The 2025 World Congress on
Advances in Structural Engineering and Mechanics (ASEM25)
BEXCO, Busan, Korea, August 11-14, 2025

Assessment of Laser-Assisted Excavation Method for Enhanced Rock Drilling Efficiency

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ABSTRACT

Conventional rock excavation techniques, such as drill-and-blast methods and mechanical excavation (e.g., TBM, roadheader), present several challenges including environmental impacts, high noise and vibration levels, and substantial equipment wear. This study evaluates the applicability of laser-assisted excavation as an innovative solution to these limitations. Experimental tests utilizing a commercial 20W laser on granite and sandstone were conducted to measure penetration rates (ROP) and specific energy (SE). Thermal imaging analysis showed surface temperatures exceeding 400°C during irradiation. These findings suggest that laser-assisted excavation has the potential to enhance mechanical drilling performance. Further studies focusing on higher-power laser systems, dynamic focal adjustments, and advanced debris removal mechanisms are recommended to achieve optimal performance and practical feasibility.

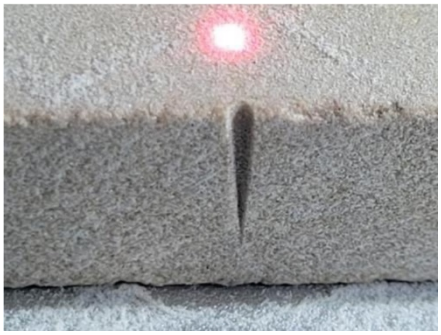

Fig. 1 Laser perforation on sand stone

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