

# 臺北捷運松山線潛盾近接隧道之設計、施工 及監測回饋

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## 摘 要

臺北捷運松山線DG166設計標基於線形及路權考量，其單圓雙孔潛盾隧道非但於部分路段之配置須由水平調整為上下疊式佈設，且由於路幅、覆土深度限制以及須避開既有地下結構物等因素，兩隧道間淨距小於3m(約0.5倍隧道外徑，即0.5D)之長度超過350m、最小淨距僅約1.5m(約0.25D)。設計階段經由數值模擬分析結果，規劃於淨距小於5m路段設置臨時內支撐，於淨距小於3m路段除了增加地盤改良外，另引進國內捷運系統首例之球狀石墨鑄鐵環片(ductile segment)，以保護先行隧道於後行隧道鑽掘過程之結構安全。為實際了解後行隧道施工過程對先行隧道之影響，設計階段更進一步規劃於近接隧道路段(淨距 $\leq 1D$ )之11個斷面，配置土壓計、水壓計以及鋼筋計(預鑄混凝土環片)或應變計(鑄鐵環片)等自動化監測儀器，以掌握其隨工程進展之變化。本文首先簡介此設計標之背景，包括地層/地下水特性及工程相關之環境限制等，並設計階段對於近接隧道段之數值分析結果以及對應之施工規劃。最後藉由綜整監測結果，提出後續相關案例之設計及施工建議。

**關鍵字：**隧道近接效應、臺北捷運松山線、監測回饋。

## Design, Construction and Monitoring Feedback of Closely Spaced Shield Tunnels for Songshan Line of Taipei Rapid Transit System

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## Abstract

Constrained by the alignment and street right-of-way, part of twin shield tunnels in the Design Lot DG166 of Songshan Line for Taipei Rapid Transit System (TRTS) were adjusted from a parallel pattern to a stacked arrangement. Further, the limitation of roadway width and overburden and the presence of the existing underground structures led to a route of more than 350m where the clearance between the tunnels is smaller than 3m (about 0.5 times of tunnel diameter, i.e., 0.5D) with a smallest value of about 1.5m (0.25D). Followed by the results of numerical analyses conducted during the design stage, ductile segments were first introduced for the rapid transit systems in Taiwan. They were employed in the sections where the clearance is smaller than 3m, and ground improvement and temporary bracing were further installed for clearance smaller than 3m and 5m, respectively, to protect the integrity of the preceding tunnel during the passage of the succeeding one. To validate the tunneling effect on the closely spaced counterpart (clearance $\leq 1D$ ), a series of electronic instruments with an automatic acquisition system was installed at 11 cross-sections of the tunnels. They included (earth) pressure cells, (hydraulic) pressure transducers, and strain gauges (for ductile segments) or rebar stress transducers (for reinforced concrete segments). This paper first highlights the background of the case, including soil