5

ULTRA-THICK SEAM MINING AT THE ČSM MINE IN THE CZECH REPUBLIC

5.1 INTRODUCTION

Thick and ultra-thick seam mining in underground black coal mines still represents a problem. Modern operational almost all mines in the world has already completely eliminated benching with artificial ceiling, or with lowering the ceiling layer.

Modern types of roof supports allow mining up to the thickness of 6 m, but for technical reasons, the seam is sometimes divided and mined in two benches with the thickness of around 4m, leaving a protective layer of coal seam between the top and the bottom of the bench.

Such method of mining may represent certain risks, such as in areas with the risk of shocks or spontaneous combustion of coal mass from a collapsed protective layer and may be used only after proper assessment of the circumstances.

This method was applied at the ČSM Mine in the Ostrava-Karviná district in the Czech Republic. One of the reasons why this method of extraction was selected was the experience with demanding coalface preparation, equipment and clearing out the facilities, especially roof supports over four meters in thickness.

5.2 GEOLOGICAL LOG AND SEAM STRATIGRAPHY

In the mining field of the ČSM mine, seams 39 and 40 merged and the resulting seam reached a thickness of up to 8.6 meters. These seam profile is shown in Figure 5.1 [6]. This is followed by thick layer of sandstone, which reaches 15 m. The over burden was evaluated with compressive strength of 80 MPa and classified as degree 2-3of the risk of shocks. The average compressive strength of subsoil is 75 MPa. The relatively lower strength of the sandstone overlying layer, compared to other seams of saddle layers, was an important factor when the decision concerning the way of mining was being made.

The seam belongs to theist straits graphic zone of saddle seams and Figure 5.1 shows an example of its development according to the borehole profile CSM-1258/04-CMD, a. s. - CSM1. It is clear from the geological profile in Figure 5.1 that the 4 mover burden seam is a layer of sandy siltstone, up to coal band of 54 cm.

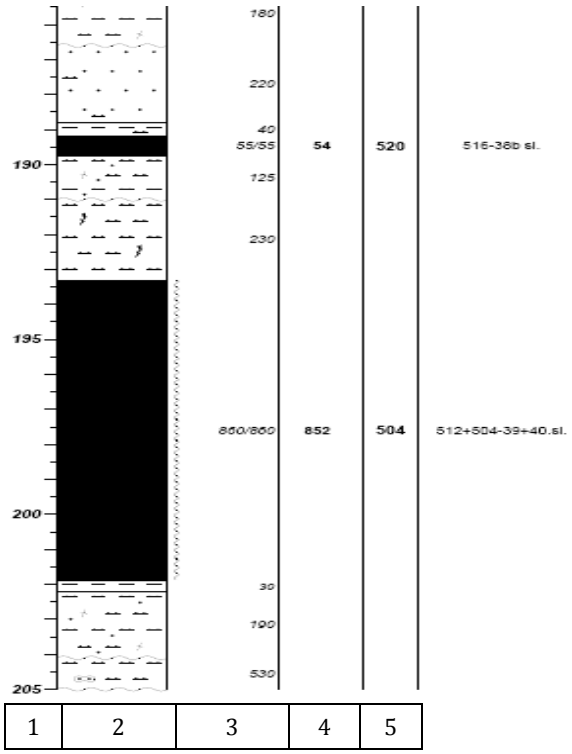

Fig. 5.1 Seam profile 39+40 in a coal field of the ČSM Mine

1. Profile, 2. Thickness, 3. Accepted real thickness, 4. OKD (Ostrava-Karviná Mines) code, 5. Seam number
Source: [6]

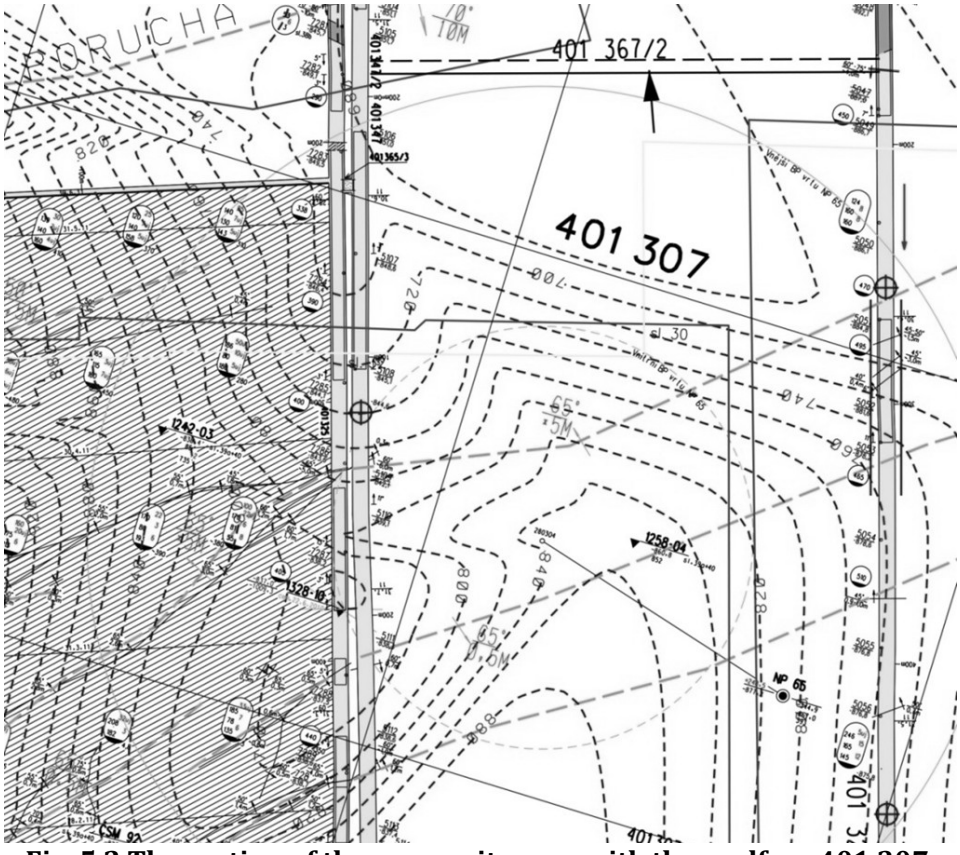

Fig. 5.2 The section of the composite map with the coalface 401 307

Source: [6]

If the strength of the over lying layer were higher and there would be a risk of shock, it would present a problem to keep the protective coal seam [1, 4, 5, 8, 9]. The location of the coalface 401, 307 is clear from the section of the composite map in the upper bench of the seam 40 (Fig. 5.2).

The chart of the equipment in the coalface and in the main entry and the up cast drift is in Fig. 5.3.

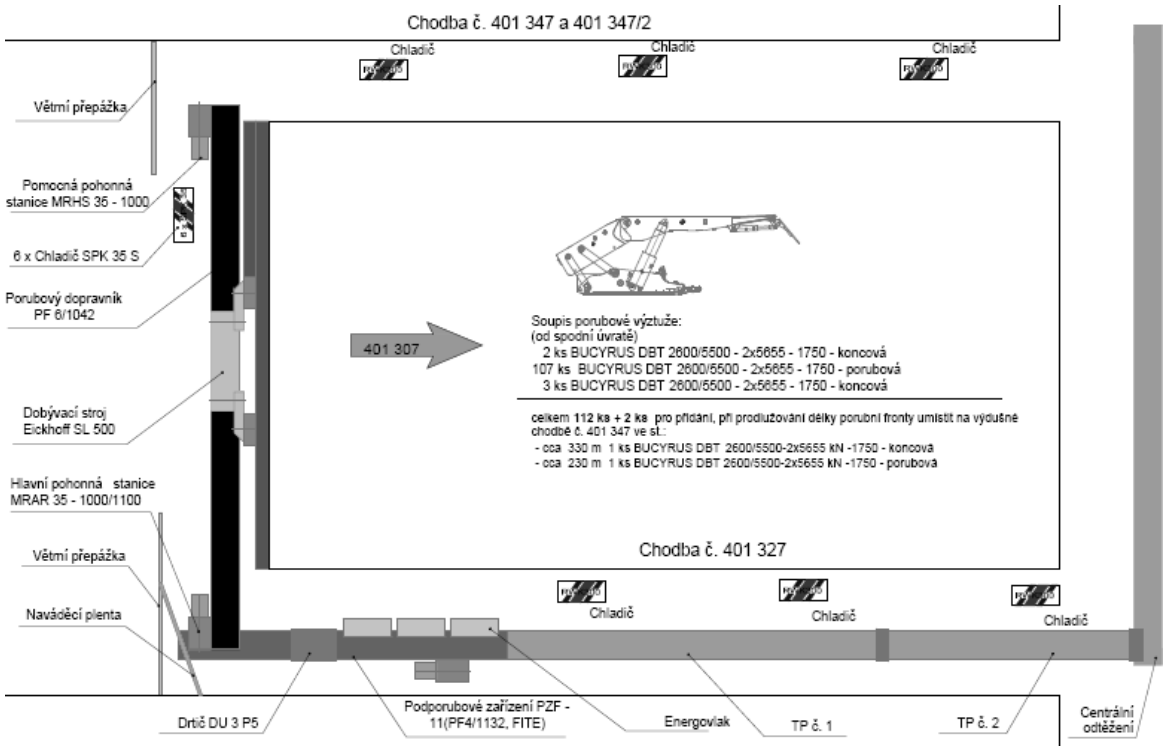

Fig. 5.3 The equipment in the coal face, in the main entry and the up cast drift

Source: [6]

The mining parameters and specifications of the extraction of the coal face 401, 307, on the bench are stated in the Table 5.1. Therefore, the seam with a thickness of up to 8.6 is mined in 2 benches. The thickness of the upper bridge is 4.5 m. The thickness of the seam part, which is left between the lower and upper bench is at least 0.8-1 m.

The lower bench has a mine able thickness of about 3.5 m then. For both benches, the common advancing support DBT2600/5500 was used.

The advancing support DBT2600/5500 has the following parameters [10]:

Section height	2.6-5.5 m
Working Range	3.0-5.5 m
Max. longitudinal inclination	±25°
The distance between the section sat the coalface	1.750 mm
The section step	900 mm
Working pressure max	32 MPa
The reinforcement resistance (for: w > 4,8 m)	886-1088 kNm-2.
The section bearing capacity(for: w > 4,8 m)	271 kN
The section weight	~ 35713 kg

Table 5.1 The coal face 401 307 parameters and the specification of the extraction

	Mine	ČSM SOUTH			Coalface n.	401 307					
TECHNOLOGY	coal cutter		coalface conveyor			collecting conveyor			extraction		
	Eickhoff SL 500		PF 6/1042			PF 4/1132			TP 1201		
Coalface length	[m]	193,6	Extraction capacity			[t/h]	1590	Extraction speed		[m/min]	3
Mined thickness	[m]	4,5	Collecting conveyor capacity			[t/h]	2200	Loading speed		[m/min]	5
Net thickness	[m]	4,5	Coalface conveyor capacity			[t/h]	2000				
Working width (slab)	[m]	0,85	Coalface mining capacity – minimum				1590				
Y (raw mining)	[t/m3]	1,145	*Capacity of the machinery in the line*								
Y (ROTP)	[t/m3]	1,31									
Line operation	[%]	0									
Way of leaching	traditional	yes	total time DS travel	slab	[min]	103,3		reloading time	[min]	bottom dead centre 15	
	with permanent working width			day	[min]	837				upper dead centre 15	
Mining cycle time	[min]	133		Planned operation of the line		[min]	837				
											ROTP
Number of cycles	per shift	2,7	Net working time fund			[min]	1035	Calculated mining		[t/day]	7862
	per 24 hours	8,1						Planned mining		[t/day]	4800
Daily procedure	[m/day]	7									

Source: [6]

The required rein for cementers is tunefully complies with the requirement for a fixed over burden to be150·ms, where ms is the seam thickness [7].

This solution conforms to the present-day economic requirements. The previous methods of benching used so-called artificial ceiling that was formed in different ways. Usually, geo textile was used, for example, in combination with wire mesh. It was placed on the upper bench floor [2, 7]. The left coal bench presents a certain risk because it collapses into a wall cave in the bottom bench. This can result in the risk of condensation. Due to timely preventive measure using nitrogen application, however, the risk of condensation was successfully eliminated.

Figure 5.4 shows how the coal face 401, 307 is prepared for clearing out. Using the mining machine, wide enough space (road) is created, where the assembled reinforcements moved and it is transported to the road [11].

The procedure shown in Figure 5.4, takes place in the following stages: When the coalfaces finished, plane TH reinforcement is clamped under the section on which Demes sieves are put (which is basically are placement for expanded metal). Sometimes plane thrusts were also anchored by bolts, but it does not follow from the layout. In the next stage, using coal cutter(usually a smallertype-AM50, etc.) the pillars cut around, the planes extended and the side TH of the leg is installed.

In the next phase, the drawing shows pulling the section out in the alley. The section is then turned and cleared out towards the main entry [11].

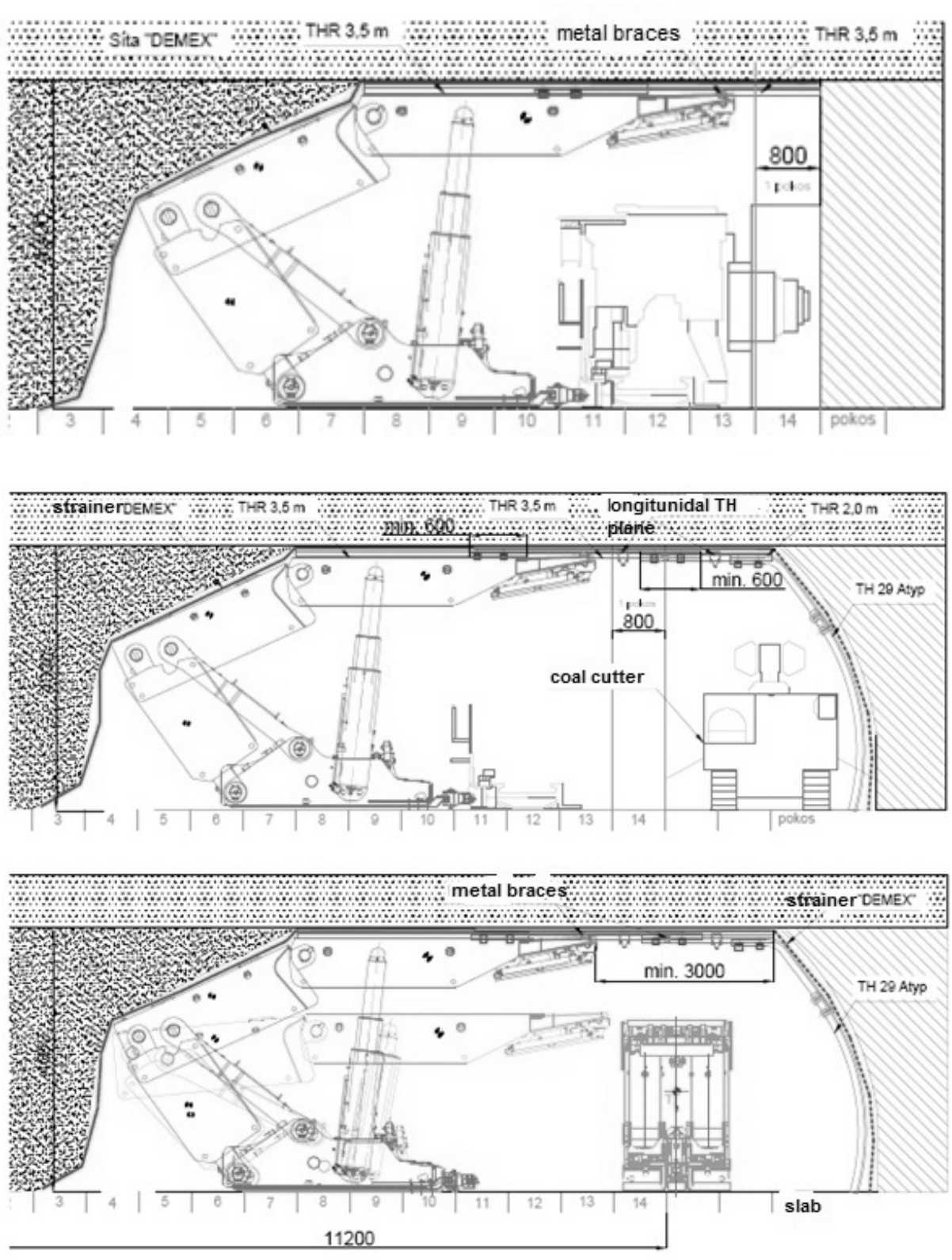

Fig. 5.4 Preparation of the coalface 401 307 for clearing out

Source: [11]

CONCLUSIONS

For the extraction of black coal seam with a thickness of 8.6 m, the method of mining with a coal protective layer can be used, which is economically advantageous. The condition forts application, however, is a detailed assessment of natural conditions. It is necessary to determine whether this is an area without danger of upheaval, or with little risk of this phenomenon, and whether the risk of spontaneous combustion can be eliminated using technical means, such as nitro generalization.

ACKNOWLEDGMENTS

The article was written also with the support of the project: SP 2014/32 – Research utilization and ensure of mine workings in the Czech Republic – problems of technical ensure.

REFERENCES

1 Bieniawski Z.T.: Rock mechanics design in mining and tunnelling. A. A. Balkema, Rotterdam 1984.

2 Folta, V.: Racionální vytěžení hnědouhelného ložiska v oblasti Dolu Centrum. Bakalářská práce VŠB-TU, Ostrava 2012.

3 Gibesová B., Chovanec J., Urban P.: Eliminace nebezpečí uhelného prachu, jako zdroje možných výbuchů v hlubinných uhelných dolech. XXXIX Dni techniky, ROP, Rybnik 2013, Posko, ISBN 978-83-926255-7-5.

4 Hudeček, V.: Analysis of Safety Precautions for Coal and Gas Outburst – hazardous strata. Journal of Mining Science, Vol.44, No. 5, 2008, pp. 464-472.

5 Hudeček, V., Pintzker, V.: Solving the Problems of Outbursts of Coal and Gases in the Paskov Mine, Partial Enterprise, Stařič Plant. Mine Planning and Mining Activity of the 21st Century, Ostrava 2003, pp 121-130, ISBN 80-248-0246-5.

6 Interní material poskytnutý ODMG dolu ČSM, OKD, 2012.

7 Lát, J., Iliev I.: Manual of underground coal mining methods. DOT CR. 1993.

8 Mikeska J., Říman A., Vavro M.: Mechanika hornin II. SNTL, Praha 1970.

9 Peng, S. S.: Coal mine ground control. Syd S. Peng Publisher, Morgantown 2008.

10 Program optimalizace produktivity POP 2010, 01 – MV Bucyrus, 2800 – 6000. Interní materiál.

11 Sabela O.: Způsoby ukončení porubu pro přípravu výklizu technologie. Bakalářská práce VŠB-TU, Ostrava 2011.

ULTRA-THICK SEAM MINING AT THE ČSM MINE IN THE CZECH REPUBLIC

Abstract: *The article presents method of preparing coalface and mining black coal seam with a thickness of 8.6 m. It further states the reasons why the procedure was selected. At the same time, a list of the coalface equipment and technology applied while the coalface was being cleared out after its completion is attached.*

Key words: *Thick seam, mining, geological log, protective layer of coal, coalface, advancing support, shock, spontaneous combustion*

EKSPLOATACJA GRUBYCH POKŁADÓW WĘGLA W KOPALNI ČSM W CZECHACH

Streszczenie: *W artykule przedstawiono sposób przygotowania przodka i wydobycie pokładu węgla o grubości 8,6 m. Ponadto wskazano na powody wyboru procedury. Równocześnie załączono listę wyposażenia przodka oraz stosowane techniki podczas wybierania przodka, aż do momentu jego zakończenia.*

Słowa kluczowe: *Gruby pokład, górnictwo, geologia, warstwa ochronna węgla, przodek, postęp, wstrząsy, samozapalenie*

Ing. Beáta GIBESOVÁ, Doc. Petr ŽŮREK, CSc, Ing. Adéla CIBULCOVÁ,
Ing. Petr URBAN PhD., Ing. Josef CHOVANEC, PhD.
VŠB - Technical University of Ostrava
Faculty of Mining and Geology
17.listopadu 15, Ostrava-Poruba, Czech republic,
e-mail: G.Beata@seznam.cz, Petr.Zurek@vsb.cz, Cibuad@seznam.cz,
Petr.Urban@vsb.cz, Josef.Chovanec@vsb.cz