

# 引进新技术 促进工勘施工发展<sup>\*</sup>

李 东<sup>1</sup>, 易永利<sup>1</sup>, 李 平<sup>2</sup>

(1 天津市地质工程勘察院, 天津 300191; 2 天津市地质矿产勘查开发局, 天津 300191)

**摘 要:** 技术进步是推动经济增长的重要因素, 创新和技术进步是经济体系的内生变量, 技术进步可带动投资规模的不断提高、经济的长期稳定增长。工勘施工引进 SMW 工法技术, 是岩土工程深基坑施工中的又一次技术上的进步, 它是一种新兴基坑围护工艺, 具有挡水性强、对周围地基影响小、环境污染小、多用途(适应各种地层)、工期短、造价低等各种优势。特别是对天津软土地区的深基坑施工十分有益, 具有利润率高、成本回收快的特点。

**关键词:** 技术进步; SMW 工法; 工勘施工

**中图分类号:** TU 195(222)

**文献标识码:** C

**文章编号:** 1672-6995(2009)09-0035-02

金融危机给世界经济发展带来极大的负面影响, 对中国经济的影响也在逐渐显现。应对这场危机, 很多专家都给出了一剂良方——自主创新。所以, 面对此次危机, 自主创新成为我们抓住机会、战胜危机, 实现可持续发展的必然选择。天津地质勘察院津勘岩土公司引进的日本 SMW 工法连续墙施工装备技术, 在天津软土深基坑施工中发挥了重要作用, 提高了该院深基坑施工和技术研发能力, 该院从 2007 年引进日本基坑施工技术 SMW 工法项目, 三年来共承担天津地区软土深基坑施工项目二十多个, 其中天津滨海新区诺和诺德深基坑面积多达 5 万平米, 最大深度 11 米, 累计创收 1.2 亿元, 成为天津市地矿局新的经济增长点和推动经济增长方式转变的核心技术力量。

## 1 技术进步促进地勘单位经济增长方式转变

现代经济增长理论中对经济增长因素的分析表明, 技术进步已成为发达国家经济增长中的最重要因素, 也是现代经济增长的基础。技术进步的影响因素有很多, 如采用新的技术、改进生产设备、加强企业管理、优化产业结构、提高职工素质以及社会专业化生产水平的提高等, 而这些因素对促进经济增长和提高经济增长的质量, 进而促进经济增长方式的转变等方面都有着重要的影响。因可以说技术进步不仅是现代经济增长的重要推动力, 而且是推动经济增长方式转变的核心力量。

### 1.1 装备技术进步是提高经济效益的重要源泉

生产设备技术水平的提高和生产工艺水平的改善是技术进步的重要方面。生产技术水平提高可以提高产出水平, 大幅度提高劳动生产率, 降低消耗; 生产设备的大型化、生产的自动化等可提高企业生产的规模效益, 降低成本, 提高投入产出率。生产工艺水平是技术水平的主要标志之一, 它的提高对减少生产消耗、提高产品质量、降低产品成本起着十分重要的作用。

劳动者素质是影响经济效益的重要因素之一, 而技术进步可以提高劳动者的素质。技术进步对劳动者的影响不仅表现在生活方式、生活水平、改善健康状况、延长寿命等方面, 更重要的是能提高劳动者的智力、知识、劳动技能等, 使之能与先进的设备、先进的工艺相互配合, 并充分发挥作用, 从而使经济效益也

获得相应的提高。

## 1.2 技术进步促进产业结构合理化, 使资源配置效率得到提高

技术进步对产业结构的影响是多方面的。技术进步通过刺激需求结构、改变就业结构、促进新兴产业出现、改变国际竞争格局等方面促进产业结构发生变化。例如: 在激烈的国际市场竞争环境中, 靠资源优势获胜的机会越来越少, 而靠技术进步取胜的机会越来越大, 这样就会推动技术密集型产业和高新技术产业的发展。此外, 技术进步也可以提高地勘单位在市场上的竞争能力, 产业技术上的升级会随着竞争能力的变化而变化。实际上, 第二次世界大战后, 技术进步已使国际竞争格局发生巨大变化。一些国家(地区)(如日本、东盟亚洲“四小龙”等)在国际市场上的竞争能力增长很快, 并带动了这些国家(地区)的产业结构发生变化。

技术进步改变产业结构的过程是使产业结构不断合理化、高级化的过程。随着技术进步, 地勘单位可利用越来越先进的机器设备去参与新市场、新项目的生产和研发活动, 落后陈旧的机器设备在市场竞争中被淘汰出局。新装备、新技术在生产活动中应用的密度越来越大, 当技术水平高度发展时, 生产的效率不断提高, 生产成本不断下降, 核心竞争力不断提升, 市场占有率逐渐扩大, 经济效益进一步提高。技术进步使产业结构不断向合理化、高级化方向发展, 带动了经济持续协调的发展, 从而使得产业结构效益和资源配置效率得到提高。

## 2 SMW 工法是基础施工的一次技术进步

### 2.1 SMW 工法简介

SMW 是 Soil Mixing wall 的缩写。SMW 工法连续墙于 1976 年在日本问世, 据日本 SMW 协会统计, 至 1993 年 7 月该工法在日本施工完成 1216 万 m<sup>2</sup>, 而到 2003 年 7 月, 该工法在日本各地施工已达 2594 万 m<sup>2</sup>, 约合 1706 万 m<sup>3</sup>, 占全日本用各种工法施工地下连续墙的 70% 左右。且该工法已在我国台湾地区以及泰国等东南亚国家和美国、法国许多地方广泛应用。

该工法是以多轴型钻掘搅拌机在现场向一定深度进行钻

<sup>\*</sup> 作者简介: 李东(1967—), 男, 天津市塘沽区人, 高级工程师, 工学学士, 主要从事工程岩土施工及评价研究。

掘,同时在钻头处喷出水水泥系强化剂而与地基土反复混合搅拌,在各施工单元之间则采取重叠搭接施工,然后在水泥土混合体未结硬前插入 H 型钢或钢板作为其应力补强材料,至水泥结硬,便形成一道具有一定强度和刚度的、连续完整的、无缝隙的地下墙体。SMW 工法最常用的是三轴型钻掘搅拌机,其中钻杆有用于粘性土及用于砂砾土和基岩之分,此外还研制了一些机型,用于城市高架桥下等施工空间受限制的场合,或海底筑墙,或软弱地基加固。

## 2.2 SMW 工法在我国和天津的技术可行性

在国内,上海隧道工程股份有限公司针对型钢水泥土复合搅拌桩支护结构技术(SMW 工法)进行了引进和研究,并于 1997 年 8 月作为建设部重点科技成果项目通过鉴定,建设部进一步进行项目推广。目前已经应用于上海地铁二号线静安寺车站、陆家嘴车站、上海浦东油管路及凌桥地区排水干管的顶管工程以及申海大厦地下车库等多项工程。另外在南京、地铁新街口车站、中胜站、南北线一期一标段盾构井,在杭州湖滨隧道工程、厦门国际航空港北溪引水暗涵工程等也被广泛应用,同时在北京也已经开始进行试验性研究和推广。在天津,已经在多个工程中进行应用,包括地铁一号线鞍山道车站、地铁一号线洪湖里车站、南开二纬路地铁车站、天津环渤海经贸大厦的基坑支护、天津开发区英泰汽车厂房的设备基础基坑支护等。同时,天津市建委会会同天津市政工程公司在其地铁工程中共同进行技术应用和技术推广工作。众多的成功工程实例表明,SMW 工法在天津已经趋于成熟,并将推广应用。

## 2.3 SMW 工法与其它支护工程的技术、经济对比

### 2.3.1 水泥土搅拌桩挡土墙

- (1) 适合软土地区且对环境保护要求不高,开挖深度小于 7m 的基坑工程;
- (2) 施工噪声低,振动小,结构止水性较好,造价经济;
- (3) 围护挡墙较宽,一般需大于 4m,需占用基坑红线内一部分面积。

### 2.3.2 地下连续墙

- (1) 施工噪声低、振动小,就地浇筑、墙接头止水效果好、整体刚度大,对周围环境影响小;
- (2) 适合于软弱地层和建筑设施密集城市的市区深基坑;
- (3) 墙接头构造有刚性和柔性两种类型,并有多种形式。高质量刚性接头的地下连续墙可作为永久性结构;
- (4) 施工的基坑范围可达基地红线,可提高基地建筑的使用面积,若建筑物工期紧、施工场地小,可将地下连续墙作主体结构并可采用逆筑法、半逆筑法施工;
- (5) 泥浆处理、水下钢筋混凝土浇制的施工工艺复杂、造价较高;
- (6) 为保证地下连续墙质量,要求较高的施工技术和管理水平。

### 2.3.3 灌注桩和搅拌桩结合

- (1) 灌注桩作为受力结构,搅拌桩作为止水结构;
- (2) 一般使用于软弱地层中的挖深不大于 12m 的深基坑;
- (3) 施工噪声低、振动小,施工方便、造价经济、止水效果

好:

(4) 搅拌桩和灌注桩结合可形成连拱型结构,搅拌桩作受力拱、灌注桩作支撑拱脚,沿灌注桩竖向设置支撑,这种组合式结构可因地制宜取得较好的技术经济效益。

## 2.3.4 SMW 工法

- (1) 施工低噪声,对周围环境影响小;
- (2) 由于采用独特的全断面重迭套打(无缝隙)工艺,以及墙体的高强和高抗渗性能,使得防水效果良好;
- (3) 结构强度可靠,适合于多种土层,配以多道支撑,可适用于深基坑,常用于深度在 6-12 米以内基坑,采取相应技术措施,深度可达 16 米;
- (4) 围护挡墙窄,适合狭小场地施工,施工速度快。

SMW 工法与上述传统基坑围护结构相比不仅挡土、防水效果好,且能在狭小场地上安全施工,无噪声、振动小、无泥浆和公害影响,并且能够缩短工期、节约造价。在一定条件下可以完全取代上述作为围护工程的几种常规施工方法,具有很大的发展前景。

通过实际造价分析,SMW 工法的工程造价为灌注桩排桩加水泥搅拌桩幕墙的 71.1%。经济指标前者优于后者。SMW 工法与普通的灌注桩+深搅桩组合相比,造价低 20% 左右。

## 4 小结

国际金融危机使企业面临着新的机遇和挑战,也面临着观念的转变和知识的更新。从历史上看,不论是 19 世纪中期的经济危机,还是 20 世纪上半叶的经济大萧条,每一场大的危机都伴随一场新的科技革命,每一次经济的复苏,都离不开技术创新,最后都是因为新技术革命而走出危机。要走出国门与世界接轨,提高地勘单位核心竞争力,必须加快地勘单位技术和装备的更新改造,加大新技术、新装备投入和引进,加快现代企业制度的建立和结构调整。曼斯菲尔认为技术进步主要来源于技术创新和技术扩散。在同一部门内影响技术扩散的基本因素有三个:新技术的模仿比例;新技术的相对盈利率;新技术所要求的投资额。要引导企业提高科技创新的意识,建立有效的技术创新投入机制,增强企业技术创新能力。SMW 工法是利用专门的多轴搅拌机就地钻进切削土体,同时在钻头端部将水泥浆液注入土体,经充分搅拌混合后,再将 H 型钢或其他型材插入搅拌桩体内,形成地下连续墙体,利用该墙体直接作为挡土和止水结构。其主要特点是构造简单,止水性能好,工期短,造价低,环境污染小,特别适合城市中的深基坑工程。是未来提高地勘单位深基坑施工技术进步和发展的选择。

## 参考文献:

- [1] 史佩栋. SMW 工法地下连续墙[J]. 西部探矿工程, 1995 (1): 51-52
- [2] 张璞,柳荣华. SMW 工法在深基坑工程中的应用[J]. 岩石力学与工程学报, 2000(1): 280-283
- [3] 吕俊江,田志昌,李斌. 基坑支护体系空间结构有限元法研究[J]. 包头钢铁学院学报, 2000(2): 15-17

收稿日期: 2009-08-19

( 1. The Development Research Center of China Geological Survey, Beijing 100093 China; 2. Chinese Academy of Land and Resource Economics Beijing 101149)

**Abstract** The paper points out that along with the rapid development of the economy in the industrializing countries, two major problems born large in the shortage of resources and environmental pollution, and the bearing capacity, has gradually become the most commonly used concept for describing the extent of restrictions of regional development, and has been drawn attention to many developed countries. The paper puts forward some suggestions for improving the study of bearing capacity from the following aspects: index system establishment, early warning system improvement, as well as the application of 3S techniques.

**Key words** resources and environment; capacity; recommendations

## 21 Discussion on the Basic Farmland Protection System in China

CHEN Mei-qiu, LIU Cheng, PENG Li-na

(College of Land Resource and Environment, Jiangxi Agriculture University, Nanchang 330045 China)

**Abstract** The policy of basic farmland protection is an important guarantee to achieve sustainable socio-economic development in China. The paper first introduces some problems involved in the protection of basic farmland, such as lack of real main subject for implementing protection, the opportunity cost brought about from protection of basic farmland can not be reasonably assessed, there are still many irrational aspects on basic farmland protection planning, the total complement of basic farmland is inadequate. In response to this, the paper suggests that the basic farmland protection system based on compensation should be established, and farmers, village collectives and local governments should become the main body of basic compensation for farmland protection; compensation standards and methods should be determined according to the land values and economic and social development trends, and relevant supporting policies should be introduced in time.

**Key words** basic farmland protection; mechanism; compensation

## 24 The Practice and Characteristics of Foreign Topsoil Stripping

ZHU Xian-yun

(Information Center of the Ministry of Land and Resources Beijing 100812 China)

**Abstract** The paper mainly introduces some experiences for topsoil stripping in foreign countries that we can use for reference; these include: the mature management system has strengthened the administrative means; the procedure for topsoil stripping is not only standard but also strict in demands; topsoil stripping has a sound and comprehensive legal system; they have more skillful use of economic instruments; they have mature technology and continuous innovation; topsoil stripping presents the trend of marketization and socialization; topsoil stripping of the ecological characteristics becomes increasingly apparent.

**Key words** topsoil stripping; reuse; practice; features

27

## Discussion on How Does Geological Exploration Units have a Finger in Distributing the Profits from Mining Rights Transfer

WANG Ren-cai, LUO Xiao-min, CUI Zhen-min  
(Chinese Academy of Land and Resource Economics Beijing 101149)

**Abstract** The paper introduces the restricting factors which have affected the geological exploration units involving in the income distribution of geological exploration projects based on the investigation, these include: deposit types, minerals, the phase of geological work, region, size of deposits. The paper offers the reasonable ratio (5% - 3%) which the geological exploration units participate in the income distribution of mining rights by using the methods of specific value and coefficients via the aspects of quantitative analysis, the assessment of mineral prospecting rights, as well as the profit margin of geological exploration units.

**Key words** geological prospecting units; distribution of income; mining rights

30

## Three-level Exploration Method of Aerogeophysical Techniques is an Effective Way to Quickly Prospecting

WANG Wei-ping, FANG Ying-yao, WU Cheng-ping  
(China Land and Resources Aerogeophysical and Remote Sensing Center Beijing 100083)

**Abstract** The paper focuses on the methods for improving geological prospecting results by using aerogeophysical techniques. It proposes three-step methods: promoting and applying fixed-wing airborne geophysical exploration to conduct a large-scale investigation, giving meticulous survey for the key metallogenic target provinces by helicopter aerogeophysical techniques, and verifying exploration targets on the ground.

**Key words** fixed-wing airborne geophysical exploration; helicopter aerogeophysical techniques; ground verification; 3 survey method; quick prospecting

32

## Study on Comparison between the Model of Income Methods of Mining Rights and Assets Appraisal

LIU Yu-min

(China Association of Mining Rights Appraisers Beijing 100037)

**Abstract** The paper achieves six basic conclusions through comparing and analyzing Business valuation earnings method and discounted cash flow method (DCF) of mining rights assessment based on some documents, such as "the Guidelines on business valuation (Trial Implementation)" issued by China Appraisal Society. The Modification of Evaluation Method with regard to income approach, and the guidelines on the determination of mining evaluation parameters, released by China Association of Mining Rights Appraisers.

**Key words** mining right assessment; asset assessment; return model

35

## The Introduction of New Technologies for Promoting the Development of Engineering Geological Investigation and Construction

LIDong<sup>1</sup>, YIYong-li<sup>1</sup>, LIPing<sup>2</sup>

(1 Tianjin Geological Engineering Investigation Institute, Tianjin 300191 China; 2 Tianjin Bureau of Geology and Mineral Exploration and Development, Tianjin 300191 China)

**Abstract** The paper emphasizes the importance of introducing SMW technology which has various advantages including the strong ability in water-retaining, little effect on the surrounding ground and little pollution to environment. Multi-purpose (to adapt to a variety of strata), short construction period, as well as low cost. This technology with the characteristics of high profit margins and quick cost recovery is very useful for deep foundation pit on soft clay ground of Tianjin.

**Key words** technological progress; SMW method; engineering geological investigation and construction

37

### Fulfilling Scientific Outlook on Development to Strengthen the Management on Project Expenditures Budget

XU Ke-guang

(Resources & Environmental Protection Audit Bureau of National Audit Office of the People's Republic of China, Beijing 100830)

**Abstract** The paper offers some specific methods for improving the management of project expenditure budget on the basis of analyzing some problems that cannot be neglected concerning the project fund management in the institutional unit at the grass-roots level. These include: guided by scientific outlook on development, improving the main approaches of the management on project expenditure budget. Reforming the financial system, Establish and improve various management systems, at the same time we should reinforce audit supervision for Project expenditures, thus substantially raising the security, regulatory, health, nature and efficiency of the effective use of financial funds.

**Key words** scientific outlook on development; project expenditure; budget management; audit

39

### Thoughts on the Comprehensive Budget Management Introduced to Geological Exploration Units

LI En-zi

(Institute of Hydrogeological and Engineering Geological Investigation of Gansu Provincial Bureau of Geology and Mineral, Zhangye 734000 China)

**Abstract** The paper first introduces the main points of the overall budget management throughout the geological prospecting units

these are adopting a top-down bottom-up, and the combination of up and down budgeting method; contents of the budget should focus on revenues, costs, cash flow; building responsibility system for the chief administrative officers of the units and departments for budget management. And then it goes on to look at some problems that must be paid more attentions to: don't make budget only for budget preparation of the budget is not simply the behavior of financial sector; we should not only attach importance to the short-term activities but also to the strategic objectives and capital cost management; we should not place emphasis on internal factors and ignore the external environment research.

**Key words** geological exploration units; financial management; overall budget management

42

### Analysis on How Does the Geological Prospecting Unit Act in an Entrepreneurial Manner

GUO Xu-jia

(Jilin Province Institute of Exploration Geophysics, Changchun 130012 China)

**Abstract** The paper points out that if the geological prospecting units want to take the road to enterprise and enter the market operation, firstly they should consider the issue of capital accumulation, and then have a favorable external environment - the geological prospecting market. It goes on to point out that if the geological prospecting units act in an entrepreneurial manner, they must be based on a sound development geological prospecting market, financing and investment, survey co-operation, and the transfer of mining rights. They also must standardize the operation of the market to ensure orderly competition, to achieve a reasonable distribution. In addition, it points out that the own condition of geological exploration unit for running it like an enterprise is to establish a modern enterprise system, establishing and perfecting the corporate governance structure, namely clearly established ownership, well defined power and responsibility, separation of enterprise from administration, and scientific management. Can we get rid of the variety of history hysteresis barriers from the origin to ensure long-term healthy and stable development of geological exploration units?

**Key words** geological exploration units; enterprise; capital accumulation; geological markets; modern enterprise system; corporate governance institutions