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Development and applications of trenchless technology in China

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Abstract

Trenchless technology has developed for almost 10 years in China since the first symposium on trenchless technology was held in Beijing (Peking) in 1996 and the China Society for Trenchless Technology-CSTT was established in 1998. Driven by the dramatically increased demand for underground pipeline installation throughout the nation, China has made significant progress in research and development in trenchless technology in the past 10 years. For example, there are more than 200 contractors engaged in trenchless construction, using more than 2000 horizontal directional drilling machines, among which approximately 700 have been introduced in the last year, and the biggest HDD rig in the world is now in China. In addition, China has made many achievements in education, research, and new products development and has accomplished many challenging projects in terms of complexity, diameter and distance in this field. There is a huge market potential for trenchless technology in mainland China.

This paper presents the latest research, education, training, marketing and technical status of trenchless technology in China, and discusses the potential market, trends and factors that will influence trenchless technology in the next decade in China.

Keywords: Trenchless technology; Development; Application; China

Contents

1. Introduction

Ten years ago, conventional open-cut methods were widely used for underground utility installation and replacement in mainland China. These trenching methods in most urbanized settings typically create road closures, traffic delays, unnecessary detours, loss of access to homes and business, unsightliness, noise, and general disruption. Faced with population growth and an aging underground utility system, China has looked to emerging technologies to assist in providing sustainable solutions to addressing this situation.

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In the 1990s, some scholars, represented by the present Chairman of China Society for Trenchless Technology (CSTT), Mr. Yan Chunwen, from the former China Ministry of Geology and Mineral Resources joined the International Society for Trenchless Technology personally and transferred the new concept of advanced trenchless technology to China. Since then traditional geological drilling technology was used as horizontal directional drilling to install the underground pipelines without the need of ground excavation in China.

In 1996, the first national symposium on trenchless technology was held in Beijing. Two years later, the China Society for Trenchless Technology was established and joined the ISTT as the 20th member in 1998 (Ma, 2006). Over the past 10 years, with the immense construction boom currently being experienced in China, trenchless technology and the market have developed very fast. Three professional trenchless technology societies have been established in China, including: the China Shanghai Society for Trenchless Technology (CSSTT); the China Beijing Society for Trenchless Technology (CBSTT); and the China Guangdong Society for Trenchless Technology (CGSTT). These societies have mandates to promote the adoption of trenchless construction methods through educational initiatives. With a combination of government and industry participation, these societies have sponsored and conducted several technical seminars in recent years. In addition, three trenchless technology research and education centers have been established in Wuhan, Shanghai and Guangzhou respectively in 2002 (Ma, 2006).

By now, the more popular trenchless construction methods that have currently been adopted in China are horizontal directional drilling (HDD), pipe jacking, micro-tunneling, pipe bursting, and pipe ramming.

This paper will present the latest research, education, training, marketing and technical status of trenchless technology in China, and discuss the potential market, the trends and the factors that will influence trenchless technology in the next decade in China.

2. Horizontal directional drilling (HDD)

HDD is a technique that enables the installation of conduits and pipelines with minimum need for open-cut surface excavation (Najafi, 2005). Installation of underground utilities in congested urban areas using open trenching can prove to be rather expensive and often associated with the interruption of traffic and the disruption of nearby commercial activities. HDD has made a significant impact on both the utility and pipeline installation industries over the past decade. The Chinese market is the fastest growing worldwide market for HDD.

On March 12, 2002, a Robbins HDD model 55030TLMSC trailer mounted directional drill made history when it completed the first ever crossing under China's famous Yangtze River. The Contractor, East China Pipeline Construction Co. Ltd. of Sinopec, used a Robbins HDD drill rig to complete this 1688 m crossing in a very fast time. It took just 15 days to put in the pilot hole, back ream twice, and pull in the product line. A steel pipeline of 406 mm diameter × 8.7 mm wall thickness is now in place under the Yangtze River at the San Jiang Kou Harbor near Nanjing City.

Currently, HDD is a multi-billion dollar a year industry with hundreds of contractors and thousands of drilling rigs operating in China, which is the fastest growing segment of the trenchless technology market. It is estimated that there are more than 2000 HDD rigs currently operating in China with 670 new machines added to the existing market in 2006, among which 37 HDD rigs were imported from foreign countries (He, 2006). The increment and the market status of HDD rigs are illustrated in Fig. 1.

To summarize, China's Horizontal Directional Drilling market has the following characteristics:

- Maintaining the fast developing tendency.

Compared to 2004, the total construction value and the number of HDD rigs both have increased by 47% in 2005. Although, this value is less than that of 2003 or 2004, the total absolute number is more than that in 2003 or 2004 respectively. This increasing rate is much faster than that in any other country in the world (Zhu, 2004).

- The number of imported HDD rig continues to reduce. 37 HDD rigs were imported from foreign countries in 2005, decrease of 21% from 47 in the year 2004 (He, 2006). The market share of foreign HDD rigs decreased by 5% at the end of 2005.
- The completion of some high risk and complex construction projects. In 2005, there were several large-diameter and long distance HDD projects that had been finished successfully, including the Yangtze River oil pipeline-crossing project at Jiujiang in Jiangxi Province. A 2323 m long, 457 mm diameter steel pipeline was installed using the Mega HDD rig DD-1100 manufactured by American Augers. Several important projects are listed in Table 1.

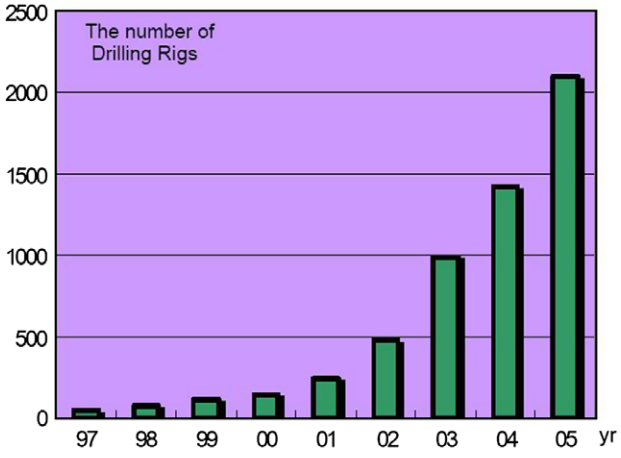

Fig. 1. The increment and the market status of HDD rigs.