



高等学校土木工程专业卓越工程师教育培养计划系列规划教材

Technical English for Civil and Structural Engineers

土木工程专业英语

· 平台课课程群 ·

主编 吴 轶 主审 刘爱荣



WUHAN UNIVERSITY PRESS

武汉大学出版社

高等学校土木工程专业卓越工程师教育培养计划系列规划教材

土木工程专业英语

主编 吴 轶
主审 刘爱荣



WUHAN UNIVERSITY PRESS

武汉大学出版社

图书在版编目(CIP)数据

土木工程专业英语/吴轶主编. —武汉:武汉大学出版社,2015.9
高等学校土木工程专业卓越工程师教育培养计划系列规划教材
ISBN 978-7-307-15995-2

I. 土… II. 吴… III. 土木工程—英语—高等学校—教材 IV. H31

中国版本图书馆CIP数据核字(2015)第118892号

责任编辑:王亚明

责任校对:薛文杰

装帧设计:吴极

出版发行:武汉大学出版社 (430072 武昌 珞珈山)

(电子邮件:whu_publish@163.com 网址:www.stmpress.cn)

印刷:虎彩印艺股份有限公司

开本:880×1230 1/16 印张:11 字数:348千字

版次:2015年9月第1版 2015年9月第1次印刷

ISBN 978-7-307-15995-2 定价:23.00元

版权所有,不得翻印;凡购买我社的图书,如有质量问题,请与当地图书销售部门联系调换。

主要编写及审稿人员简介



■ 吴 轶，博士，广州大学教授。2004年获华南理工大学结构工程专业工学博士学位，2005年晋升副教授，2010年晋升教授。长期从事高层建筑结构抗震、结构减震控制及城市防灾减灾方面的教学、科研工作。主持与主要参加10余项国家自然科学基金、省部级及厅局级项目。在*Engineering Structures*、《工程力学》、《计算力学学报》、《土木工程学报》等刊物上发表40余篇学术论文，出版教材2部，参编教材3部。



■ 刘爱荣，博士，硕士生导师，广州大学教授，广东省力学学会理事。2001年获西南交通大学固体力学专业工学博士学位，同年进入广州大学土木工程学院任教；2003年晋升副教授；2005年在美国西北理工大学进修；2007年晋升教授，同年被评为广州大学优秀教师；2009年晋升为广州大学校管科研单位——结构灾害与控制联合研究中心副主任，并于2013年晋升为执行主任。现在广州大学从事教学、科研和管理工作。主要从事新型桥梁的结构行为研究，承担过多座复杂桥梁的理论计算分析、模型试验和检测工作。近年来，先后主持了国家自然科学基金项目、广东省自然科学基金项目、广东省科技计划重点引导项目、广州市重大科技专项、广东省教育厅重点创新项目等20余项科研项目。获教育部科技进步二等奖1项、广东省科技进步二等奖2项、广州市教学优秀二等奖1项。出版教材1部；获国家发明专利2项；撰写了60余篇学术论文，分别在*Journal of Bridge Engineering*、《土木工程学报》、《工程力学》、《中国公路学报》等权威刊物上发表。

高等学校土木工程专业卓越工程师教育培养计划系列规划教材

学术委员会名单

(按姓氏笔画排名)

主任委员:周创兵

副主任委员:方志 叶列平 何若全 沙爱民 范峰 周铁军 魏庆朝
委员:王辉 叶燎原 朱大勇 朱宏平 刘泉声 孙伟民 易思蓉
周云 赵宪忠 赵艳林 姜忻良 彭立敏 程桦 靖洪文

编审委员会名单

(按姓氏笔画排名)

主任委员:李国强

副主任委员:白国良 刘伯权 李正良 余志武 邹超英 徐礼华 高波
委员:丁克伟 丁建国 马昆林 王成 王湛 王媛 王薇
王广俊 王天稳 王曰国 王月明 王文顺 王代玉 王汝恒
王孟钧 王起才 王晓光 王清标 王震宇 牛荻涛 方俊
龙广成 申爱国 付钢 付厚利 白晓红 冯鹏 曲成平
吕平 朱彦鹏 任伟新 华建民 刘小明 刘庆潭 刘素梅
刘新荣 刘殿忠 闫小青 祁皓 许伟 许程洁 许婷华
阮波 杜咏 李波 李斌 李东平 李远富 李炎锋
李耀庄 杨杨 杨志勇 杨淑娟 吴昊 吴明 吴轶
吴涛 何亚伯 何旭辉 余锋 冷伍明 汪梦甫 宋固全
张红 张纯 张飞涟 张向京 张运良 张学富 张晋元
张望喜 陈辉华 邵永松 岳健广 周天华 郑史雄 郑俊杰
胡世阳 侯建国 姜清辉 娄平 袁广林 桂国庆 贾连光
夏元友 夏军武 钱晓倩 高飞 高玮 郭东军 唐柏鉴
黄华 黄声享 曹平周 康明 阎奇武 董军 蒋刚
韩峰 韩庆华 舒兴平 童小东 童华炜 曾珂 雷宏刚
廖莎 廖海黎 蒲小琼 黎冰 戴公连 戴国亮 魏丽敏

出版技术支持

(按姓氏笔画排名)

项目团队:王睿 白立华 曲生伟 蔡巍

特别提示

教学实践表明,有效地利用数字化教学资源,对于学生学习能力以及问题意识的培养乃至怀疑精神的塑造具有重要意义。

通过对数字化教学资源的选取与利用,学生的学习从以教师主讲的单向指导的模式而成为一次建设性、发现性的学习,从被动学习而成为主动学习,由教师传播知识而到学生自己重新创造知识。这无疑是锻炼和提高学生的信息素养的大好机会,也是检验其学习能力、学习收获的最佳方式和途径之一。


本系列教材在相关编写人员的配合下,将逐步配备基本数字教学资源,其主要内容包括:

课程教学指导文件

- (1)课程教学大纲;
- (2)课程理论与实践教学时数;
- (3)课程教学日历:授课内容、授课时间、作业布置;
- (4)课程教学讲义、PowerPoint 电子教案。

课程教学延伸学习资源

- (1)课程教学参考案例集:计算例题、设计例题、工程实例等;
- (2)课程教学参考图片集:原理图、外观图、设计图等;
- (3)课程教学试题库:思考题、练习题、模拟试卷及参考解答;
- (4)课程实践教学(实习、实验、试验)指导文件;
- (5)课程设计(大作业)教学指导文件,以及典型设计范例;
- (6)专业培养方向毕业设计教学指导文件,以及典型设计范例;
- (7)相关参考文献:产业政策、技术标准、专利文献、学术论文、研究报告等。

 本书基本数字教学资源及读者信息反馈表请登录 www.stmpress.cn 下载,欢迎您对本书提出宝贵意见。

丛书序

土木工程涉及国家的基础设施建设,投入大,带动的行业多。改革开放后,我国国民经济持续稳定增长,其中土建行业的贡献率达到1/3。随着城市化的发展,这一趋势还将继续呈现增长势头。土木工程行业的发展,极大地推动了土木工程专业教育的发展。目前,我国有500余所大学开设土木工程专业,在校生达40余万人。

2010年6月,中国工程院和教育部牵头,联合有关部门和行业协(学)会,启动实施“卓越工程师教育培养计划”,以促进我国高等工程教育的改革。其中,“高等学校土木工程专业卓越工程师教育培养计划”由住房和城乡建设部与教育部组织实施。

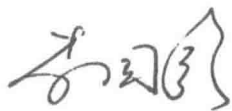
2011年9月,住房和城乡建设部人事司和高等学校土建学科教学指导委员会颁布《高等学校土木工程本科指导性专业规范》,对土木工程专业的学科基础、培养目标、培养规格、教学内容、课程体系及教学基本条件等提出了指导性要求。

在上述背景下,为满足国家建设对土木工程卓越人才的迫切需求,有效推动各高校土木工程专业卓越工程师教育培养计划的实施,促进高等学校土木工程专业教育改革,2013年住房和城乡建设部高等学校土木工程学科专业指导委员会启动了“高等教育教学改革土木工程专业卓越计划专项”,支持并资助有关高校结合当前土木工程专业高等教育的实际,围绕卓越人才培养目标及模式、实践教学环节、校企合作、课程建设、教学资源建设、师资培养等专业建设中的重点、亟待解决的问题开展研究,以对土木工程专业教育起到引导和示范作用。

为配合土木工程专业实施卓越工程师教育培养计划的教学改革及教学资源建设,由武汉大学发起,联合国内部分土木工程教育专家和企业工程专家,启动了“高等学校土木工程专业卓越工程师教育培养计划系列规划教材”建设项目。该系列教材贯彻落实《高等学校土木工程本科指导性专业规范》《卓越工程师教育培养计划通用标准》和《土木工程卓越工程师教育培养计划专业标准》,力图以工程实际为背景,以工程技术为主线,着力提升学生的工程素养,培养学生的工程实践能力和工程创新能力。该系列教材的编写人员,大多主持或参加了住房和城乡建设部高等学校土木工程学科专业指导委员会的“土木工程专业卓越计划专项”教改项目,因此该系列教材也是“土木工程专业卓越计划专项”的教改成果。

土木工程专业卓越工程师教育培养计划的实施,需要校企合作,期望土木工程专业教育专家与工程专家一道,共同为土木工程专业卓越工程师的培养作出贡献!

是以为序。



2014年3月于同济大学四平路校区

前 言

随着我国经济建设高速、持续发展,国家对各类建筑人才的需求日益增长,对高校土建类高素质人才的培养提出了新的要求,从而对土建类教材建设也提出了新的要求。在“大土木、大工程”的背景下,将土木工程类专业合并成一个土木工程专业后,许多课程的设置和内容都进行了调整,原来分门别类的专业英语课程也相应地合并成为一门“土木工程专业英语”课程。此外,许多专业技术人员与研究人员也希望有一本系统的土木工程专业英语参考书。为此,编者在编写本书时尽可能做到内容的系统性、知识性和实用性,使本书除可用作教材外,还可供土木工程专业的教师、研究人员和工程技术人员参考。

本书选材涉及土木工程概况、土木工程类别、土木工程材料、工程荷载以及作用、结构构件类别、地下工程、桥梁工程、道路工程、工程抗震设计、隔震技术、建筑加固技术等方面,分为13章,每章均由课文、生词和短语(Words and Phrases)组成。在内容上,涉及工程材料、材料力学、理论力学、混凝土结构设计原理、钢结构设计原理、道路工程、结构抗震设计、建筑加固理论、土力学、基础工程等相关学科知识。

本书具有如下特色:

(1) 知识的全面性。由于土木工程专业涉及的基础学科知识十分宽广,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,本书课文和阅读材料题材广泛,覆盖土木工程各专业的重要内容,材料充实、新颖,有效地拓展了专业知识的广度与深度。

(2) 内容的新颖性。结合多年来本课程的教学经验,编者查阅了大量资料,重点关注土木工程专业领域的最新研究成果,在选材上作了认真的筛选,不但材料新颖,而且教材内容更贴近教学实际,更加注重对专业基础内容和前沿专业知识的关注与认识。每章所列生词、专业术语、短语都是教学实践中学生经常会用到的,因此针对性较强,可以满足课内和课外学术阅读的要求。

(3) 结构的系统性。各章紧扣主题,内容丰富,每章分为基础阅读材料以及专业词汇和短语两部分。这样可以巩固专业英语的基础知识,扩大词汇量,加大学习的深度。

(4) 整体的广泛适用性。本书选材广泛、新颖,覆盖面广,既可以作为工程技术人员专业英语的参考书,又可以作为本科生、研究生与教师用书。通过学习本书,学生应达到《大学英语专业阅读阶段教学基本要求》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。”

本书由广州大学吴轶担任主编,由广州大学吴从晓、汪大洋、朱勇、王宏伟担任参编。

具体编写分工为:吴轶(前言,第1、2、8、9、10、11章,6.1、6.2、6.4节),吴从晓(第3、12章),汪大洋(第4章),朱勇(第5、13章),王宏伟(6.3节,第7章)。

广州大学刘爱荣担任本书主审,详细审阅了编写大纲和全部书稿,并提出了许多宝贵意见,在此表示感谢。

本书是在参考国内外诸多教材的基础上,取长补短,借鉴经验编写而成的,并参阅了诸多文献资料,在此对这些文献的作者表示衷心的感谢。

特别鸣谢:华南理工大学建筑设计研究院与广州城建开发设计院有限公司在本书编写过程中给予了大力支持。

我们希望本书有助于培养适应社会发展需要的、素质全面的新型工程建设人才。受编者知识水平所限,书中疏漏之处在所难免,敬请读者批评指正。

编者

2015年7月



Technical English for Civil and Structural Engineers

土木工程专业英语

内 容 简 介

本书是按照高等学校土木工程专业卓越工程师教育培养计划的要求编写的，系统地介绍了土木工程类专业英语的相关知识。本书在充分体现全面性、新颖性、系统性和广泛适用性的基础上，注重对专业基础内容和前沿专业知识的关注，内容贴近教学实际，针对性强。本书既可以作为工程技术人员专业英语的参考书，又可以作为本科生、研究生教材与教师用书。

本书选材涉及土木工程概况、土木工程类别、土木工程材料、工程荷载及作用、结构构件类别、地下工程、桥梁工程、道路工程、工程抗震设计、隔震技术、建筑加固技术等方面，共分为13章，每章均由课文、生词和短语组成。在内容上，涉及工程材料、材料力学、理论力学、混凝土结构设计原理、钢结构设计原理、道路工程、结构抗震设计、建筑加固理论、土力学、基础工程等相关学科知识。

Contents

Chapter 1 Overview of Civil Engineering	(1)	3.2 Steel	(29)
1.1 Introduction of Civil Engineering	(1)	3.3 Masonry	(30)
Section A The Origin of Civil Engineering	(1)	References	(31)
Section B What Is a Civil Engineer	(3)	Chapter 4 Loads and Actions in Civil Engineering	(32)
1.2 The Importance of Civil Engineering	(5)	4.1 Dead Load and Live Load	(32)
Section A The Role of Civil Engineering in Society	(5)	4.2 Wind Load and Wind Damage	(33)
Section B Historic Civil Engineering Landmarks	(6)	Section A Introduction of Wind Load	(33)
References	(9)	Section B Classification of Wind Load	(34)
Chapter 2 Types of Civil Engineering	(11)	Section C Horizontal Wind Loads and Roof Wind Loads on Structural Frames	(35)
2.1 Structural Engineering	(11)	Section D Wind for Components and Wind Damage	(36)
Section A Introduction of Structural Engineering	(11)	4.3 Earthquake Action and Damage	(38)
Section B Basic Types of Structures	(13)	Section A Earthquake Action	(38)
2.2 Bridge Engineering	(15)	Section B Earthquake Damage	(39)
2.3 Underground Engineering	(17)	4.4 Tsunami Damage to the Structure of Civil Engineering	(41)
Section A Introduction of Metropolitan Railway	(17)	Section A Tsunami Damage	(41)
Section B Introduction of Tunnel Engineering	(18)	Section B Tsunami Damage to Buildings	(43)
2.4 Road Engineering	(20)	Section C Resistance of Tsunamis for Structures	(44)
Section A Introduction of Road Engineering	(20)	References	(45)
Section B Maintenance of Road Engineering	(22)	Chapter 5 Members of Civil Engineering	(46)
References	(24)	5.1 Horizontal Forced Structural Members	(46)
Chapter 3 Materials of Civil Engineering	(26)	Section A Introduction of Beam	(46)
3.1 Concrete	(26)	Section B Forces within a Beam	(48)
Section A Introduction of Concrete	(26)	Section C Shear Strength and Parameters	(50)
Section B Properties of Concrete	(27)		

Section D	Coupling Beams	(52)	Section B	Concrete-filled Steel Tube Column	(89)
Section E	Flat Plates	(54)	6.4	The Modern Complex High-rise Building Structure	(90)
Section F	Behavior of Concrete Slabs	(56)	Section A	Performance-based Seismic Design	(90)
Section G	Floor Framing Systems	(57)	Section B	Performance Objectives of PBSD	(92)
5.2	Vertical Forced Structural Members	(59)	References		(93)
Section A	Introduction of Column	(59)	Chapter 7 Bridge Engineering		(95)
Section B	Increasing Compressive Strength	(60)	7.1	Introduction of Bridge Engineering	(95)
Section C	High-strength Steel in Concrete Columns	(62)	Section A	History of Bridge	(95)
Section D	Confinement in Reinforced Concrete Columns	(63)	Section B	London Millennium Footbridge	(96)
Section E	Introduction of Concrete Structural Wall	(65)	7.2	Classification of Bridge	(98)
Section F	Behavior of Structural Wall	(67)	Section A	Rigid Beam and Cantilever	(98)
Section G	Steel Plate Shear Walls	(69)	Section B	Suspension and Arch	(99)
5.3	Arch	(70)	7.3	Design of Bridge	(100)
Section A	Introduction of Arches	(70)	Section A	Design of Bridge Structure	(100)
Section B	Development of Arch Bridges	(71)	Section B	Numerical Analysis of Bridge Structures	(101)
5.4	Truss	(74)	References		(102)
Section A	Introduction of Truss	(74)	Chapter 8 Underground Engineering		(104)
Section B	Analysis of Internal Force	(75)	8.1	Introduction of Underground Engineering	(104)
Section C	Production and Installation of a Truss	(77)	Section A	Exploitation of Underground Space	(104)
References		(78)	Section B	The Underground Strategy	(105)
Chapter 6 Basic Types of Engineering Structure		(82)	8.2	Underground Tunnel Engineering	(106)
6.1	Reinforced Concrete Structures	(82)	Section A	Tunneling Risk	(106)
Section A	Application of Reinforced Concrete Structures	(82)	Section B	A New Requirement of Tunneling	(107)
Section B	Performance of Reinforced Concrete Structures	(83)	8.3	Development of Underground Space Structure	(108)
6.2	Steel Structure	(85)	Section A	Web-based Shield Tunnel Construction Information System	(108)
Section A	Introduction of Steel Structures	(85)	Section B	Urban Underground Space Planning	(110)
Section B	Incheon International Airport	(87)	References		(111)
6.3	Classification of Steel Concrete Composite Structure	(88)			
Section A	Steel Concrete Composite Structure	(88)			

Chapter 9 Road Engineering	(114)	Chapter 12 Isolation and Energy Dissipation	
9.1 Urban Road	(114)	Damper Technology	(141)
Section A Introduction of Urban		12.1 Seismic Isolation Technology	(141)
Road	(114)	Section A Introduction of Seismic	
Section B Development of Road		Isolation Technology	(141)
Engineering	(115)	Section B Functions of Seismic	
9.2 Freeway Engineering	(117)	Isolation Technology	(143)
Section A Design of Freeway	(117)	12.2 Energy Dissipation System	(144)
Section B Development of Freeway	(118)	Section A Introduction of Energy	
References	(119)	Dissipation System	(144)
		Section B Classification of Dampers ...	(146)
Chapter 10 Foundation Engineering	(122)	References	(148)
10.1 Introduction of Foundation	(122)		
Section A A Shallow Foundation	(122)	Chapter 13 Retrofitting Techniques for	
Section B Types of Pile Foundation ...	(124)	Seismic Strengthening	(150)
10.2 The Principles of Foundation		13.1 Outline of Retrofitting Techniques	
Design	(126)	for Seismic Strengthening	(150)
Section A What Is Foundation		Section A Origin of Retrofitting	
Design	(126)	Techniques for Seismic	
Section B Causes of Settlement	(127)	Strengthening	(150)
References	(128)	Section B The Importance of Retrofitting	
		Techniques for Seismic	
Chapter 11 Performance-based Seismic		Strengthening	(151)
Design	(129)	Section C Problems of Retrofitting	
11.1 Introduction of Performance-based		Techniques for Seismic	
Seismic Design	(129)	Strengthening	(153)
Section A The Origin of Performance-based		13.2 Types of Retrofitting Techniques	
Seismic Design	(129)	for Seismic Strengthening	(155)
Section B Development of Performance-based		Section A Classification of Retrofitting	
Seismic Design	(130)	Techniques for Seismic	
11.2 Structural Seismic Demand and		Strengthening	(155)
Seismic Capacity	(132)	Section B Introduction of Fibre Reinforced	
Section A Structural Seismic		Polymer	(157)
Demand	(132)	13.3 Applications of Materials in	
Section B Structural Seismic		Seismic Strengthening	(159)
Capacity	(133)	Section A Applications of Composite	
11.3 Loss Evaluation in Earthquake		Materials	(159)
Events	(135)	Section B Steel Plates in Seismic	
Section A Methodologies of Earthquake		Strengthening	(161)
Economic Loss Estimate	(135)	References	(162)
Section B Earthquake Disaster	(136)		
References	(137)		

Chapter 1 Overview of Civil Engineering

1.1 Introduction of Civil Engineering >>>

Section A The Origin of 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 like roads, bridges, canals, dams, and buildings^[1-3]. 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**, **geophysics**, **geodesy**, control engineering, structural engineering, **biomechanics**, **nanotechnology**, **transportation** engineering, earth science, atmospheric sciences, **forensic engineering**, **municipal or urban engineering**, water resources engineering, materials engineering, **coastal engineering**^[4], surveying, and construction engineering^[4]. Civil engineering takes place on all levels: in the public sector from municipal through to national governments, and in the private sector from individual homeowners through to international companies.

Civil engineering has been an aspect of life since the beginning of human existence. The earliest practice of civil engineering might have commenced between 4000 and 2000 B. C. in Ancient Egypt and Mesopotamia (Ancient Iraq) when humans started to abandon a **nomadic existence**, creating a need for the construction of shelter. During this time, transportation became increasingly important leading to the development of the wheel and sailing.

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**^[5]. The construction of Pyramids in Egypt (c. 2700-2500 B. C.) might be considered the first instances of large structure constructions. Other ancient historic civil engineering constructions include the Qanat water management system (the oldest older than 3000 years and longer than 71 km^[6]), the **Parthenon** by Iktinos in Ancient Greece (447-438 B. C.), the Appian Way by Roman engineers (c. 312 B. C.), the Great Wall of China by General Meng Tian under orders from Qin Emperor Shih Huang-ti (c. 220 B. C.)^[7] and the **stupas** constructed in ancient Sri Lanka like the **Jetavanaramaya** and the extensive irrigation works in Anuradhapura. The Romans developed civil structures throughout their empire, including especially **aqueducts**, insulate harbors, bridges, dams and roads.

In the 18th century, the term civil engineering was coined to incorporate all things civilian as opposed to military engineering. The first **self-proclaimed** civil engineer was John Smeaton who constructed the Eddystone Lighthouse^[4]. 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 recognizing 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 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, harbors, **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.

The first private college 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^[7]. The first civil engineering degree to be awarded to a woman **was granted** by Cornell University to Nora Stanton Blatch in 1905.

Words and Phrases

professional engineering discipline	专业工程学科
maintenance	[ˈmeɪntənəns] <i>n.</i> 维护, 维修; 保持
sub-discipline	<i>n.</i> 亚学科
geotechnical engineering	岩土工程
geophysics	[ˌdʒi:əʊˈfɪzɪks] <i>n.</i> 地球物理; 地球物理学
geodesy	[dʒiˈɒdɪsi] <i>n.</i> [测] 测地学
biomechanics	[ˌbaɪəʊməˈkæniks] <i>n.</i> 生物力学; 生物机械学
nanotechnology	[ˌnænəʊteknɒlədʒi] <i>n.</i> 纳米技术
transportation	[ˌtrænsˈpɔ:teɪʃən] <i>n.</i> 运输; 运输系统; 运输工具
forensic engineering	法律工程学
municipal or urban engineering	市政工程
coastal engineering	河岸工程
nomadic existence	游牧生活
geographical variation	地理差异
interchangeably	[ˌɪntəˈtʃeɪndʒəbli] <i>adv.</i> [数] 可交换地
Parthenon	[ˈpɑ:θɪnən] <i>n.</i> 帕台农神殿(希腊用以祭祀雅典娜女神的神庙)
stupas	<i>n.</i> 舍利塔; 浮屠塔
Jetavanaramaya	<i>n.</i> 祇陀林佛塔
aqueduct	[ˈækwɪdʌkt] <i>n.</i> [水利] 渡槽; 导水管; 沟渠
self-proclaimed	[ˈselfprəˈkleɪmd] <i>adj.</i> 自称的
eminent	[ˈemɪnənt] <i>adj.</i> 杰出的; 有名的; 明显的
intercourse	[ˈɪntəkɔ:s] <i>n.</i> 交流; 往来
mole	[məʊl] <i>n.</i> 防波堤
drainage	[ˈdreɪnɪdʒ] <i>n.</i> 排水; 排水系统; 污水; 排水面积
be granted	被授予

Section B What Is a Civil Engineer

A civil engineer is a person who practices civil engineering; the application of planning, designing, **constructing**, maintaining, and operating infrastructures while protecting the public and environmental health, as well as improving existing infrastructures that have been neglected.

Originally, a civil engineer worked on public works projects and was contrasted with the **military engineer**, who worked on **armaments** and defenses. Over time, various branches of engineering have become recognized as distinct from civil engineering, including chemical engineering, mechanical engineering, and electrical engineering, while much of military engineering has been absorbed by civil engineering^[8].

Civil engineers typically possess an academic degree with a major in civil engineering. The length of study for such a degree is usually three to 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. While an undergraduate degree (BEng/BSc) normally provides successful students with industry **accredited** qualification, some universities offer postgraduate engineering awards (MEng/MSc) which allow students to further specialize in their particular area of interest within engineering.

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 being 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 professional 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^[9]. In other countries such as the UK, 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**^[10]. 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, be charged with **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.

There is no typical career path for civil engineers. Most people who graduate with civil engineering degrees start with jobs that require a low level of responsibility, and as the new engineers prove their competence, they are trusted with tasks that have larger consequences and require a higher level of responsibility. However, within each branch of civil engineering career path options 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 senior design engineers. While in other areas, entry-level engineers perform the more routine tasks of analysis or design and interpretation. **Experienced engineers** generally do 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. Therefore, work experience is necessary in civil engineering.

The civil engineer must have a key role in **project management**. This conviction forms the basis of this section along with the understanding that education must be a **prerequisite** to **professionalism** in any **sphere**. Projects are becoming increasingly complex, and the project management team is subject to the influence of social and environmental constraints together with concerns for the control of natural resources. These and other factors indicate the pressing importance of proper training and education to develop suitable skills in the potential project manager. Civil engineering education can be organized in curricula that allow both technical and **managerial skills** to be developed. Thus the civil engineer will be **eminently** capable of exercising sound project management. In so doing, he or she will not have to **abdicate** importantly managerial functions to others, often less ably prepared to understand the technological aspects of developing and implementing alternative **strategies**.

Words and Phrases

- constructing [kən'strʌktɪŋ] *n.* 建造
- military engineer *n.* 军事工程师
- armament ['ɑ:məmənt] *n.* 武器;军备
- Bachelor of Engineering 工程学士
- designate ['deziɡneɪt] *vt.* 指定;指派;标出;把...定名为
- Bachelor of Science 理学学士
- accredited [ə'kredɪtɪd] *adj.* 公认的;可信任的
- certified ['sɜ:tɪfaɪd] *adj.* 被证明的;有保证的;具有证明文件的
- international engineering agreement 国际工程协议
- provincial [prə'vɪnʃl] *adj.* 省的;地方性的
- legislation [ˌledʒɪs'leɪʃn] *n.* 立法;法律
- expulsion [ɪk'spʌlʃn] *n.* 驱逐;开除
- ethical standard 道德标准
- jurisdiction [ˌdʒʊərɪs'dɪkʃn] *n.* 司法权,审判权,管辖权;权限,权力
- criminal negligence [法] 过失犯罪
- pertaining to 适合,合宜;与...有关
- entry-level engineer 初级入门的工程师
- experienced engineer 经验丰富的工程师
- project management 项目管理
- prerequisite [ˌpri:'rekwəzɪt] *n.* 先决条件;决定性
- professionalism [prə'feʃənəlɪzəm] *n.* 专业水平;专长;职业化
- sphere [sfɪə(r)] *n.* 范围,领域
- managerial skill 管理技能
- eminently ['emɪnəntli] *adv.* 突出地;显著地
- abdicate [ˌæbdɪkeɪt] *vt.* 退位;放弃
- strategy [ˌstrætədʒi] *n.* 战略,策略

1.2 The Importance of Civil Engineering >>>

Section A The Role of Civil Engineering in Society

Civil engineering, the profession of **designing and executing structural works** serves the general public. The term was first used in the 18th century to distinguish the newly recognized profession from **military engineering**, until then **preeminent**. From earliest times, however, engineers have engaged in peaceful activities, and many of the civil engineering works of ancient and medieval times—such as the Roman public baths, roads, bridges, and **aqueducts; the Flemish canals**; the Dutch sea defenses; **the French Gothic cathedrals**; and many other monuments—reveal a history of inventive genius and persistent **experimentation**^[11].

Civil engineering as a very important basic discipline has its important properties: comprehension, sociality, **practicality**, unity. Civil engineering provides a **corporeal technology basis** for the development of the national economy and the improvement of people's life and plays a promoting role in the revitalization of many industries. Engineering construction is the basic production process of **fixed assets**. Therefore, the construction industry and the real estate have become **a pillar of the economy** in many countries and regions.

Civil engineering is the design and maintenance of public works such as roads, bridges, water and energy systems as well as **public facilities** like ports, railways and airports. Civil engineers touch many aspects of our everyday lives. From the water you use to brush your teeth in the morning to the road you drive on to work and the school where you take your children to, the power that charges your cell phone, civil engineers design and build the systems that bring us water and power. They build the infrastructure within our national parks. Civil engineers build **mass transit**.

In daily life, infrastructure construction is also a major part of the civil engineering. Infrastructures are basic physical and organizational structures needed for the operation of a society or an enterprise^[12] or the services and facilities necessary for an economy to function^[13]. It can be generally defined as **the set of interconnected structural elements** that provide **framework** supporting an entire structure of development. It is an important term for judging a country or a region's development.

The term typically refers to the technical structures that support a society, such as roads, bridges, water supply, **sewers**, electrical grids, **telecommunications**, and so forth, and can be defined as “the physical components of **interrelated systems** providing **commodities** and services essential to enable, sustain, or enhance societal living conditions”^[14].

Viewed functionally, infrastructure facilitates the production of goods and services, and also the distribution of finished products to markets, as well as basic social services such as schools and hospitals. For example, roads enable the **transport of raw materials** to a factory^[11]. In **military parlance**, the term refers to the buildings and **permanent installations necessary** for the support, **redeployment**, and operation of military forces^[15].

Civil engineering is all about creating, improving and protecting the environment in which we live. It provides the facilities for day-to-day life and for transport and for industry to go about its work. It deals with the design, construction and maintenance of the physical and naturally built environment. Put simply, civil engineers build bridges, roads, canals, dams, tall buildings, and other large structures.

Like the Romans, Egyptians and Mayans who built great **civilizations** before us, our civilization relies more than ever on teams of inventive people to design, build and maintain the **sophisticated** environment that surrounds