

城市岩土地基 工程地质

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城市岩土地基工程地质

URBAN ENGINEERING GEOLOGY OF THE ROCK AND SOIL FOUNDATION

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内 容 提 要

本书是一部就城市岩土地基进行工程地质系统研究的学术专著。书中涵盖了两大部分内容:上篇是基础理论与方法篇,分别研究了城市岩土地基工程地质研究的基本问题、中国城市岩土地基工程地质特征、城市岩土地基工程地质结构研究、城市岩土地基工程地质性质纵向变化规律研究、城市岩土地基工程地质评价与区划、城市岩土地基使用能力分析与评价、城市岩土地基稳定性的工程地质分析、城市环境岩土工程问题研究、城市岩土地基的化学变化、性质变异与改良研究、城市岩土体环境与可持续发展;下篇是实证研究,以滨海城市——烟台市区为例,分别研究烟台市区经济与地学环境、烟台市区岩土地基工程地质特征、烟台市区岩土体立体结构分析、烟台市区环境岩土工程问题分析、烟台市区岩土地基工程地质区划、烟台市区岩土地基使用能力分析与优化利用、烟台市区岩土地基的改良与基础工程设计、烟台市区岩土体环境评定与可持续利用。这些研究成果是工程地质学、岩土工程学、工程岩土学、环境工程学等众多分支学科在城市地域内综合、融会与升华的结晶。

本书内容新颖,资料翔实,既有理论论述,又有实证研究,既有基础理论阐述,又有工程实例分析。可供从事城市岩土工程勘察、设计、施工、监测、监理等专业的技术人员和从事城市建设管理和环境保护的管理人员参考,也可作为高等院校岩土工程专业、地质工程专业研究生教材或教学参考书。

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序

地基稳定性问题对城市建设是最主要的工程地质问题之一。城市建筑物以房屋、道路、桥梁等为主。尤其是房屋,大小、高高低低,各种用途、各种结构形式,密集成群,都有一个共同问题,即地基稳定性问题。愈是大型、高层建筑,这个问题愈突出,道路桥梁地基稳定性问题同样也是如此。至于地下建筑,其主要工程地质问题是围岩稳定性问题而不是地基稳定性问题。

本书对地基稳定性问题作了全面系统的论述,并以烟台市岩土地基为实例,对所论述的理论细节,一一作了印证,既加深了对理论的理解,又把握了实际应用。这种理论与实际的有机结合,既具体又生动,很有特色。

地基稳定性的控制性因素是地基的地质结构,这包括地基岩土的类型及一定深度内的层次变化与组合关系。本专著提出了地基岩土体用、基础设计,以及环境评价提供了可靠的资料和正确的工程地质结论。

本书由李相然博士和姚志祥博士共同编著。他们两位是多年的朋友,经常合作科研项目,交流学术思想,切磋专业问题。这次协作可说是珠联璧合:姚志祥多年在烟台从事勘察工作,对烟台的工程地质情况了然在胸,实际工作经验丰富;李相然从事教学科研工作,在工程地质领域涉及面较广,地质基础知识雄厚,结合教研工作先后编著了《滨海城市环境工程地质》、《土力学应试指导》、《城市地下工程实用技术》等著作。他们刻苦努力的敬业精神很值得学习,这是他们完成本书写作的根本条件。

本书内容新颖,对岩土地基的理论系统全面,又有烟台市的丰富资料作为实证,阅读起来,便于理解,而且层次清楚,结构合理,深入浅出,文图并茂,是一本难得的好书。它的出版,有益于读者参考学习,定会在我国的建设高潮中起到重要作用。

张 咸 恭

2002 年 8 月

前 言

城市是地球表层物质、能量和信息高度集中的场所,是人类大量集中居住和活动的主要地域空间,也是工程建设最主要的地区。任何城市都是建立在不同的地质体(岩土体)上,城市工程建设与城市岩土体环境存在着密切的联系。近年来,随着城市化进程加快、人口的剧增和社会经济的高速发展,所占用的土地面积、地下水域和空间范围在不断扩大,人类工程活动也日趋向高层、超高层建筑群的高密度开发;城市地铁及城市各种生命线管网工程建设;大规模的填海造地和新区的大空间的拓展等。因此,在城市规划和建设中,加强岩土地基的工程地质研究,充分合理地利用岩土体条件,以便更好地为城市建设服务,是 21 世纪城市可持续发展战略中带根本性的课题。

工程地质和岩土工程分属两大学科领域,前者属于地质学范畴,后者属于土木工程范畴,这两大学科又有许多共同的内容,在城市地域单元内开展工程地质和岩土工程研究,两大学科之间有许多碰撞和摩擦,如何将岩土工程、工程地质进行有机融合,在城市地域内开展研究,为城市规划和建设服务,既是从事城市建设的工程师们面临的实践课题,也是许多专家学者一直探索的重要课题。《城市岩土地基工程地质》一书就是工程地质学、岩土工程学、工程岩土学、环境工程学等众多分支学科在城市地域内综合、融会、升华的结晶。

岩土地基工程地质研究对象是岩体和土体。岩体在其形成和存在的整个地质历史过程中,经受了各种复杂的地质作用,因而有复杂的结构和地应力场环境,而不同地区的不同类型岩体,由于经历的地质作用过程不同,其工程性质往往具有很大的差别。岩石出露地表后,经过风化作用而形成土,在各地质时期各地区的风化环境、搬运和沉积的动力学条件均存在差异性,因此,土体不仅工程性质复杂而且其性质的区域性和个性很强。本书是对城市地域内的岩土地基进行专门工程地质研究,其研究的重点内容包括如下几个领域:

城市岩土地基工程地质性质与特征研究。我国地域辽阔,岩土类别多,分布广,尤其是特殊岩土,类型多,工程地质性质差异大。以土为例,软粘土、黄土、膨胀土、盐渍土、红粘土、有机质土都有较大范围的分布,且工程地质性质虽有共性,但其个性对工程建设的影响更为重要。人们已经发现上海粘土、湛江粘土和昆明粘土的工程地质性质存在较大差异。因此,为了更好地为城市工程建设服务,应深入系统的研究和总结本地区的岩土地基工程地质性质和特征。本书既系统分析了我国城市岩土地基工程地质特征,又研究了烟台市区岩土地基的工程地质特征。

城市岩土地基工程地质结构研究。城市岩土地基工程地质结构,对于城市合理规划与布局,选择建筑物基础方案和基础类型有重要指导意义,也有利于全面论证城市工程地质条件及工程地质问题,是城市岩土地基工程地质研究的主要内容之一。因此,为了合理利用天然地基,科学规划不同类型的场区,合理选择基础持力层,也必须对城市岩土地基组合结构进行研究。书中不仅提出了岩土体立体结构的思想,还分析了岩土地基组合结构的典型形式和研究方法。

城市岩土地基工程地质性质纵向变化规律研究。岩土地基工程地质性质纵向变化规律

的研究,尤其是城市软土地区和风化壳的工程地质性质纵向变化规律研究,对于工程建设中充分合理利用岩土地基条件有重要实践意义,书中深入分析了城市软土地区和风化壳的工程地质性质纵向变化规律,并探讨了研究方法。

城市岩土地基工程地质评价与区划。城市岩土地基工程地质评价与区划是城市工程地质研究的重要工作,也是城市规划建设的基础工作。城市岩土地基工程地质评价的常用模型、程序与方法与实例分析等,是本书研究的主要内容。

城市岩土地基使用能力分析。工程建设不能超过地基的使用能力,城市岩土地基的使用能力分析,对于科学合理地利用土地,避免土地开发的环境问题发生,以及基础施工的难易程度,工期的长短及造价的高低等都有重要意义,是岩土工程领域一个新的课题。本专著在对岩土地基承载力、建筑物地基持力层等深入分析基础上,以烟台市区为例,进行了城市岩土地基使用能力评价与分区。

城市岩土地基稳定性的工程地质分析。岩土地基是建筑物的根本,其稳定性好坏直接影响到建筑物的安危、经济和正常使用。由于基础工程是在地下或水下进行,施工难度大,在一般高层建筑中,其造价约占总造价的25%,工期约占总工期的25%~30%。当需采用深基础或人工地基时,其造价和工期所占比例更大。地基基础工程还是隐蔽工程,一旦失事,不仅损失巨大,且补救十分困难。因此,对岩土地基的稳定性进行工程地质分析,具有十分重要的实际意义。书中在对地基应力与变形分析的基础上,研究了岩石地基稳定性和特殊地基土的稳定性。

城市环境岩土工程问题研究。这是城市岩土地基工程地质研究的新内容。工程岩土环境是受自然环境与社会经济系统双重控制而形成的一个开放复杂的系统。随着人口的增长和经济的快速发展,环境、化学、生物等的相互交叉作用对兴建土木工程造成复杂的影响,引起诸多环境岩土工程问题。因此,城市环境岩土工程问题研究是城市岩土地基工程地质研究的崭新课题。本书分析了环境岩土工程学研究的基本问题,将环境岩土工程问题划分为两大类型(物理环境岩土工程问题和化学环境岩土工程问题),深入研究了当前城市环境岩土工程的主要问题,并提出了防治对策。

城市岩土地基的化学变化、性质变异研究。土体是由固、液、气三相组成,固、液、气三相之间的相互作用对土的工程性质影响很大。岩土地基受污染后,对岩土体的工程性质影响很大,会影响地基的使用能力。本书研究了岩土地基化学变化的原因及由此引起的物理力学性质变异,并探讨了岩土地基化学变化的作用机理,提出了环境岩土化学这一边缘学科的含义与研究内容。

城市岩土地基的改良与基础工程设计。土和土体改良的基本原理是通过改变土的成分和结构来达到改良某些土性质的目的;岩体性质的改良,应首先致力于恢复或增强岩体的完整性,降低其有效孔隙性,以提高岩体的力学强度和降低其渗透性,来适应工程建设的需要。岩土地基改良的技术方法很多,应综合考虑各种因素,选择合理的改良方法。本书分析了烟台市区地基处理的形式和适应性,桩基的类型与特点,结合工程实例,分析了基础工程设计中岩土体条件的优化利用。

城市岩土体环境评定与可持续利用。城市工程建设对岩土环境造成不同程度的影响,有的已经诱发严重的环境岩土工程问题,这给岩土工程师们提出了许多新的课题。随着城市化、工业化发展进程加快,城市岩土环境研究将更加重要。另一方面,在进行岩土工程项目

时,不仅要考虑当前工程建设时的岩土工程问题,而且应从工程项目的可持续性高度,重视研究工程与环境之间的相互协调与制约的影响,要对岩土工程项目可能引起的环境改变,甚至环境恶化的可能性或带来的工程灾害的预测和防治工作认真地研究评估。因此,站在可持续发展的高度,探讨岩土环境变异规律与治理调控措施,是城市岩土地基工程地质研究的一项新课题。本书深入分析了岩土体环境变异的诱因,提出了岩土体环境与城市建设协同发展方略,对烟台市区的岩土体环境进行了评定,提出了岩土体环境优化利用的建议和城市土地利用工程控制的思想,从岩土体环境出发,分析烟台市的城市发展方向。

本书共 18 章,涵盖了两大部分内容:上篇是基础理论与方法篇,分别研究了城市岩土地基工程地质研究的基本问题、中国城市岩土地基工程地质特征、城市岩土地基工程地质结构研究、城市岩土地基工程地质性质纵向变化规律研究、城市岩土地基工程地质评价与区划、城市岩土地基使用能力分析、城市岩土地基稳定性的工程地质分析、城市环境岩土工程问题研究、城市岩土地基的化学变化、性质变异与改良研究、城市岩土体环境与可持续发展;下篇是实证研究,以滨海城市——烟台市区为例,分别研究烟台市区的经济与地学环境、烟台市区岩土地基工程地质特征、烟台市区岩土体立体结构分析、烟台市区环境岩土工程分析、烟台市区岩土地基工程地质区划、烟台市区岩土地基使用能力分析与优化利用、烟台市区岩土地基的改良与基础工程设计、烟台市区的岩土体环境评定与可持续利用。

本书具有两大特点:研究内容上体现了工程地质学、岩土工程学、工程岩土学、环境工程学等众多分支学科在城市地域内综合、融会与升华;研究方法上注重理论研究与实证研究相结合,既有基础理论阐述,又有大量的工程实例分析。

本专著是作者山东省教育厅项目“工程地质环境质量评价理论在城市规划与土地利用中应用研究”(J99E06)的主要内容和中国冶金地勘总局与山东省科委联合资助基金项目“济南城市环境岩土工程问题评价与对策研究”的阶段成果。在研究过程中,始终贯穿系统科学理论和可持续发展思想,综合运用工程地质学、岩土工程学、工程岩土学、环境工程学、管理科学、数理科学、环境科学等众多学科有关理论和方法,注重规范分析与实证分析的有效结合,城市岩土地基工程地质理论研究与应用研究相结合。在解决问题的方法论上,体现从定性到定量的综合集成思想,力求将现代工程地质、岩土工程理论,众多学科的研究成果应用于该项研究中。

本书成果最终成型,离不开有关各方面的大力支持与帮助。在本书撰写过程中始终得到中国地质大学张咸恭教授、长安大学胡广韬教授、南京大学罗国煜教授等前辈的鼓励与指导,特别令人感动的是,张咸恭先生不仅经常来信来电给予指导,还在住院期间为本书写序。中国冶金地质勘查工程总局闫学义局长在书稿完成的全过程中,不仅在专业上给予指导还给予许多无私的帮助。在此,谨表示真挚的谢意。中国地质环境监测院刘传正教授,中国有色西安勘察院关文章教授,青岛建筑工程学院岩土工程研究所所长贺可强教授,山东建筑工程学院岩土工程研究所所长王延祥教授,在课题研究中提供了许多宝贵的建议。研究中还得到中国冶金地勘总局和山东岩土工程总公司等单位的大力支持。在该书的撰写过程中,先后指导了土木工程系 96 级学生徐彦、王笃国、李秀领、祝令亚、宋志远,97 级学生陶津、赵晓(以上均已考取岩土工程专业、地质工程专业研究生)、王庆新、翟明波、于静等的毕业论文,他们在撰写毕业论文中也为本书做了许多具体的工作,在此表示深深地感谢。

该书的顺利完成与出版,是朋友团结协作的结晶。南京大学姚志祥博士协助撰写了本书

第5章、第6章、第7章、第11章、第12章内容。烟台大学土木工程系主任邢纪波教授,多年来不仅给予许多无私的帮助,还给予许多学术启迪。青岛海洋大学贾永刚教授、韩德亮博士,烟台市地质环境监测站刘伟金站长,烟台大地防渗加固工程有限公司赵春富总工、烟台地质工程勘察院刘殿浩总工、烟台市测绘院陈永建总工等为本书的完成提供许多帮助,在此深表谢忱。

城市岩土地基工程地质研究是一跨学科研究课题,牵涉诸多复杂问题,理论框架尚不十分成熟,正处于完善和发展阶段,上述研究内容只是抛砖引玉,热忱欢迎专家和读者给予赐教和指正。

李相然

2002年4月于烟台

PREFACE

City is a high concentrated ground with surface substance, energy and information of the earth, it is a main tract space for human concentrated habitation and activity, it is also a main area for the engineering construction. Any city is all constructed on the different geological mass (or rock-soil mass, RSM), there is a consanguineous relation between the urban engineering construction and urban rock-soil mass environment (RSME). In recent years, urban land acreage, the region of ground water and space are constantly extending along with the quickening of urbanization course, the leap of population and the high speed development of society and economy, human engineering activity is also intensifying day by day, high density exploitation of the high and exceed high architectural complex; urban subway and lifeline pipe net construction; large scale land formation by filling seashore and big space development of the new developed area, etc.. Therefore, it is a fundamental task in urban sustainable development tactics for the urban planning and construction in 21 century, to strengthen the study of the engineering geology of the rock and soil foundation (EGRSF), to make full use of the condition of RSM reasonably.

Engineering geology and geotechnical engineering dividedly belong to two subject fields, the former belongs to geology, the latter belongs to civil engineering, they have many same contents. there is much collision and friction between the two subjects when engineering geology and geotechnical engineering are studied in the urban tract cell. How to syncretize organically between the engineering geology and geotechnical engineering to serve urban planning and construction, It is not only a practice task for the engineers of the urban construction, but also an important subject for many experts and scholars. «Urban Engineering Geology of the Rock and Soil Foundation» is the crystallization of synthesis, comprehensive study and sublimation of many subjects (i. e., engineering geology, geotechnical engineering, science of engineering rock and soil, environmental engineering, etc.) in the urban tract.

The study objects of the EGRSF are rock mass and soil mass. Rock mass has suffered various kinds of complicated geological action in the whole geological history, so it has complicated structure and crustal stress field environment, engineering property of the rock mass of different types in different areas are very different. Soil is formed by weathering of rock after it is outcropped, there is otherness about weathering environment, dynamical condition of the transition and sediment in different geological phases and different areas, so soil mass has complicated engineering property and its property has great regionality and individuality. «Urban Engineering Geology of the Rock and Soil Foundation» is a special study for the rock and soil foundation (RSF) in the urban tract. Key research con-

tents of this book are as follows:

Study of the urban engineering geological property and characteristics of the rock and soil foundation. There are various rocks and soils, especially there are many special rocks and soils in our country, the engineering geological diversity of which is great. For example, soil, such as soft clay, loess, expansive soil, salinized soil, red clay, histosol, they are distributed in large areas, their special property is big effected to engineering construction. People have discovered that there are great difference in engineering geological property among Shanghai clay, Zhanjiang clay, and Kunming clay. So, the regional engineering geological property and characteristics of the rock and soil foundation should be systematically studied and summarized, in order to serve the urban engineering construction better. This book not only analyses the urban engineering geological characteristics of the rock and soil foundation in China, but also studies the engineering geological characteristics of the rock and soil foundation in the district of Yantai city.

Study of the engineering geological structure of the urban rock and soil foundation. The engineering geological structure of the urban rock and soil foundation, has great instructive significance for urban reasonable planning, the selection of the scheme and types of the foundation, it is also propitious to demonstrate the urban engineering geological conditions and problems. It is an important content for EGRSF. So the combination structure of the urban RSF should be studied in order to make use of natural foundation, plan the various fields and select the supporting course of the foundation. A new thought of the stereo-structure of the RSM was proposed, Typical forms and study methods of the combination structure of the urban RSF are also analysed in this book.

Study on the vertical change regularity of the engineering geological property of the urban rock and soil foundation. The vertical change regularity of the engineering geological property of the RSF, especially the change regularity of the urban soft soil area and crust of weathering has important practice significance for the reasonable utilization of the conditions for RSF in engineering construction. The vertical change regularity of the engineering geological property of the urban soft soil area and crust of weathering is deeply analysed, study methods are also discussed.

The evaluation and zoning of the engineering geology of the urban rock and soil foundation. It is an important task for urban engineering geology research, it is also a basic work for the urban planning and construction. The evaluation model in common use, program, method and case study for the engineering geological evaluation of the urban RSF, etc., are the main contents of this book.

The analysis of using capability of the urban rock and soil foundation. Engineering construction can not exceed using capability of the foundation. This subject is very important for the reasonable utilization of the urban land, the avoidance of environmental problems in land exploitation, the difficult and easy degree, the time limit, and the cost of foundation construction are also influenced by it, so it is a new project for the geotechnical

engineering. Based on the analysis for the bearing capacity of the RSF, the supporting course of the building foundation, the using capability evaluation and zoning of the urban RSF are studied as a case study of Yantai city in the book.

The engineering geological analysis of the stability of the urban rock and soil foundation. Rock and soil foundation is the root for a building, it is totally called foundation engineering, The safety, economy and normal use of the buildings are directly influenced by the stability of the foundation. Because the foundation engineering is done in subterranean or under water, the construction difficulty is great, its cost accounts for about 25 percent of the total cost, its time limit accounts for about 25 to 30 percent of the total time limit in high building. Its proportions of the cost and time limit are even larger when deep foundation or artificial foundation is adopted. The foundation engineering is concealed engineering, once failed, the loss is great and remediation is very difficult. So it is very important to study this project. Based on the analysis of the stress and deformation of the foundation, the stability for the rock foundation and special foundation soil are studied in this book.

Study on the urban environmental geotechnical problems. This is new content of the EGRSF. Engineering rock-soil environment is an open and complicated system which is controlled by double systems of the natural environment and social and economical one. Along with the leap of population and the high speed development of society and economy, complicated effect has been caused to civil engineering by the across actions of the environment, chemistry and biology. Many environmental geotechnical problems have been caused. It is a new task for the EGRSF. Basic problems of environmental geotechnology are analysed, and environmental geotechnical problems are divided into two types (i. e. , physical environmental geotechnical problems and chemical environmental geotechnical problems), main the urban environmental geotechnical problems are studied deeply, Countermeasures of the prevention and cure for the urban environmental geotechnical problems are discussed.

Study on the chemical change, property variation of the urban rock and soil foundation. Soil mass is composed by the three phases with solid, liquid and gaseous state. The engineering property of the soil is influenced by the action each other among three phases. The engineering property of the RSM is also influenced when RSF is polluted, when using capability of the foundation is influenced. The cause of chemical change for the RSF and physical and mechanical property variation of the RSF are studied. The mechanism of the chemical change for the RSF is discussed. The meanings and contents of a new subject-environmental rock and soil chemistry is proposed.

The improvement of the urban rock and soil foundation and the design of foundation engineering. Basic principle of soil and soil mass improvement is that the property is improved by changes of composition and structure. When the rock mass property is improved, resuming and enhancement integrality of the rock mass should be taken up first,

in order to reduce efficient porosity, enhance the mechanical intensity and debase penetrability of the rock mass, adapt engineering construction. There are many methods to improve the RSF. Reasonable improvement method should be chosen according to all kinds of factors. Main types and the adaptability of the ground treatment in the district of Yantai city are analysed, types and characteristics of pile foundation in application in the district of Yantai city are also discussed. The optimizing utilization of the rock-soil mass conditions in the design of foundation engineering is analysed in this book.

Assessment and sustainable utilization of the rock-soil mass environment. Urban engineering construction affected rock-soil environment, and serious environmental geotechnical problems have been caused. Many new projects are proposed to geotechnical engineers. The study of the RSME is becoming very important along with the quickening of urbanization and industrialization course. On the other hand, not only the present environmental geotechnical problems should be considered when geotechnical engineering project is done, but also be potential effect. Therefore, the discussion among the variation rule and countermeasures of the prevention and cure of the RSME is a new project for EGRSF. The inducement of the rock-soil mass environment variation is analysed. The tactics of the development in coordination with the rock-soil mass environmental protection and economical construction are also proposed. The RSE in the district of Yantai city is assessed, a suggestion of the optimizing utilization of the RSE and a new thought of the engineering control of the land utilization in the district of Yantai city are also proposed, the urban development way of the Yantai city from the view of the RSE is analysed.

There are 18 chapters in this book, including two part of contents: part I is the study of the basic theory and method, such as basic problems of the engineering geology research of the urban rock and soil foundation, the urban engineering geological characteristics of the rock and soil foundation in China, study of the engineering geology structure of the urban rock and soil foundation, study of the vertical change orderliness of the engineering geological property of the urban rock and soil foundation, the evaluation and zoning of the engineering geology of the urban rock and soil foundation, the using capability analysis and evaluation of the urban rock and soil foundation, the engineering geological analysis of the stability of the urban rock and soil foundation, study of the urban environmental geotechnical problems, study of the chemical change, property variation and improvement of the urban rock and soil foundation, urban rock-soil mass environment and sustainable development; part II is Study of the demonstration, a case study (i. e. , littoral cities) of the district in Yantai city, such as the economical and geological environment in the district of Yantai city, the engineering geological characteristics of the rock and soil foundation in the district of Yantai city, analysis of the stereo-structure of the rock-soil mass in the district of Yantai city, analysis of environmental geotechnical problems in the district of Yantai city, the engineering geological zoning for the rock and soil foundation in the district of Yantai city, the using capability analysis and optimizing utilization of the

rock and soil foundation in the district of Yantai city, the improvement of the rock and soil foundation and the design of foundation engineering in the district of Yantai city, assessment and sustainable utilization of the rock-soil mass environment in the district of Yantai city.

This book has two characteristics. One is the results of synthesis, comprehensive study and sublimation of many subjects (i. e. , engineering geology, geotechnical engineering, science of engineering rock and soil, environmental engineering, etc.) in the urban tract in the contents, the other is the combination of theory and demonstration study, not only the basic theory expatiates, but also a lot of engineering case study analyse.

This book is the main content of the project of the education office in Shandong province (i. e. , study on the evaluation theory of engineering geological environmental quality applied to urban planning and land utilization) and it is also a phase fruit of the fund project of the chief bureau of the China metallurgy geological investigate (i. e. , study on the evaluation and countermeasures of the environmental geotechnical problems in Jinan city). The theory of system science and the thought of sustainable development are impenetrated all the time in the course of the study, many subject theory and method of the engineering geology, geotechnical engineering, science of engineering rock and soil, environmental engineering, manage science, mathematics, environmental science, etc. , are applied in this study. The effective combination of the analysis of criterion and demonstration, the combination of the theory and application research are paid attention to in the course of this study. Synthesis integration thought from quality to quantity is incarnated in the methodology, modern theories for the engineering geology, geotechnical engineering and research fruit of many subjects are striven to apply to the research.

The engineering geology of the urban rock and soil foundation is a study task including many subjects. Many complicated problems are involved in it, its theory frame is not mature, it is in perfecting and development stage. This book is throwing out a minnow to catch a whale, we zealously welcome the experts and readers to grant instruction and point out mistakes so that they can be corrected.

Li Xiangran

2002. 4

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