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# Size of plastic zone around circular excavations in Hoek-Brown media under non-hydrostatic insitu stress

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**Abstract:**
The size of a plastic zone developed around an unsupported circular excavation in rock can be estimated using numerical analyses or analytical models, Analytical approaches that allow non-linear strength criterion (e.g., Hoek-Brown) are restricted to assumptions of hydrostatic insitu stress conditions. Detournay and St. John's present a closed form solution for plastic zone estimation for non-hydrostatic loading in a material obeying the linear Mohr-Coulomb strength criterion. In ground conditions that create butterfly-shaped yield zones, none of the analytical approaches work. The analytical methods developed by Detournay and St. John and the overstressed zone approach are compared with numerical results obtained using FLAC, in which strength was governed by the Hoek-Brown failure criterion. This paper presents equations based on FLAC analyses that allow prediction of the maximum extent of plastic zones in 'butterfly-shaped' yield zones.

**Keywords:** non-hydrostatic loading with Mohr-Coulomb failure criterion; Kirsch elastic overstretch approach; FISH function to estimate equivalent Mohr-Coulomb envelope; FLAC excavation models; comparison of analytical and numerical methods; oval and butterfly-shaped yield zones; plastic zone radius.