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by

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IN THE NAME OF GOD

This thesis is dedicated to my dear *family*

and my dear *parents*

for their love and patience

AFFIRMATION

The work as presented in this thesis is an authentic record to the best of my own knowledge and belief and it is based on the work carried out in the Department of Civil and Mining Engineering at University of Wollongong. I hereby certify that this thesis contains no material which I have submitted, in whole or in part, for a degree at this or any other institution. The following publications have been based on this thesis:

Baafi, E.Y., **Mirabediny, H.** and Whitchurch, K., (1995), "*A Simulation Model for Selecting Suitable Digging Method for a Dragline Operation*", 25th International Symposium on the Application of Computers and Operations Research in the Mineral Industry, The Australasian Institute of Mining and Metallurgy, QLD, pp: 345-348.

Baafi, E.Y., **Mirabediny, H.** and Whitchurch, K., (1995), "*A Dragline Simulation Model for Complex Multi-Seam Operations*", Mine Planning and Equipment Selection 95, Singhal et al (eds.), A. A. Balkema, Roterdam, pp: 9-14.

Mirabediny, H., (1995), "*Dragline Simulation: Case Studies*", ECS's Users Annual Conference, Published Internally, Bowral, NSW. pp: 8-15.

Mirabediny, H. and Baafi, E.Y., (1996). "*Effect of Operating Technique on the Dragline Performance: A Monitoring Data Analysis*", Mining Science and Technology, Geo, Y. and Golosinski, T. S. (eds.), A. A. Balkema, Roterdam, pp: 479-485.

Mirabediny, H., (1996), "*The Use of Monitoring Data in Conjunction with Dragline Simulation*", ECS's Users Annual Conference, Published Internally, Bowral, NSW. pp: 17-24.

Baafi, E.Y., **Mirabediny, H.** and Whitchurch, K., (1997), "*Simulation of Dragline Operations*", International Journal of Surface Mining and Reclamation, No. 11 (March 97), pp: 7-13.

Mirabediny, H. and Baafi, E.Y (1998), "*Dragline Digging Methods in Australian Strip Mines: A Survey*", First Australasian Coal Operators Conference (COAL98) , Wollongong, NSW).

Mirabediny, H. and Baafi, E.Y. (1998), "*Statistical Analysis of Dragline Monitoring Data*", (Accepted for presentation at 28th International Symposium on the Application of Computers and Operations Research in the Mineral Industry, London).

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ABSTRACT

During recent years, the Australian coal industry has increasingly used large walking draglines as the dominant waste removal equipment in open cut coal mines. Because of the nature of the coal formations, dragline operations in Australian coal mining situations are quite complex and draglines are frequently used in applications beyond their normal capabilities. With the current trend to increasing dragline sizes in most of the Australian coal mines, the draglines become the highest capital investment item in these mines. It is therefore necessary to give detailed attention to the optimising operating procedures of the dragline.

Dragline productivity and its stripping capabilities are directly affected by the selection of digging method, strip layout and pit geometry. Every mine has a unique combination of geological conditions. The operating methods that work well at one mine may not necessarily work at another site. Selection of an optimal stripping method, strip layout and pit geometry for a given dragline must be considered with respect to the geological conditions of the mines. With increasing geological complexity of Australian strip mines, it is becoming more important to use sophisticated techniques such as computerised mine planning methods to assist in optimising the dragline operations.

A computerised dragline simulation model (CADSIM) has been developed for use in selection of optimum strategies for a dragline operation. The procedure developed links with a geological ore body model to develop a geological database for simulation. CADSIM model can be used in selection the most cost effective dragline digging method. A specific simulation language, "DSLX", was used to program seven common and innovative dragline methods currently used in Australian open cut mines. The DSLX language uses predefined functions to build strip geometry, working benches, blast profiles and spoil piles. The outputs from CADSIM model in form of volumetric, swing angles and hoist distances data were then aggregated with dragline specifications and site time study data to compare productivity and costs of the selected digging methods. The results of two case studies showed that this procedure lends itself to the "optimum" solution for dragline mine planning and design problems for a given coal deposit.

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LIST OF SYMBOLS AND ABBREVIATIONS

2D	:	Two Dimensional
3D	:	Three Dimensional
ACARP	:	Australian Coal Association Research Program
ACRIL	:	Australian Coal Industry Laboratories
ADPC	:	Australian Dragline Performance Centre
ASCII	:	American Standard for Communication Interchange
bcm	:	bank cubic metre
BE	:	Bucyrus Erie (commercial name)
CAD	:	Computer Aided Drafting
CADSIM	:	Computer Aided Dragline Simulator (a dragline simulation model developed in this thesis)
Co.	:	Cooperation
DAC	:	Discounted Average Cost
DCF	:	Discounted Cash Flow
deg	:	degree
DMS	:	Dragline Monitoring System
DSLX	:	Dragline Simulation Language for X windows (commercial name)
ft	:	feet
GMS	:	Gridded Seam Modelling
hr	:	hour
IDW	:	Inverse Distance Weighted
IRR	:	Internal Rate of Return
km	:	kilometre
l	:	litre
lbs	:	pound
m	:	metre
m^3	:	cubic metre
Max	:	Maximum
Mbcm	:	$\times 10^6$ bank cubic metre
Min	:	Minimum

MSL	:	Maximum Suspended Load
Mt	:	$\times 10^6$ tonne
MUF	:	Maximum Usefulness Factor
N.A.	:	Not Available
No.	:	Number
NPV	:	Net Present Value
NSW	:	New South Wales
Op. hr	:	Operating hours
PC	:	Personal Computer
QLD	:	Queensland
R	:	Correlation Coefficient
R^2	:	Coefficient of Determination
R_e	:	Dragline effective reach
Reh	:	Rehandle
SDE	:	Specific Dig Energy
sec	:	second
SF	:	Swell Factor
St. Dev.	:	Standard Deviation
t	:	tonne
y	:	year