities, but the personal liabilities, too.

2.1 Answer the following questions.

① What is structural engineering and what needs to know about the forces that act on structures being a structural engineer?

② What will new structural engineers do in order to go through a rigorous training process during their first few years of work?

2.2 Oral task.

Describe the feeling of being a structural engineers in your mind.

3. Oral Practice

Architectural Majors and Courses 建筑专业知识应用

① Can you tell me what major you are studying and how do you think of/about your major? 你能告诉我，你现在学什么专业吗？你认为你的专业怎么样？

② I am sure to treasure the good chance and to study hard to realize my dream. 我一定珍惜机会，刻苦学习，实现我的梦想。

③ By the way, what about the teaching facilities? 顺便问一下，你们学校的教室设施怎么样？

④ For vocational engineering colleges, it is effective and practical to integrate theory with practice and to do practice geared to the needs of the job. 对于专业工程院校，理论联系实际和对口实习是有效和实用的。

⑤ Would you please show me around your campus? 你愿意带我参观一下你们的校园吗？

⑥ Would you mind telling me what you are doing on the worksite? 你介意告诉我在工地现场你在做什么吗？

⑦ Last year, the project was awarded the National Construction Engineering Luban Award. 去年，这个工程项目获得了“全国建设工程鲁班奖”。

⑧ I wonder how many constructors there are on your worksite. 我想知道你们工地上有多少建筑工人。

⑨ I am very interested in your recruiting and using workers here. 我对你们这里的招聘及用工很感兴趣。

Unit 2

1. Text

Civil Engineering Materials

As an engineer, one must know about the materials used in the construction site. All structures are constructed of materials known as engineering materials or building materials. It is necessary for an engineer to be conversant with the properties of such materials. Civil engineering materials can be natural and man-made. They contain **cement**, metal, timber, concrete, **bituminous**, etc. Besides these traditional materials, new types of constructional materials are also investigated and developed and will be applied gradually. Now, green civil engineering materials and even **eco-materials** for civil engineering are recommended based on the consideration of sustainable development. This has the benefits of reducing energy, saving resources and protecting the environment, having minimum harm to human health.

Cement. Cement is obtained by burning a mixture of **calcareous** and **argillaceous** materials at a very high temperature. **Calcined** product is known as **clinker**. A small quantity of **gypsum** is added to the clinker and is **pulverized** into very fine powder known as cement. On **setting**, cement resembles a variety of sandstone found in Portland in England and is, therefore, called **Portland cement**.

Types of cement. By changing the chemical composition and by using different raw materials and additives, many types of cements can be manufactured to cater to the need of the construction industry for specific purposes. **Rapid hardening cement** is used where high strength is required instantly in initial stages. For example, repair works, early removal of **formwork**, etc. Low heat cement can be used in mass concreting works like construction of dams, etc. **Portland pozzolana cement** produces less heat of hydration and offers greater resistance to the attack of aggressive water. **Air-entraining cement** is produced by mixing a small amount of an air-entraining agent with ordinary Portland cement. By adding this, the properties of concrete can be changed and it also increases the frost resistance of hardened concrete. High strength cement is required for certain special works. To improve the strength a higher content of C_3S and higher **fineness** are incorporated in ordinary Portland cement. This cement can be used for railway sleepers, **prestressed concrete**, precast concrete and air-field works.

Concrete (Fig.2-1). Cement is mixed at or near the construction site with sand, aggregate (small stones, crushed rock, or gravel), and water to make concrete. Concrete has a high strength and its strength depends on the proportion in which cement, stones and water are mixed. It hardens with age and the process of hardening continues for a long time after the concrete has attained sufficient strength.

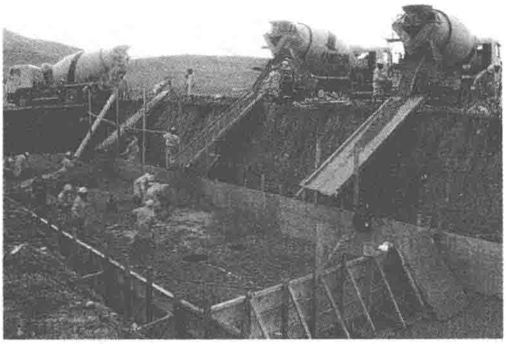

Fig.2-1 Concrete

Normal concrete has a comparatively low tensile strength and for structural applications it is normal practice either to incorporate steel bars to resist any tensile forces (steel reinforced concrete) or to apply compressive forces to the concrete to counteract these tensile forces (pre-stressed concrete or post-stressed concrete). Concrete is used structurally in buildings, **shell structures**, bridges, sewage-treatment works, railway sleepers, roads, dams, chimneys, harbours, off-shore structures and so on. It is used also for a wide range of precast concrete products which include concrete blocks, cladding panels, and pipes.

The impact strength, as well as the tensile strength, of normal concrete is low and this can be improved by the introduction of randomly orientated fibers into the concrete. Steel, **polypropylene**, **asbestos glass**, carbon and even wood fibers have all been used with some success in precast products and in-situ concretes, including pipes, building panels and piles.

Timber. Timber is one of the oldest known civil engineering materials (Fig.2-2). In addition to its usefulness as a structural material, timber has also fulfilled a role in temporary structures. Although timber is a kind of sustainable resource, the consumption speed of forests must be slowed down because of the relative slowness of tree growth.

Timber has a wide use in flooring, facing, skirting, windows, doors, stairs, **paneling** and furniture. The requirements for this purpose include ease of working and finishing, good grain pattern and appearance when clear-finished, dimensional stability in conditions of variability of temperature and humidity, both internal and external, and resistance to **infestation** and **fungal** attack, etc.

Nowadays timber is also playing an important role in **falsework** carpentry, such as shuttering for in-situ or precast concrete work, supporting formwork for brick or stone arch or