



Research Article

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## Application of green bio-mining technology for coal under villages in environmental protection

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### ABSTRACT

*View of current coal market conditions, implementation difficulties and high cost in village relocation, strip mining technology is an effective way to solve the issues of coal mining under village. Strip mining is one of the green mining technology, which can be achieved both non-location of the village and protection of the mine ecological environment. Engineering applications show that the application of strip mining which realized green coal mining and ecological environment protecting can bring the following benefits: smaller surface subsidence, smaller building damage and less environment disturbance.*

**Key words:** green mining; environmental protection; environmental protection; building damage; environmental protection; surface subsidence;

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### INTRODUCTION

Coal is nonrenewable resource. Compared with world powers, our land and mineral resources are much more pitiful.

The current problem is that the amount of coal under villages up to 5.221 billion. 10%~30%.

Phenomena that coal occurs under villages exist in all mine areas. The reserves usually accounts for 10%~30% of the total reserves

There are 18 villages in the range of Jining No 2 Coal Mine. 170 million Recoverable coal is under these villages which account for 37.4% of the total recoverable reserves.

Therefore, effective solutions to technical problems of coal mining under the village, to achieve land protection bring the following benefits: protection of farmland, protection of groundwater, protection of environment, and harmonious development of various social sectors.

For decades, technologists from coal mining enterprises, governments and research institutes, and coal tertiary institutions have done much work to solve the issues of coal mining under village, which resulted in a greatly improving of the overall technological level.

However, to achieve not only mining coal, but also making the least damage to the environment and making energy production and the ecological environment to achieve a harmonious development is still the current technical problems be solved.

To make the work of coal mining under the village can be rapid and healthy development in the future, the technology used in coal mining under the village must be compatible with the basic national conditions of China.

### 1. GREEN COAL MINING TECHNOLOGY UNDER THE VILLAGE BASED ON ENVIRONMENT PROTECTION

For the coal under the village, traditional mining technologies are the followings: Firstly, mining after village relocation. Secondly, repairing and compensating villages after mining without relocation of villages. Thirdly, rebuilding villages after mining without relocation of villages

Longwall collapse roof control method style as a traditional roof control method often lead to subsidence of large areas ground surface and changes of groundwater runoff, which cause irreversible impacts to environment.

The three methods have lead to serious environmental damage, large surface disturbance, tension relationship between the workers and peasants.

So, they are gradually being phased out in Practical engineering.

The recommendation of green mining technology system aim reducing the natural environment and damage to a minimum. The connotation of "Green mining" is that people make efforts to follow the principles in green industries, form a harmony mining technology, strive to achieve "low extraction, high utilization, low emission."

Be achieved coordination between resources under the village and environment (green) mining, the technical ways are flowing: Backfill mining method can reduce more than 80% of ground subsidence, which is very effective for mining under the village. But, it requires a large initial investment, which will greatly increase the cost of per ton of coal. The increase mining costs limit the application of this method. So in the past decade, there almost no using water-sand backfill mining method to mine coal under the village.

One of the green mining technology, strip mining method is that mining area is divided into several equal or unequal width of strip along the inclination or towards of the coal seam. One strip is mined, the other is reserved. Use the left coal pillar support roof in order to achieve the purpose of reducing ground subsidence.

The advantage of this approach is simple, less investment.

The highlighted advantage of strip mining method is small subsidence after mining. It suitable for mining under the following conditions: existing unable or inappropriate relocation of the dense buildings on the ground above the coal; existing complex structure or memorial buildings on the ground above the coal; existing embarrassment relocation towns or intensive village on the ground above the coal; existing Railway bridges, tunnels or railway lines on the ground above the coal; existing Water bodies on the ground above the coal or Karst pressure water under the coal seam; existing Terrain difficulty for drainage above the coal.

Strip mining method can effectively reduce the surface deformation, reducing the amount of surface subsidence up to 90%(80%.)

With the development of science and technology and the breakthroughs of strip mining technology in recent years, strip mining yield benefits have a certain improving. From the strategic perspective of Mine sustainable development, strip mining which left. Some of the resources to protect the Mining Area surrounding environment is more meaningful for the coal under the village.

### 2. DETERMINE OF GREEN MINING PLAN FOR COAL UNDER THE VILLAGE

According to the actual situation of Jining No2 Coal Mine, strip mining method is determined. Probability integral method is used to expect for surface deformation, strip mining method is selected. According to the relevant coal mining subsidence theory, when strip mining, parameters by probability integral method can be calculated by the following formula:

Subsidence Coefficient

$$\eta_a = \frac{H - 30}{5000 \times a / b - 2000} \times \eta_b \quad (3.1)$$

Tangent of main impact angle

$$\text{tg } \beta = \text{tg } \beta - 0.574 \text{ Ln } + 2.34 \quad (3.2)$$

Eccentricity of Inflection point

$$S_a = \frac{1}{4 - 3.7\rho} S_b \tag{3.3}$$

Horizontal Coefficient

$$b_a = \frac{10000}{10750 + 7.6H} b_b \tag{3.4}$$

Based on the above formula, Combined with the design parameters of strip mining, Calculation results shown in Table 1.

**Table 1 Parameters of surface movement and deformation when strip mining**

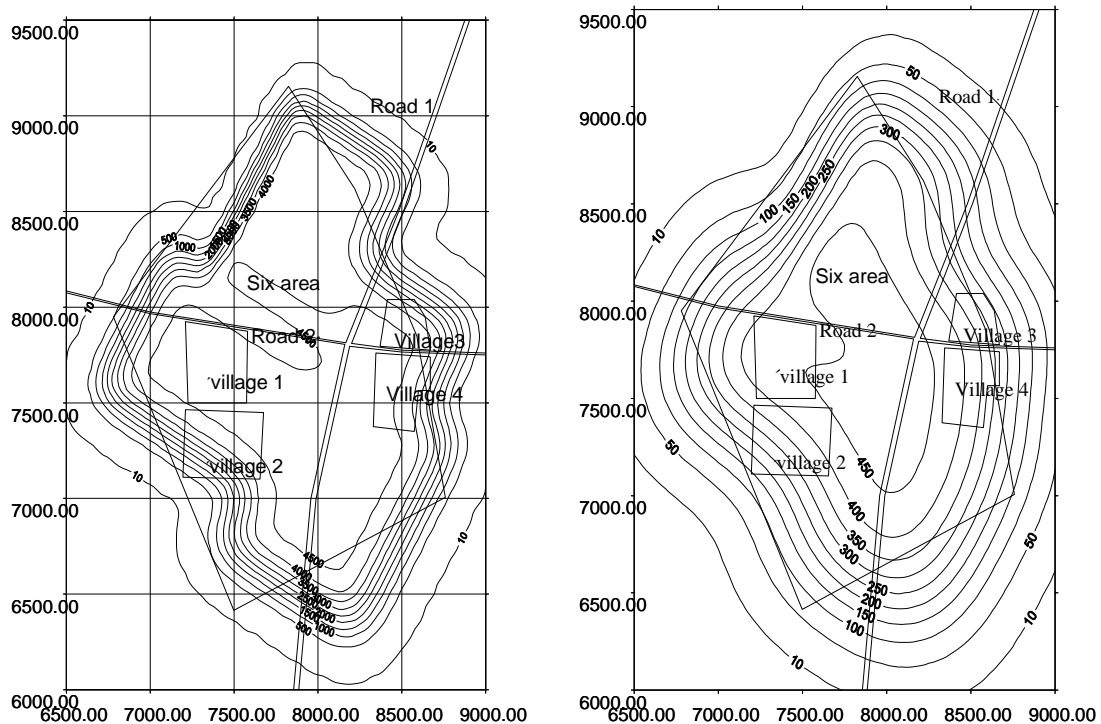
Project	Height of mining b(m)	a(m)	$\eta$	C(%)	b	tg $\beta$	S(m)
Project 1	60	80	0.095	42.3	0.183	0.924	13.5
Project 2	55	65	0.117	45.8	0.183	0.924	14
Project 3	60	70	0.119	46.2	0.183	0.924	14
Project 4	55	55	0.152	50	0.183	0.924	15
Project 5	60	50	0.211	54.5	0.183	0.924	17

According to mining scheme in table 1 and estimated parameters determined in the former part of the article, using the "mining subsidence prediction system " developed by mining damage and protection institute of China university of mining and technology to predict Each mining program.

It can expected static and dynamic on multiple random shape face any time and any point using the "mining subsidence prediction system"

By comparison among 5 Strip mining program, determine the selection of program I.

Prediction of Surface deformation of full mining and striping mining (program I) is shown in Figure 1



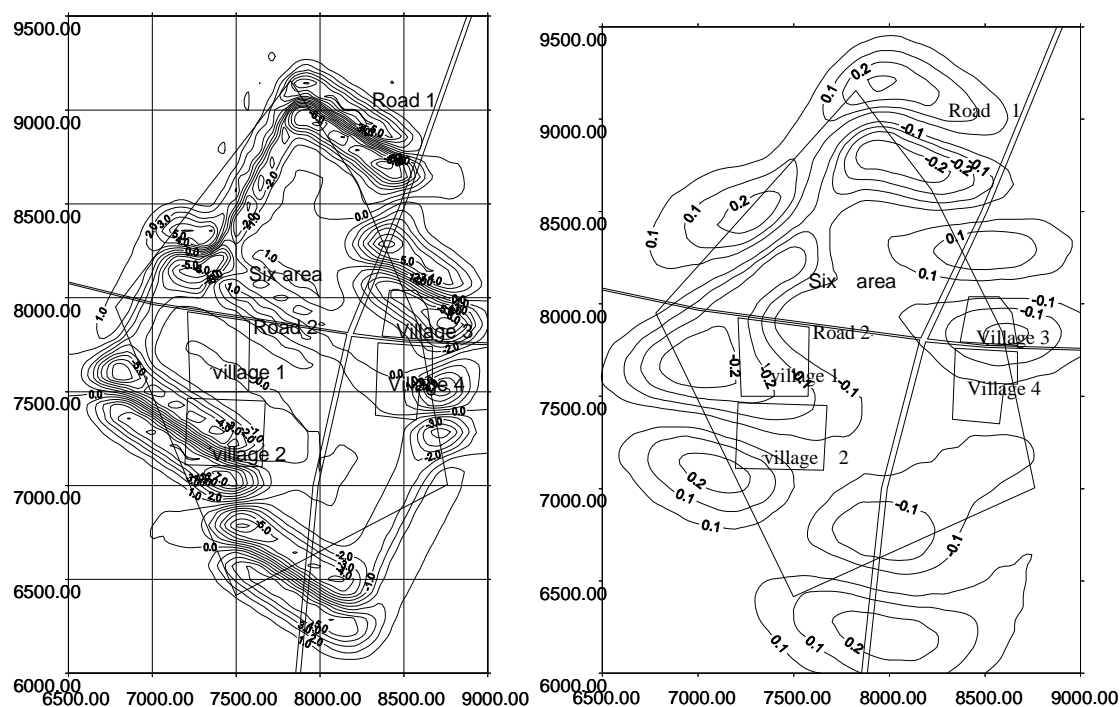


Fig.1: comparison of Surface deformation of full mining and striping mining

The maximum ground displacement and deformation of full mining and striping mining (program I) is shown in Table 2

Figure1 and Table2 shows: Ground displacement and deformation are quite large after full mining. It can lead to much more serious damage to Village house, road and other building (structure) where many parts reached IV level damage.

Ground displacement and deformation are quite large after strip mining. The maximum value of ground displacement is 473mm and horizontal deformation of the surface are less than 0.5mm/m

Using strip mining can not only reduce the extent of damage the building, but also has a technological advantage an not be ignored in ecological and environmental protection also.

Table 2 the maximum ground displacement and deformation

Project	/mm	/mm/m	What level of deformation mm/m
Whole mining	4623	-9.16~7.88	-13.71~11.38
Project1	473	-0.25~0.21	-0.41~0.25

### 3.1 Monitoring and analysis of damage to surface buildings

6312 mining face is the first strip mining face in six mining area of the Jining No2 Coal Mine. In order to test the design is reasonable and ensure the safety of the building surface, measurement of mining subsidence and ground movement and deformation was carried out in 6312 mining face.

31 observation points have been built at the top of 6231 mining face and 13 observations have been taken at the initial of mining. The observed maximum subsidence is 89mm (including the superposition of 6307 mining face), where is located in the northwest corner of Tian yi logistics parking lot. It expected to sink 400mm there.

Ground subsidence is as follows: 47mm at the 13th station; 51mm at the 28th station; 47mm at Xiaohao village. While, the maximum ground subsidence was 63mm at 16# point where has not been influenced by mining of 6307 coal mining face.

Affected roads are Jining East Outer Ring Road and Jinan Zou Road, where are located in the observation line of the north line of 19 # point. And the maximum ground subsidence was 111mm.

The observed maximum subsidence is 60mm, where is located 109 meters south of the center Zhuanpan road, and located in the observation line of the north line of 106 # point.

#### CONCLUSION

Theoretical analysis and field measurement methods was used to analyze the influence of strip mining to surface deformation, building damage and environmental controlling of Jining No 2 Coal Mine to achieve efficient and green mining of thick seam under the village.

It has important practical significance to exploit "Three under "pressure coal, improve resource recovery, prevent or reduce the mining damage, protection of the ecological environment.

Comparison of engineering practice that strip mining can effectively control the surface deformation caused by mining. It is an important technical way to solve coal mining under the village under the existing level of technology.

Strip mining has a wide range of social efficiency, can simplify the relationship between industry and agriculture, protect farmland and the environment, contribute to form a Green and safe recovery mining technology system that "energy - resources - environment"(ERE) coexist and develop coordinated.

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