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Analysis of Tunnel Behavior Considering the Excavation Damaged Zone (EDZ) Size in NATM and Road-Header Methods and Optimization of Support Pattern

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ABSTRACT

Recently, the saturation of above-ground facilities in urban areas has led to a significant increase in demand for underground space development to ensure efficient land use. In South Korea, large-scale railway and road tunnel projects such as the GTX (Great Train eXpress) and the Gimpo-Paju Han River Underwater Tunnel are actively underway. To minimize public complaints and enhance construction safety, demand for mechanical excavation methods has also surged. Particularly, the introduction of large road-headers into domestic tunnel construction sites has heightened interest in improving the excavation performance and support patterns of road-header methods. However, the standard support patterns currently used in mechanical excavation methods are primarily based on blasting excavation standards. This results in excessive use of support materials during excavation, reducing economic efficiency. Furthermore, research on improving standard support patterns remains insufficient. Therefore, this study analyzed the size of the Excavation Damaged Zone (EDZ) according to different excavation methods and evaluated the potential for improving standard support patterns using numerical analysis. Additionally, practical improvements to support patterns for rock masses classified from RMR grades 2 to 4 using road-header excavation were proposed based on RMR14 criteria.

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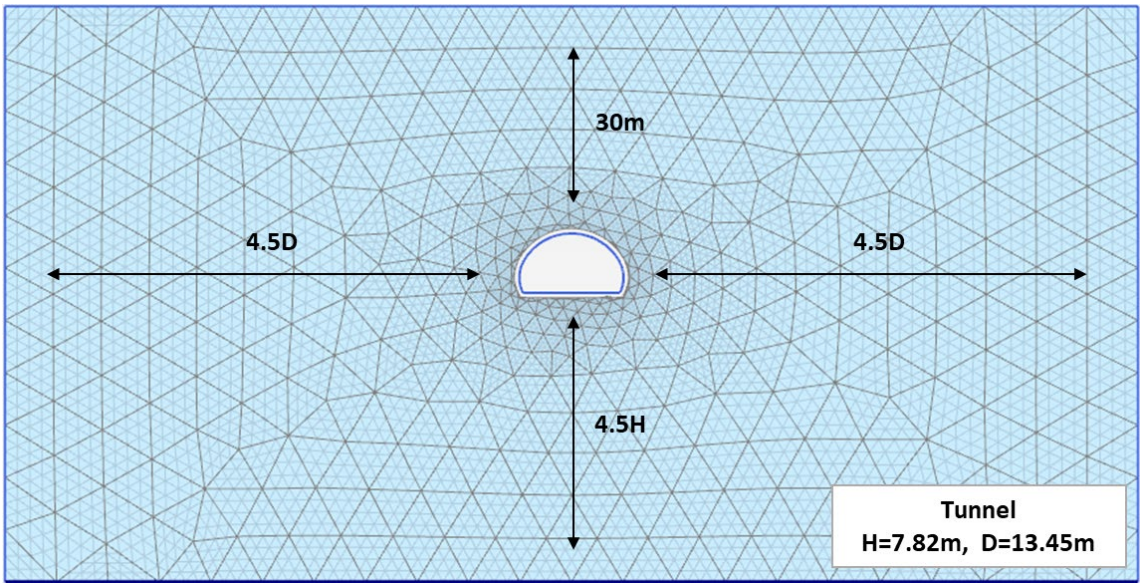

Fig. 1 Modeling conditions for numerical analysis

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