



Dino Sarač¹

Zhendong Li²

Harkaman Gurung³

Alwalid Alekrish⁴

FINITE ELEMENT ANALYSIS OF WEAK ROCK UNDERCUT REINFORCED WITH SOIL NAILS

Summary:

A hard rock cavern is usually self-standing and stable with a full crown. However, for an undercut in very weak to weak limestone, additional support was required to make it stable and safe.

This paper presents a case study of using soil nails to stabilize an undercut in weak sedimentary rock supporting a traffic deck foundation. The undercut behavior was analyzed with a finite element program for both Ultimate Limit State stability and Serviceability Limit State taking into account the soil nails. The analyses confirmed the need for soil nails to stabilize the undercut under traffic loads applied at the top and was used to adopt soil nail pattern. Modelling aspects, undercut behavior and movement monitoring results are presented and discussed in this paper. Total monitored movements after 2 years were about 40% of predicted movements.

Effect of flexural and axial stiffness of plate elements onto soil nail axial load was also investigated. Neglecting flexural stiffness resulted in slight load redistribution with load reduction in heavier loaded nails of less than 5% which is not significant for practical purposes. Further parametric analysis of influence of flexural and axial stiffness on the axial force indicated changes in the axial force of up to 5% which is also not significant for practical purposes. This is in agreement with methodologies for soil nail design adopted in standards and engineering manuals.

Key words:

Undercut, Finite Element Analysis, Weak Rock, Soil Nails.

¹Dino Sarac, chief geotechnical engineer, BACS, Riyadh, Kingdom of Saudi Arabia, dsarac@bechtel.com

²Zhendong Li, principle engineer, ByrneLooby (UK) Ltd, Guildford, GU1 3RX, UK, zli@byrneooby.com

³Harkaman Gurung, senior geotechnical engineer, BACS, Riyadh, Kingdom of Saudi Arabia, hgurung@bechtel.com

⁴Eng. Alwalid Alekrish, Vice President for Projects and Programs, Arriyadh Development Authority, Kingdom of Saudi Arabia