Investigation on Slope Stability of Internal Dump of the "Baganuur" Coal Open Pit Mine

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1. Introduction

The internal dump slope stability is one of an important problem in the open-pit coal mine. Since 1986, "Baganuur" open-pit coal mine internal dump has slid totally 38 or more times in all section. The problems which have slide waste rock to the coal operation area when the extracted coal has been in the current mine site. Due to loss of technologies, it accounts for the majority of total mine coal waste, also it is possible to increase in the future. Therefore, to make research studies of slope stability of the internal dump, the correct parameters of the internal dump will be determined, and the rock properties will be determined in accord with the standards and execute in the practice.

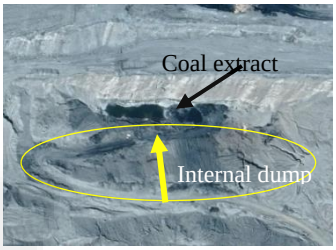

Figure 1. Internal dump slid area, coal operation area zone.

2. Research Methodology

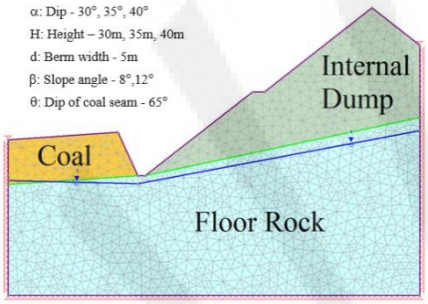

Figure 2. Internal dump parameters, numerical simulation, Phase2 software.

The internal dump design of height, dip and footwall angle must be chosen to correct parameters of the internal dump as well as the waste dump. In this research study carried out by considering the current parameter situations of the internal dump slope as well as, the future long term mine operation, safety and economic situation. The research study of the internal dump parameters which are dump height, dip and footwall angle is carried out by investigating and comparing between the results of the geometrical combinations between the current internal dump and experimented internal dump. The research study was done by rocscience Phase2 software, in which adopts shear strength reduction factor method (CSRF). According to the risk rating on slope stability, the safety level of the slope has considered being the critical value when the CSRF is 1.

3. Results and Discussions

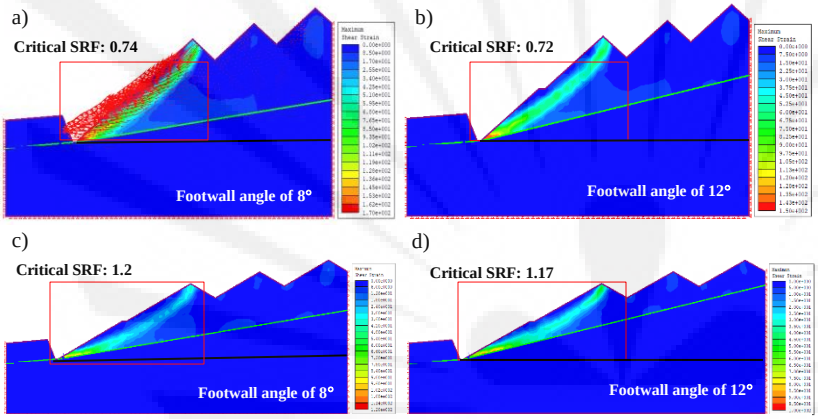

Figure 3. Safety Multi-Dump slope stability numerical simulations: (a) dump dip 38°, footwall angle 8° (b) dump dip 38°, footwall angle 12°; (c) dump dip 26°, footwall angle 8° (d) dump dip 26°, footwall angle 12°

Table 1. Result of slope stability numerical simulation for internal dump different dip angle, dump height, and footwall angle.

Dump Dip, °	Footwall angle, °	Dump height, m	*CSRF* for simulation under different SRF of Safety Multi-Dump
38	12	35	0.72
38	8	35	0.74
26	12	35	1.17
26	8	35	1.2
26	12	40	1.07
26	8	40	1.1

According to the numerical simulation results comparing the current parameters and experimented parameters. Fig.3a shows the deformation vectors on the numerical simulation that shows the possible failure situation of the internal dump waste rock at the dump height of 35m, dump dip of 38°, and footwall angle of 8° (CSRF is 0.74). The CSRF is reduced from 0.74 to 0.72 when a footwall angle of 12°. Also, fig.3b can show the bottom of the internal dump maximum shear strain more than fig.3a. The next figures (3c and 3d) created numerical simulation based on experiment result parameters. The numerical simulation result shown in fig.3c and 3d is based on dump height of 35m, and footwall angles of 8° and 12°. When at the dump dip 26°, the shear strain has significantly decreased in creating the internal dump than fig.3a and 3b experiments. The displacement of the internal dump has decreased at the footwall angle of 8°. Furthermore, the displacement is increased, due to an increase in footwall angle to 12°. The differences in internal dump situation are followed by a decrease in CSRF (Table 1). The result of experiments, the current parameters of the internal dump situation has potential sliding surface increases. The internal dump can improve the slope stability when at the dump dip under 30°, slope angle between 8° to 12°. Also, at the dump dip of 26° internal dump possible to improve dump height.