大斷面潛盾隧道之發展與應用

方永壽　李承祐　劉　政　　邱志榮　林摩西　李魁士
交通大學土木工程系　　台灣世曦工程顧問股份有限公司

摘　要

本研究探討直徑大於10m大斷面潛盾隧道的發展與應用。內容包含：大斷面潛盾機在公路隧道、鐵路與捷運隧道、及排水隧道之代表性應用案例；規劃設計應檢核之項目；潛盾隧道環片之材質、厚度、寬度、環圈分割、及混凝土環片製作；大斷面潛盾機型選擇、與施工場區之設計考量。本研究蒐集位於歐洲、日本、及中國大陸128條大斷面潛盾隧道施工實績，其中公路隧道共63條，佔所收集案例的49%；鐵路(含捷運)隧道共48條，佔38%，顯然大斷面潛盾隧道最主流的用途是公路及鐵路隧道。本研究統計在日本建造73件大斷面潛盾隧道施工實績，其中環片材質採用預鑄鋼筋混凝土(RC)的有59個案例，佔所收集案例的81%，顯示大斷面潛盾隧道最主流的環片材質是鋼筋混凝土。依據過去的施工實績可建立環片厚度與隧道外徑之比例關係，歸納出潛盾隧道外徑超過10.0m，RC環片之厚徑比約為3.5～4.0%。早期(1985至2005年)在日本的大斷面潛盾隧道施工74%案例採用泥水式潛盾機施工，但是近年(2005至2015年)大斷面潛盾隧道施工朝向全面採用土壓平衡式潛盾機發展。

關鍵字：案例、大斷面、環片、潛盾機、隧道。

Development and Application of Large Cross-Section Shield Tunnels

Yung-Show Fang　Cheng-You Lee　Cheng Liu
Department of Civil Engineering, National Chiao Tung University, Hsinchu, Taiwan
Chih-Jung Chiu　Mo-Hsi Lin　Chris Kweishr Li
CECI Engineering Consultants, Inc., Taiwan

Abstract

This paper reports the development and application of large cross-section tunnels constructed using shield machines with diameters greater than 10 m. This paper discusses the application of large-diameter shields in the construction of road, railroad, and water drainage tunnels; the checklists for planning and design; lining segments; selection of a shield machine; and considerations for the construction jobsite. Of 128 cases of large cross-section shield tunnels collected from Asia and Europe, 49% of them were used for road tunnels, and 38% were used for railroad and metro tunnels. Thus, the large cross-section tunnels were mainly constructed for road and railroad tunnels. Of the 73 large cross-section tunnels excavated in Japan, 59 of them (81%) were lined with reinforced concrete (RC) segments. The lining segments that were used most often were composed of RC. The relationship between the thickness of the lining segment and the outer diameter of the tunnel was defined as the thickness–diameter ratio. According to previous construction cases, the thickness–diameter ratios of the large cross-section tunnels ranged from 3.5% to 4.0%. In Japan, from 1985 to 2005, 74% of the large-diameter tunnels were constructed using slurry shields. However, since 2005, most large-diameter tunnels have been constructed using earth-pressure-balance shields.

Key Words: case, large cross section, lining segment, shield, tunnel.