普通高等教育规划教材

土木工程专业英语

TUMU GONGCHENG ZHUANYE YINGYU

姜珂 主编　　魏健 靳慧霞 副主编

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·北京·

本书是为高等学校土木工程类专业学生编写的专业英语阅读教材。课文内容以结构工程、道路桥梁、岩土工程以及工程管理等专业背景为线索，主要介绍了建筑材料、结构设计及分析、道路桥梁设计及施工、场地勘察、土力学及地基基础以及工程项目管理等方面内容。材料的选取在涵盖专业基本知识的同时，还突出近年来土木工程的新发展及新知识。每个单元包括一篇正文和两篇阅读材料，阅读难度分别为简单、中等和较高三个层次，形成难易不同的阅读阶梯，以供不同读者根据需求在阅读时方便地选择；书后附有常用土木工程专业词汇，可供读者阅读及翻译专业文献时查阅使用。

本书适合作为高等学校土木工程类专业的专业英语阅读教材，也可作为设计、施工、管理等广大工程技术人员和研究生作为提高英语水平、丰富专业知识的阅读材料。

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前 言

土木工程是有着悠久历史的学科之一。近年来由于工程技术的进步和经济发展的需要，这门古老学科焕发出新的光彩，知识不断更新，技术日新月异。在这种背景下，我们所编的《土木工程专业英语》阅读材料在涵盖专业基本知识的同时，还力求突出土木工程的近年发展成果及未来发展趋势。

本书的主要特点如下：

（1）题材力求新颖。《土木工程专业英语》共22个单元，以结构工程、道路桥梁、岩土工程以及工程管理等专业背景为线索，主要介绍了建筑材料、结构设计及分析、道路桥梁设计及施工、场地勘察、土力学及地基基础以及工程项目管理等方面内容。题材均选自近年来出版的专业文献、书籍及网络上的相关知识内容，集文字、图表与图片于一体，注重激发学习者的兴趣和思考，使学习者在学习语言和专业基本知识的同时，了解土木工程领域的最新进展。

（2）难度层次递进。每个单元由正文、阅读素材1和阅读素材2三个部分组成，其阅读难度分别选择为简单、中等和较难，形成难易不同的阅读层次。每篇正文后配有课文注释和课后练习，注释简明扼要，练习则集语言训练与专业知识为一体。

（3）附有常用专业词汇。专业词汇的掌握是阅读好专业文献的重要基础，词汇的掌握也是今后进一步学习、阅读和写作的基石，因此，本教材最后附有土木工程专业词汇，可供读者阅读及翻译专业文献时查阅使用。

本书由姜珂主编，魏健、靳慧霞担任副主编，参编人员还有吴萍、刘冰、宋岩等。

由于编者的专业知识水平所限，本书还有许多不尽合理的地方，希望广大同仁和读者给予批评指正！在此也对编写过程中给予帮助的同事表示感谢！

编者

2010年6月

Contents

Unit 1

Text: Civil Engineering

Civil engineering is a professional engineering discipline that deals with the design, construction and maintenance of the physical and naturally built environment, including works such as bridges, roads, canals, dams and buildings. Civil engineering is the oldest engineering discipline after military engineering, and it was defined to distinguish non-military engineering from military engineering. It is traditionally broken into several sub-disciplines including environmental engineering, geotechnical engineering, structural engineering, transportation engineering, municipal or urban engineering, water resources engineering, materials engineering, coastal engineering, surveying, and construction engineering. Civil engineering takes place on all levels: in the public sector from municipal through to federal levels, and in the private sector from individual homeowners through to international companies.

History of the Civil Engineering Profession Engineering has been an aspect of life since the beginnings of human existence. Civil engineering might be considered properly commencing between 4000 and 2000 BC in Ancient Egypt and Mesopotamia when humans started to abandon a nomadic existence, thus causing a need for the construction of shelter. During this time, transportation became increasingly important leading to the development of the wheel and sailing. The construction of Pyramids in Egypt (circa 2700-2500 BC) might be considered the first instances of large structure constructions. Other ancient historic civil engineering constructions include the Parthenon by Iktinos in Ancient Greece (447-438 BC), the Appian Way by Roman engineers (c. 312 BC), and the Great Wall of China by General Meng T'ien under orders from Ch'in Emperor Shih Huang Ti (c. 220 BC). The Romans developed civil structures throughout their empire, including especially aqueducts, insulae[1], harbours, bridges, dams and roads.

Until modern times there was no clear distinction between civil engineering and architecture, and the term engineer and architect were mainly geographical variations referring to the same person, often used interchangeably. In the 18th century, the term civil engineering began to be used to distinguish it from military engineering.

The first self-proclaimed civil engineer was John Smeaton who constructed the Eddystone Lighthouse. In 1771 Smeaton and some of his colleagues formed the Smeatonian Society of Civil Engineers, a group of leaders of the profession who met informally over dinner. Though there was evidence of some technical meetings, it was little more than a social society.

In 1818 the Institution of Civil Engineers was founded in London, and in 1820 the eminent engineer Thomas Telford became its first president. The institution received a Royal Charter in

1828, formally recognising civil engineering as a profession. Its charter defined civil engineering as:

"...the art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states, both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation and docks for internal intercourse and exchange, and in the construction of ports, harbours, moles, breakwaters and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construction and application of machinery, and in the drainage of cities and towns."[2]

The first private college in the nation to teach Civil Engineering in the United States was Norwich University founded in 1819 by Captain Alden Partridge. The first degree in Civil Engineering in the United States was awarded by Rensselaer Polytechnic Institute in 1835. The first such degree to be awarded to a woman was granted by Cornell University to Nora Stanton Blatch in 1905.

History of the Science of Civil Engineering Civil engineering is the application of physical and scientific principles, and its history is intricately linked to advances in understanding of physics and mathematics throughout history. Because civil engineering is a wide ranging profession, including several separate specialized sub-disciplines, its history is linked to knowledge of structures, materials science, geology, soils, hydrology, environment, mechanics and other fields.

Throughout ancient and medieval history most architectural design and construction was carried out by artisans, such as stone masons and carpenters, rising to the role of master builder. Knowledge was retained in guilds and seldom supplanted by advances. Structures, roads and infrastructure that existed were repetitive, and increases in scale were incremental.

One of the earliest examples of a scientific approach to physical and mathematical problems applicable to civil engineering is the work of Archimedes in the 3rd century BC, including Archimedes Principle, which underpins our understanding of buoyancy, and practical solutions such as Archimedes' screw [3]. Brahmagupta, an Indian mathematician, used arithmetic in the 7th century AD, based on Hindu-Arabic numerals, for excavation (volume) computations.

Sub-disciplines of Civil Engineering

Structural Engineering Structural engineering is concerned with the structural design and structural analysis of buildings, bridges, towers, flyovers, tunnels, off shore structures like oil and gas fields in the sea, and other structures. This involves identifying the loads which act upon a structure and the forces and stresses which arise within that structure due to those loads, and then designing the structure to successfully support and resist those loads. The loads can be self weight of the structures, other dead load, live loads, moving (wheel) load, wind load, earthquake load, load from temperature change etc. The structural engineer must design structures to be safe for their users and to successfully fulfill the function they are designed for (to be *serviceable*). 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, such as furniture or self-weight, or dynamic, such as wind, seismic, crowd or vehicle loads, or transitory, such as temporary construction loads or impact. Other considerations include cost, constructability, safety, aesthetics and sustainability.

Geotechnical Engineering Geotechnical engineering is an area of civil engineering concerned with the rock and soil that civil engineering systems are supported by. Knowledge from the fields of geology, material science and testing, mechanics, and hydraulics are applied by geotechnical engineers to safely and economically design foundations, retaining walls, and similar structures. Environmental concerns in relation to groundwater and waste disposal have spawned a new area of study called geoenvironmental engineering where biology and chemistry are important.

Some of the unique difficulties of geotechnical engineering are the result of the variability and properties of soil. Boundary conditions are often well defined in other branches of civil engineering, but with soil, clearly defining these conditions can be impossible. The material properties and behavior of soil are also difficult to predict due to the variability of soil and limited investigation. This contrasts with the relatively well defined material properties of steel and concrete used in other areas of civil engineering. Soil mechanics, which define the behavior of soil, is complex due to stress-dependent material properties such as volume change, stress-strain relationship, and strength.

Transportation Engineering Transportation engineering is concerned with moving people and goods efficiently, safely, and in a manner conducive to a vibrant community. This involves specifying, designing, constructing, and maintaining transportation infrastructure which includes streets, canals, highways, rail systems, airports, ports, and mass transit. It includes areas such as transportation design, transportation planning, traffic engineering, some aspects of urban engineering, queuing theory, pavement engineering, Intelligent Transportation System (ITS), and infrastructure management.

Water Resources Engineering Water resources engineering is concerned with the collection and management of water (as a natural resource). As a discipline it therefore combines hydrology, environmental science, meteorology, geology, conservation, and resource management. This area of civil engineering relates to the prediction and management of both the quality and the quantity of water in both underground (aquifers) and above ground (lakes, rivers, and streams) resources. Water resource engineers analyze and model very small to very large areas of the earth to predict the amount and content of water as it flows into, through, or out of a facility. Although the actual design of the facility may be left to other engineers. Hydraulic engineering is concerned with the flow and conveyance of fluids, principally water.[4] This area of civil engineering is intimately related to the design of pipelines, water distribution systems, drainage facilities (including bridges, dams, channels, culverts, levees, storm sewers), and canals. Hydraulic engineers design these facilities using the concepts of fluid pressure, fluid statics, fluid dynamics, and hydraulics, among others.

Coastal Engineering Coastal engineering is concerned with managing coastal areas. In some jurisdictions the terms sea defense and coastal protection are used to mean, respectively, defence against flooding and erosion. The term coastal defence is the more traditional term, but coastal management has become more popular as the field has expanded to include techniques that allow erosion to claim land.

Materials Engineering Another aspect of Civil engineering is materials science. Material engineering deals with ceramics such as concrete, mix asphalt concrete, metals focus around increased strength, metals such as aluminum and steel, and polymers such as polymethylmethacrylate (PMMA) and carbon fibers.

Construction Engineering . Construction engineering involves planning and execution of the designs from transportation, site development, hydraulic, environmental, structural and geotechnical engineers. As construction firms tend to have higher business risk than other types of civil engineering firms, many construction engineers tend to take on a role that is more business-like in nature: drafting and reviewing contracts, evaluating logistical operations, and closely-monitoring prices of necessary supplies.[5]

Environmental Engineering Environmental engineering deals with the treatment of chemical, biological, and/or thermal waste, the purification of water and air, and the remediation of contaminated sites, due to prior waste disposal or accidental contamination. Among the topics covered by environmental engineering are pollutant transport, water purification, waste water treatment, air pollution, solid waste treatment and hazardous waste management. Environmental engineers can be involved with pollution reduction, green engineering, and industrial ecology. Environmental engineering also deals with the gathering of information on the environmental consequences of proposed actions and the assessment of effects of proposed actions for the purpose of assisting society and policy makers in the decision making process.

Selected from "*Wikipedia, the free encyclopedia*"

Words and Expressions

nomadic *adj*. 游牧的
circa *adv*. 大约; *prep*. 大约
Appian Way 亚壁古道(古罗马大路)
aqueduct *n*. 沟渠，导水管
eminent *adj*. 显赫的，杰出的，有名的，优良的
mole *n*. 防波堤，筑有防波堤的海港
breakwater *n*. 防浪堤，挡浪板，挡水板
intricate *adj*. 复杂的，错综的，难以理解的
artisan *n*. 工匠，技工
guild *n*. (中世纪的)行会，同业公会，协会，行业协会
infrastructure *n*. 下部构造，基础下部组织
incremental *adj*. 增加的
underpin *v*. 加强……的基础，巩固，支撑
buoyancy *n*. 浮性,浮力,轻快
flyover *n*. <英>[交]跨线桥
hydraulics *n*. 水力学
mass transit 公共交通，公共交通工具(总称)，大量客运
aquifer *n*. 含水土层，蓄水层
culvert *n*. 管路
levee *n*. 防洪堤，码头，大堤; *v*. 筑防洪堤于
jurisdiction *n*. 权限
focus *n*. (兴趣活动等的)中心，焦点，焦距
polymethylmethacrylate *n*. 聚甲基丙烯酸甲酯，有机玻璃
thermal *adj*. 热的，热量的
contaminate *v*. 污染
ecology *n*. 生态学，[社会]环境适应学，均衡系统

Notes

[1] In Roman architecture, an insula (plural *insulae*) was a large apartment building where the Plebs (lower class) and Equates (middle class) of Romans dwelled. The floor at ground level was used for tabernas, shops and businesses with living space on the higher floors.

[2] "...the art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states, both for ... and in the construction and application of machinery, and in the drainage of cities and towns."
整句话是对民用工程的一个详细定义，短语 "defined...as" 意为 "把……定义为……"，defined 和后面的两个 as 介词搭配，表明民用工程的定义有两个方面的内容，分别是 as... the art of 和 as the means of。短语 "as applied in" 的意思是 "诸如在……的应用"，共有三个方面，由 as applied 之后的三个 in 所表明。

[3] The **Archimedes screw**, also known as **Archimedes' screw**, the **Archimedean screw** or the **screwpump** is a machine historically used for transferring water from a low-lying body of water into irrigation ditches. It was one of several inventions and discoveries traditionally attributed to Archimedes in the 3rd century BC.

[4] Hydraulic engineering is concerned with the flow and conveyance of fluids, principally water. Be concerned with 意为 "与……有关、涉及"，principally water 的意思相当于 "principally concerned with water"。整句的意思是：水利工程主要涉及流体的流动和传输，尤其是水的流动和传输。

[5] As construction firms tend to have higher business risk than other types of civil engineering firms, many construction engineers tend to take on a role that is more business-like in nature: drafting and reviewing contracts, evaluating logistical operations, and closely-monitoring prices of necessary supplies.
这是一个主从复合句，As 引导的是一个原因状语从句，主句是 "many construction engineers tend to ..."。整句的意思是：由于建筑公司比其他类型的民用建筑公司往往承担更高的商业风险，许多建筑工程师往往会本能地扮演一种公事公办的角色：起草和修改合同、评估后勤的运作、严密监控必需供应品的价格等。

Exercises

1. Try to explain what is civil engineering in your own words.
2. Translate the following words into English.
   结构工程　岩土工程　水利工程　海岸工程　环境工程　施工工程
3. Translate the sixth paragraph into Chinese.

Reading Material 1

Civil Engineers

Education and Licensure Civil engineers typically possess an academic degree with a major in civil engineering. The length of study for such a degree is usually four or five years and the completed degree is usually designated as a Bachelor of Engineering, though some universities designate the degree as a Bachelor of Science. The degree generally includes units covering physics, mathematics, project management, design and specific topics in civil engineering. Initially such topics cover most, if not all, of the sub-disciplines of civil engineering. Students then choose to specialize in one or more sub-disciplines towards the end of the degree.

In most countries, a Bachelor's degree in engineering represents the first step towards professional certification and the degree program itself is certified by a professional body. After completing a certified degree program the engineer must satisfy a range of requirements (including work experience and exam requirements) before being certified. Once certified, the engineer is designated the title of Professional Engineer (in the United States, Canada and South Africa), Chartered Engineer (in most Commonwealth countries), Chartered Professional Engineer (in Australia and New Zealand), or European Engineer (in much of the European Union). There are international engineering agreements between relevant professional bodies which are designed to allow engineers to practice across international borders.

The advantages of certification vary depending upon location. For example, in the United States and Canada "only a licensed engineer may prepare, sign and seal, and submit engineering plans and drawings to a public authority for approval, or seal engineering work for public and private clients". This requirement is enforced by state and provincial legislation such as Quebec's Engineers Act. In other countries, no such legislation exists. In Australia, state licensing of engineers is limited to the state of Queensland. Practically all certifying bodies maintain a code of ethics that they expect all members to abide by or risk expulsion. In this way, these organizations play an important role in maintaining ethical standards for the profession. Even in jurisdictions where certification has little or no legal bearing on work, engineers are subject to contract law. In cases where an engineer's work fails he or she may be subject to the tort of negligence and, in extreme cases, the charge of criminal negligence. An engineer's work must also comply with numerous other rules and regulations such as building codes and legislation pertaining to environmental law.

Careers There is no one typical career path for civil engineers. Most engineering graduates start with jobs of low responsibility, and as they prove their competence, they are given more and more responsible tasks, but within each subfield of civil engineering, and even within different segments of the market within each branch, the details of a career path can vary. In some fields and firms, entry-level engineers are put to work primarily monitoring construction in the field, serving as the "eyes and ears" of more senior design engineers; while in other areas, entry-level engineers end up performing the more routine tasks of analysis or design and interpretation. More senior engineers can move into doing more complex analysis or design work, or management of more complex design projects, or management of other engineers, or into specialized consulting, including forensic engineering.

General Responsibilities of a Civil Engineer A civil engineer engages in many general responsibilities on a daily basis. These responsibilities are a crucial part of their job and enable the civil engineer to engage in their profession to the best of their ability. One general responsibility of the civil engineer is to analyze various factors concerning a construction job. The civil engineer will analyze the proposed site location as well as the entire construction job which is to be completed at such a site. They will analyze the process for completing the construction job every step of the way.

The civil engineer must also plan the construction project that will be taking place in conjunction with the results they found due to their analysis of the proposed project. During the process and at the end, the civil engineer must inspect the product to ensure that all rules, regulations and guidelines have been explicitly followed.

Specific Duties of a Civil Engineer Within the general responsibilities of a civil engineer are specific duties that must be carried out on a frequent basis, often times daily. The first duty of a civil engineer is to inspect and analyze the proposed construction project. They will not only inspect the plan itself but will go to the site location many times to ensure that the plan fits the location and vice versa.

When they have adequately analyzed the situation, they will write detailed reports stating what is acceptable and what needs to be changed prior to beginning the project. Once these proposed changes have been made, the civil engineer will review the plans and project site once again to ensure that all changes have been made as required.

The job of a civil engineer does not end at this point. The civil engineer will follow the project from start to finish and make any necessary changes along the way. They will ensure that procedure is being followed and check on safety features of the project during the time it is being completed.

A civil engineer must use many different equations, applications and figures to ensure the proper procedure application. Items that civil engineers must take part in and use include chemical testing applications, drafting and design software, electrical test devices and equipment, land surveying techniques and the metric system, to name just a few pertinent items.

The civil engineer must also be certain to follow land use laws and regulations every step of the way. This is extremely important as one who does not abide by such rules and regulations may find that the project is stalled, either temporarily or permanently. Therefore, a specific duty of a civil engineer is to know the pertinent land use laws and regulations and to follow them consistently.

One who is a civil engineer is also the key contact person regarding the construction project in many cases. They will answer questions directed towards them by individuals involved with the construction project and the general public as well. While answering questions, they will also be responsible for backing up their statements with reports, graphs, charts and surveys.

Selected from "*Wikipedia, the free encyclopedia*" & "*www.exforsys.com*"

Reading Material 2

Civil Engineering in 21st Century

The manner in which civil engineering is practiced must change. That change is necessitated by forces such as globalization; sustainability requirements; emerging technology; and increased complexity with the corresponding need to identify, define, and solve problems at the boundaries of traditional disciplines. As always within the civil engineering profession, change must be accomplished mindful of the profession's primary concern of protecting public safety, health, and welfare.

The profession recognizes the need for change. For example, in June 2006, the American

Society of Civil Engineers (ASCE) convened the Summit on the Future of Civil Engineering -2025. This gathering of civil engineering and other leaders, including international participants, articulated a global vision for the future of civil engineering. The vision1 sees civil engineers as being entrusted by society as leaders in creating a sustainable world and enhancing the global quality of life.

The Vision for Civil Engineering in 2025

The American Society of Civil Engineers defines civil engineering as "...the profession in which a knowledge of the mathematical and physical sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the progressive well-being of humanity in creating, improving and protecting the environment, in providing facilities for community living, industry and transportation, and in providing structures for the use of humanity." The civil engineering profession is moving forward.

For example, in June 2006, a diverse group of civil engineering and other leaders, including international participants, gathered to articulate an aspirational global vision for the future of civil engineering. Participants in this Summit on the Future of Civil Engineering saw a very different world for civil engineers in 2025. An ever-increasing global population that is shifting even more to urban areas will require widespread adoption of sustainability. Demands for energy, transportation, drinking water, clean air, and safe waste disposal will drive environmental protection and infrastructure development. Society will face threats from natural events, accidents, and perhaps other causes such as terrorism.

Informed by the preceding, a global vision was developed that sees civil engineers entrusted by society to lead in creating a sustainable world and enhancing the global quality of life. The 2025 vision is:

Entrusted by society to create a sustainable world and enhance the global quality of life, civil engineers serve competently, collaboratively, and ethically as master:

- planners, designers, constructors, and operators of society's economic and social engine, the built environment;
- stewards of the natural environment and its resources;
- innovators and integrators of ideas and technology across the public, private, and academic sectors;
- managers of risk and uncertainty caused by natural events, accidents, and other threats; and
- leaders in discussions and decisions shaping public environmental and infrastructure policy.

As used in the vision, "master" means one who possesses widely recognized and valued knowledge, skills, and attitudes acquired as a result of education, experience, and achievement. Individuals within a profession who have these characteristics are willing and able to serve society by orchestrating solutions to society's most pressing current needs while helping to create a more viable future.

Summit organizers and participants intend that the vision will guide policies, plans, processes, and progress within the civil engineering community and beyond, worldwide. Civil engineers and leaders of civil engineering organizations should act to move the civil engineering profession toward the vision. One critical action is reform in the education and prelicensure experience of civil engineers. This report is presented in the spirit of that reform.

Emergence of the Body of Knowledge

In October 1998, following years of studies and conferences, the ASCE Board of Direction adopted Policy Statement 465 (PS 465), which has since been refined and confirmed. The ASCE board last revised Policy Statement 465 in April 2007 and, as it has since October 2004, the statement explicitly includes the body of knowledge (BOK). The policy now reads, in part:

The ASCE supports the attainment of a body of knowledge for entry into the practice of civil engineering at the professional level. This would be accomplished through the adoption of appropriate engineering education and experience requirements as a prerequisite for licensure.

The BOK is defined in the policy as "the necessary depth and breadth of knowledge, skills, and attitudes required of an individual entering the practice of civil engineering at the professional level in the 21st century." The long-term effect of PS 465 is illustrated in Figure, which compares today's civil engineering professional track with tomorrow's.

From ASCE's perspective, the civil engineering BOK represents a strategic direction for the profession. Under today's curricula design and accreditation and regulatory processes and procedures, some of the elements of the BOK may not be translated into curricula, accreditation criteria, and licensing requirements in the near term. In other words, the BOK describes the "gold standard" for the aspiring civil engineering professional. Because input into curricula design, accreditation, and licensing comes from many and varied stakeholders beyond ASCE, these processes are not likely to reflect all aspects of the civil engineering BOK. ASCE is optimistic that the curricula design, accreditation, and licensing processes will change over time to adopt a more BOK-centric approach. As this occurs, a greater proportion of the BOK will be reflected in curricula and in accreditation and licensure requirements.

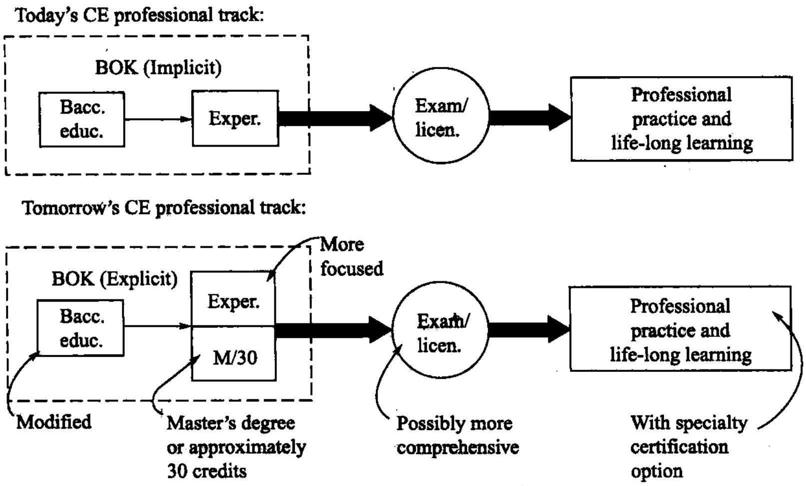

Fig.1.1 Difference between today's & tomorrow's CE professional track

Guidance for Students

The civil engineering profession knows where it is going and invites you to join the journey. The vision should provide you with a framework within which you can understand the purpose and measure the progress of your education, prepare to move into your internship, and, ultimately enter the practice of civil engineering at the professional level.

(a) Utilize Campus Resources As a civil engineering student, you will be faced with challenges in and outside of the classroom. For example, you may fail an examination, receive a low grade in a course, have difficulty understanding certain fundamentals, or encounter problems financing your education. Fortunately, you are likely to be surrounded by many and varied resources typically available on campuses. Personal examples are friends, professors, advisors, and counselors. Your campus is likely to have programs, centers, and offices that can assist you with time management, writing, studying, tutoring, computing, financial aid, part-time work, and summer and permanent employment. Draw on selected resources, depending on your needs, so that you continue to move forward in your formal education.

(b) Actively Participate in Campus Organizations You could choose from the student chapters of such engineering organizations as ASCE, NSPE, the Society of Women Engineers, the Society of Hispanic Professional Engineers, and the National Society of Black Engineers. However, you can also learn about communication, leadership, and teamwork by being actively involved in such campus-wide activities and groups as student government, service clubs, sports teams, a student newspaper, and sororities and fraternities. Consider your active participation in such groups as these as an opportunity to serve while enhancing your knowledge, skills, and attitudes.

(c) Explore International Programs "Engineers will need to deal with ever-increasing globalization; and find ways to prosper within an integrated international environment; and meet challenges that cross cultural, language, legal, and political boundaries..." Given the impact of globalization on engineering, you should at least explore participating in an international study program. Many are available and they both literally and figuratively cover the globe. These programs typically involve a semester or so of study at a university in another country along with such other learning opportunities as summer travel and/or work. While participation in an international program may extend the length of your formal education, that is likely to be a small cost relative to the added benefits.

(d) Seek Relevant Work Experiences You can apply and augment your classroom and laboratory learning during your formal education by finding relevant work experience. Applying what you have learned deepens your understanding of the material and demonstrates the relevance of your ongoing formal education. Compensation for this work can also help to finance your education. Work options include part-time employment with a local engineering organization, summer employment, internships, and cooperative education.

(e) Protect Your Reputation Craftsmen are judged primarily by the objects they create. Engineers, in contrast, are judged primarily by the credibility of their advice. Most of the clients and others you will eventually serve will not be able to fully judge the technical and other advice you offer. However, they will be aware of and be able to judge your reputation and use that to value and trust-or devalue and mistrust-you. You may think that this scenario is years away for you-that it is not relevant now while you are in school. However, your reputation as a professional is beginning now, while you are a student. Years from now, individuals who are now students, faculty, and staff will recall what you said and did. Cherish, protect, and enhance your reputation by what you say and do. Tell the truth. Keep your word. Be careful what you write in e-mails, memoranda, letters, and reports. Give credit when using ideas, data, and information developed by others.

(f) Prepare Yourself for an Ever-Changing World Ancient Romans achieved an astonishing level of civil engineering excellence. Their works included extensive and complex viaduct and bridge structures. An example is the Pont du Gard in southern France, a towering structure composed of three tiers of arches that still stands 2,000 years after it was designed and constructed. The civil engineering profession has come a long way since then. You are learning about an array of sophisticated tools and complex materials, including computer-aided drafting and design (CADD), digital models, sustainable design, analytical testing apparatuses, and composites. Just as today's practice is much different from yesterday's, so will tomorrow's practice-your practice-be much different from today's. The BOK will help you adjust to inevitable changes and prepare you to lead some of them. Furthermore, various books and other materials are available to help you successfully complete your studies and proactively move into employment.

(g) Find the Right First Job As your formal education draws to a close-whether it results in earning a bachelor's, master's, or other degree-you will naturally be thinking about employment. You are likely to consider many and varied factors in selecting an employer. Examples are compensation, benefits, location, computer resources, the functions you will perform, and the kinds of projects on which you will work. Choose wisely among the positions that will be available to you in the public and private sectors. In addition to, and perhaps more important than the preceding factors, are the following questions:

i . Who will be your immediate supervisor? This is important because, early in your career, frequent interaction with him or her in a variety of settings will further influence your attitude toward the profession and the additional knowledge and skills you acquire. In a similar fashion, who will you work with? Choose your employer carefully.

ii . Does the organization have a positive culture-that is, does it value high expectations and provide support, partner with its personnel in their personal and professional development, insist on ethical behavior, and seek to be a leader among its peers?

iii. Is the potential employer aware of the BOK and your desire to complete its fulfillment so that you sit for the licensing examination? While you have the primary responsibility for fulfilling the BOK, you will benefit from a knowledgeable and supportive employer.

Selected from "*Civil Engineering Body of Knowledge for the 21st Century*"