Accepted Manuscript

Dynamic Analysis of Rock Slopes Using the Distinct Element Method: A Case Study at the Right Abutment of the Upper Gotvand Dam, IRAN

Mohsen Sharifi Broojerdi, Mahmoud Behnia, Mousa Hazrati Aghchai

PII:	S1464-343X(18)30126-2
DOI:	10.1016/j.jafrearsci.2018.05.003
Reference:	AES 3206
To appear in:	*Journal of African Earth Sciences*
Received Date:	25 December 2016
Accepted Date:	14 May 2018

Please cite this article as: Mohsen Sharifi Broojerdi, Mahmoud Behnia, Mousa Hazrati Aghchai, Dynamic Analysis of Rock Slopes Using the Distinct Element Method: A Case Study at the Right Abutment of the Upper Gotvand Dam, IRAN, *Journal of African Earth Sciences* (2018), doi: 10.1016 /j.jafrearsci.2018.05.003

Dynamic Analysis of Rock Slopes Using the Distinct Element Method: A Case Study at the Right Abutment of the Upper Gotvand Dam, IRAN

Mohsen Sharifi Broojerdi[1], Mahmoud Behnia[2*], Mousa Hazrati Aghchai[3],

1,3- Rock mechanics Expert, Mahab Ghodss Consulting Engineering, Dastgerdi Ave., Tehran, IRAN

2*- Assistant Professor, Department of Mining Engineering, Isfahan University of Technology (IUT), Isfahan, Iran

ABSTRACT

This paper reviews the dynamic stability of the right abutment of the Gotvand Dam, the highest earth fill dam located at the southwest of Iran, using the distinct element method. The right abutment comprises a soft clayey layer called the Lower Mudstone Siltstone interlayer layer (LMST) covered by disturbed conglomerate blocks. According to the results of the dynamic numerical analyses, no collapse will occur at the right abutment area. However, the residual shear displacement of disturbed blocks on the LMST layer will be 20-60 cm for Maximum Credible Earthquake (MCE) loading. Such a displacement can cause cracking in the cut-off wall, and hence it was considered the main indicator of the right abutment instability. Investigating different solutions, such as buttressing and excavation, showed that these approaches are not effectively preventing abutment shear displacement. Therefore, the designing process was carried out by accepting the risk of cut-off wall cracking in seismic loading conditions. However, some pre-remedial solutions (as discussed thoroughly in the text) have been considered in the construction process to minimize the risk of water seepage from the cut-off wall.

Keywords: Upper Gotvand Dam, Slope Stability, Numerical Analysis, Distinct Element Method.

1. INTRODUCTION

Slope stability of dam abutments is so important that is to be considered especially in regions with earthquake occurrence potential. Different methods such as conventional pseudo-static, Newmark [1], and numerical analysis are used for dynamic slope stability analyses. The selected analysis technique depends on both geological conditions and the potential failure mode, with careful consideration given to the strengths and limitations of each methodology. Conventional methods are limited to simple problems including simple slope geometries and basic loading conditions and hence provide little insight into the slope failure mechanism. In addition, they may lead to misunderstanding slope behaviour and too expensive, useless, and even dangerous treatments. Many rock slope instability problems involve complexities related to geometry, non-linear behaviour, in situ stress and full dynamic loading. To overcome these limitations, numerical modelling techniques have been developed to provide approximate solutions to problems which