



Calculation of PIT 4 Coal Reserves with Cross-Cross Method

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ABSTRACTS

Calculating coal reserves using the vertical section method can describe the condition of deposits and overburden in each section. This study aimed to determine the direction of coal distribution, the volume of overburden, and the volume of coal using the cross-section method and to obtain the stripping ratio (SR). In this research activity, data is needed in the form of documentation on pit 4, cross-section, drill logs, and coordinates of drill points. After all the data has been collected, it is continued by making a cross-section in the form of a horizontal (cross-section) using Auto Cad software. The final stage of the interpretation of the two data results is calculating the number of coal reserves, the amount of overburden (OB), and the stripping ratio value by the concept of continuity that has been carried out from the existing data.

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INTRODUCTION

Calculating coal reserves using the vertical section method can describe the condition of deposits, and overburden in each section (Ade Riany Diem et al., 2018; Rachmat et al., 2007). Calculation of reserves at the research site uses the cross-section method with varying distances with an average distance of 50 meters for each section, some sections have different distances because at the ends of the mining plan area the interpolation radius is as far as 800 meters. Analysis of the data used for the cross-section method is to use data on the average area between the side sections, the thickness of the layer, and the distance between the two sections. In each cross-section will be obtained (known) the area of coal and the area of overburden. The volume of coal and overburden can be determined by multiplying the area of the cross-sectional influence distance (Anonymous. 1999).

Geological modelling is the initial part of a mine planning process. Geological modelling has a very important role in providing an overview of the interpretation results of the coal deposit cross-sectional model (Anshariah, 2015; Juradi et al., 2021; Kusnama, 2008). Many mining companies generally use drill logs. Based on the drill log data, it is possible to know the subsurface conditions and also to obtain various other data such as the depth and thickness of the layers of excavated material (Arif et al., 2019; Rachmat, 2009; Sira et al., 2022). Determination of mining limits aims to determine the mining limits of a mineral deposit (namely the number of reserves and calories), which will maximize the total net value of the minerals (Nurhakim. 2008; (Arif et al., 2019; Arifin et al., 2022; Kusnama et al., 2009). The purpose of this research is to know the direction of the spread of coal, the volume of overburden, the volume of coal, to know the stripping ratio (SR) (Budiman et al., 2017; Mustafiah, 2016; Nompou et al., 2020).

METHODS

The method used in this study is the cross-sectional method to estimate the amount of coal reserves. The quantitative analysis used in this research is evidentiary by combining several data including literature review, field data, drilling data, and data from calorie analysis. All of them are reviewed and analyzed comprehensively to determine the number of reserves based on drill data and as a determinant for the company in carrying out production.

The literature study was conducted before and during the study. At this stage, the collection of sources of information related to the estimation of coal reserves is carried out.



The processing stage is the stage where the data that has been obtained from the field which is drill data then the data is made cross-sectional, and the drill data is also processed using software in the form of Microsoft Excel where the data is processed in Microsoft excel is data from the results of making cross sections then the data is processed find using the following formula:

$$V = \frac{(L A - A' + B - B')}{2} \times I \times D \times FK$$

- Description: V = Volume
- L A-A' + B-B' = Cross-sectional area
- I = Interval
- D = Density
- FK = Correction Factor

To get the values from each cross section using the same formula, after all, values are obtained from each coal and overburden value, the stripping ratio value can also be determined, the stripping ratio formula is as follows:

$$SR = \frac{VOB}{VC}$$

- Description: SR = Stripping Ratio
- VOB = Volume Overburden
- VC = Volume of coal

The data obtained from the drilling results are analyzed then the data is interpreted, then determine the depth (position) and thickness of the coal at each drilling point. After that, make a cross-section in the form of a horizontal cross-section (Cross Section) using Auto Cad and Surpac software. The final stage of the results of the interpretation of the two data is to calculate the number of coal reserves, the volume of overburden (OB) and stripping ratio values according to the concept of sustainability, thus it can be seen that this coal reserve is a measured resource.

RESULTS AND DISCUSSION

Coal Reserve PIT 4

The amount of coal reserves is 1,002,127.696 MT with a specific gravity of 1.28 calculated from the cross-section of each incision based on the results of exploration drilling and production drilling both deep and shallow with data that has been grouped and processed from what has been obtained.

Table. 1. Calculation Results of Pit 4 Coal Volume

No	Section	Coal Area (m ²)	Divising Factor	Interval (m)	FK	Density (ton/m ³)	Coal Volume (m ³)
1	A - A'	2,500.75	2	50	0.85	1.28	
2	B - B'	2,705.62	2	50	0.85	1.28	141,613,264
3	C - C'	3,225.69	2	50	0.85	1.28	161,331,632
4	D - D'	3,688.88	2	50	0.85	1.28	188,076,304
5	E - E'	3,606.8	2	50	0.85	1.28	198,442,496
6	F - F'	3,062.47	2	50	0.85	1.28	181,404,144
7	G - G'	1,763.26	2	50	0.85	1.28	131,259,856
Amount							1,002,127.696

Volume Soil Cover (Overburden) PIT 4

Overburden volume is calculated from the results of exploration drilling and production drilling both deep and shallow with data that has been grouped and processed from what has been obtained, then a cross section is made from each incision, the value of the Overburden volume is 3,522,138.5 BCM which has been obtained from the calculation results. cross section that has been made.

Table. 2. Overburden Volume Calculation Results

No	Section	OB Area (m ²)	Divising Factor	Interval (m)	OB Volume (BCM)
1	A - A'	12365,15	2	50	
2	B - B'	14,903.34	2	50	681,712.25
3	C - C'	15,456.91	2	50	759,006.25
4	D - D'	13,163,30	2	50	715.505.25
5	E - E'	11,267.32	2	50	610,765.5
6	F - F'	7,920.81	2	50	479,703.25
7	G - G'	3,097.03	2	50	275,446
Amount					3.522.138,5

Coal Quality

Coal samples obtained from geological surveys and drilling data are sent to the laboratory for proximate analysis. From the results of the analysis of coal samples in the laboratory, data in the form of inherent moisture, ash content, volatile matter, fixed carbon, HGI, total moisture and calorific value have been obtained where the analysis of this coal sample uses the air-dried basis analysis method.

Table. 3. Coal Quality

Coal Analysis	Unit	Quantity	Analysis Method
Proximate Analysis			
a. Inherent Moisture	%	37.46 - 39.62	ADB
b. Ash Content	%	3.00 - 4.11	ADB
c. Volatile Matter	%	35.50 - 41.74	ADB
d. Fixed Carbon	%	36.17 - 41.13	ADB
e. HGI		35 - 37	ADB
f. Total Moisture	%	21.72 - 25.44	ARB
g. Calorific Value	Kcal/Kg	4919 - 5426	ADB
Ultimate Analysis			
a. Carbon	%	35.70 - 42.50	ADB
b. Hydrogen	%	4.58 - 7.03	ADB
c. Sulfur	%	0.28 - 2.99	ADB
d. Nitrogen	%	0.58 - 1.54	ADB
		11.70 - 14.30	ADB

Description: ADB (Air Dried Base), ARB (As-Received Basis)

Stripping Ratio PIT 4

Stripping Ratio is a comparison between the volume of overburden and the importance of coal, so to find out the value of the SR itself, the overburden will be removed by 3,522.138.5 to get the desired coal of 1.002.127.696, so the value from the stripping ratio obtained from the comparison between overburden and coal is 3.51.

Table. 4. Stripping Ratio Pit 4

Section	OB Area (m ²)	Coal Area (m ²)	OB Volume (BCM)	Coal Volume (m ³)	SR
A - A'	12365.15	2500.75			
B - B'	14903.34	2705.62	681,712.25	141,613,264	4.81
C - C'	15456.91	3225.69	759,006.25	161,331,632	4.70
D - D'	13163.30	3688.88	715,505.25	188.076,304	3.80
E - E'	11267.32	3606.8	610,765.5	198,442,496	3.07
F - F'	7920.81	3062.47	479,703.25	181,404,144	2.64



G - G'	3097.03	1763.26	275,446	131,259,856	2.09
Amount			3,522,138.5	1,002,127.696	3.51

The calculation of coal reserves using the cross-sectional method has been processed using software (Microsoft excel) and auto cad software. Then the results of analyses on each cross-section that have been made can be seen how much coal, overburden (OB) in each area, and the stripping ratio value is known from the comparison between overburden and coal.

Table. 5. Coal quantity, overburden (OB), and stripping ratio value

OB Volume (BCM)	Coal Volume (m ³)	SR
681,712.25	141,613,264	4.81
759,006.25	161,331,632	4.70
715,505.25	188,076,304	3.80
610,765.5	198,442,496	3.07
479,703.25	181,404,144	2.64
275,446	131,259,856	2.09
3,522,138.5	1,002,127,696	3.51

CONCLUSION

Based on the research that has been done, the following conclusions are obtained: From the results of the calculation of coal reserves using the cross-section method based on the dip with the direction of spreading coal from north to south using auto cad software, the potential coal reserves in pit four are: the amount of coal is 1,002,127,696 MT, the amount of overburden is 3,522.138.5 BCM which is calculated based on the cross-section that has been made, and the stripping ratio value of 3.51 is obtained from the comparison between overburden and coal.

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