The International Journal of
TRANSPORT & LOGISTICS
Medzinárodný časopis
DOPRAVA A LOGISTIKA

ISSN 1451-107X

SOLUTION OF HOISTING MACHINES RESTORATION

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Abstract:
Operational life of a hoisting machine is a very important part of transport logistics in every mining company. This paper presents the current situation in the Blind hoisting shaft "Golema Reka" as a capital mining facility and the situation of the hoisting system in it. By the research of this problem it was proposed a technical solution for extending the operational life of this hoisting system. Technical solution will cover replacement of rigid guides of hoisting skips with elastic guides or rope guides.

Key words: *shaft, hoisting plant, rope guides, skip*

1 INTRODUCTION

The hoisting-service blind shaft “Golema reka” with its associated mining parts is a capital facility of paramount importance for the underground lead and zinc mine “SASA”, Makedonska Kamenica. This hoisting blind shaft was first planned to serve as a vertical ore hoisting plant to horizon 950 and as service the mining activities for exploitation between the horizons 950 and 830. The shaft and its associated facilities are designed for an annual hoisting capacity of 700 000 tonnes of ore from a depth of 230 meters. It’s construction was completed in 1986. Considering that the ore mineralisation is located next to the hoisting blind shaft “Golema reka”, the excavation of this ore was done with cut and fill mining method with filling material from the flotation plant. (Fig.1). Although is selected the appropriate mining method for excavation, this still led to deformations of the lining of the shaft due to increased ground pressure and the influences of the blasting. These deformations of the shaft significantly influenced the steel guides, and come to their deformation movement that prevented the hoisting system of the conveyance and the counterweight object. Considering that the total investments in the construction of the internal shaft “Golema Reka”

and its associated mining facilities amounted to about 14 million deutsche marks, this blind shaft was planned also to serve for hoisting of ore from the mining area "Svinja Reka", which today is in active exploitation from the intervals between horizons XIVb and 830. When the "SASA" mine was restarted for work in June 2006, the hoisting-service blind shaft "Golema reka" become relevant and today about 80% of the ore is hoisted through this system. Mining exploitation activities in the area "Golema Reka" were stopped, and the mine management design a program for restoration of the shaft in order to enable reliable and secure hoisting of ore from bunker loading station on horizon 830 to the bunker unloading station on horizon 950 and also extending the life of the hoisting system.

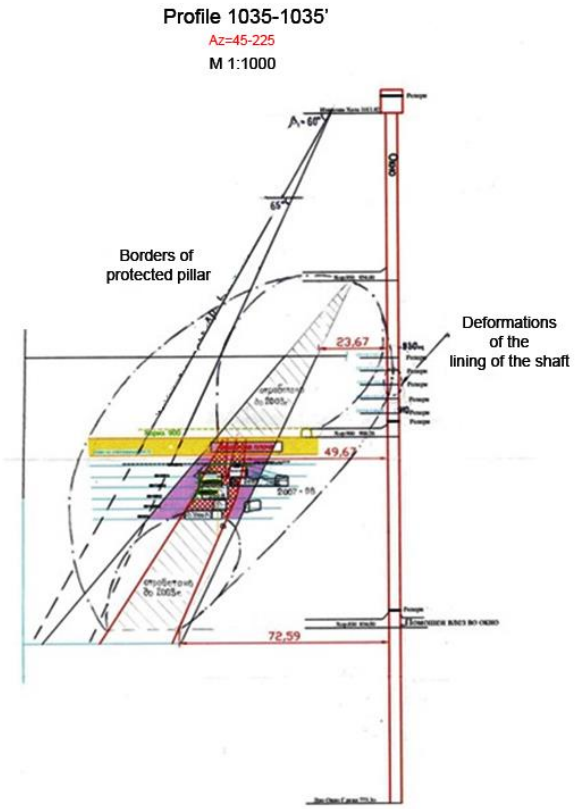

Fig. 1 *Area of deformations in the lining of the shaft due to the mining exploitation*

Program for extending the life of the blind shaft hoisting system of "Golema Reka", covers the following activities - restoration of the lining on the hoisting shaft and replacing the steel sets (traverse and guides); restoration of the bunker unloading station on horizon 950; replacement of the old skip-cage with a new; replacement of existing hoisting machine with a new; replacement of rigid guides with rope guides. In the manuscript will be described in detail the above mentioned activities for extending the life of the hoisting system in the blind shaft "Golema Reka".

2 RESTORATION OF THE LINING ON THE HOISTING SHAFT AND REPLACING THE STEEL SETS

The influences of the exploitation mining works done in the protected pillar of the shaft led to deformations in the shaft longitudinal axis, with deviation from max 114 mm. This resulted in disruption of the vertical track conveyance, and also cause a local damage to the lining of the shaft (Fig.2). Under the influence of forces from the rock mass, there was also damage to the guidance of the conveyance and the counterweight object. There were also damages on individual places of the shaft. To repair the lining and the steel set structure of the internal shaft, the management of "SASA" mine, hired the Czech company "Vystavba dolu"-Ostrava. With the changing trajectory of hoisting conveyance, also come to changes in clearance between the conveyance and the lining of the shaft. The clearance in certain places was less than 150 mm, and these places was necessary to adapt by removing the concrete lining to preserve the projected dimension on the overall length of the shaft. On Fig. 2, can be seen some of the damaged places on the blind shaft.

Fig. 2 *Damaged places on the blind shaft*

Restoration of the lining of the shaft will be made in accordance with the extent of the damage [1], mainly in two ways:

1. With steel mesh fixed with steel anchor bolts, and eventually covered with shotcrete;
2. The places with biger damage will be fixed by removing the concrete lining and filling it with concrete bricks;

Replacing the traverses will be made according to the basic criteria - horizontal deviation of the current state from the optimal design is 10 mm or more and it is necessary to change the traverses in which the deviation from the optimal design is 10 mm or more. The new traverse that were built are produced from steel square profile, measuring 150x150 mm, thickness of steel of 16 mm, and they allow leveling guides in horizontal direction, perpendicular to the longitudinal axis of cross sections in range ± 36 mm, without a new installation. Replacing the steel guides with profile S49, are made as follows:

- Before replacement it is necessary to measure the actual length of the old guides and prepare the new ones with the same length;

- With this work will be made complete replacement of the mounted guides, in direction from top to bottom and also simultaneously changing the cross sections and the restoration of the shaft lining;
- The assembly of the guides must be with respect of the project for hoisting plant, ie the distance between the guides must be 1410 mm with a tolerance of + 0 mm to + 2 mm.

3 RESTORATION OF THE BUNKER UNLOADING STATION ON HORIZON 950

Because of the previous usage of the hoisting system in shaft "Golema Reka", appeared damage in the other facilities of the shaft like the sloping part of the bunker unloading station (Fig.5), due to the abrasive rock pieces, and also on the vertical- prismatic part of the bunker unloading station (Fig.3), which led to damage in the reinforced concrete support, caused by the trucks that dump the ore inside. These deformations of the support on the bunker unloading station on horizon 950, significantly influenced its stability and preventing further exploitation in the mining area "Golema Reka".

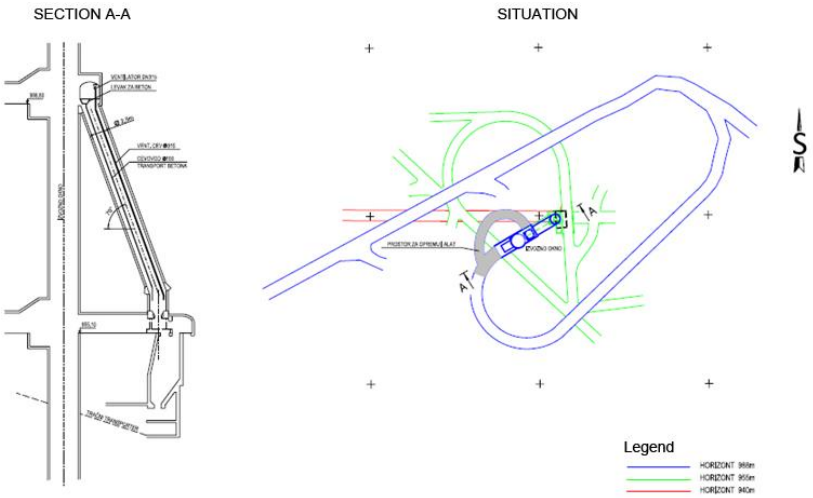

Fig. 3 *Vertical section and situation of bunker unloading station on horizon 950*

Repairing work on the unloading bunker, involves two independent activities [2]:

1. Repairing of the sloping floor on the bunker ring (Fig. 6a);
2. Connecting the rest of the vertical part of the circular bunker with the rectangular part of the unloading bunker for belt conveyor (Fig. 6b).

Repair of the sloping floor of the bunker will be performed within the scope of the damaged lining on the floor of the bunker. It was assume that the damage is up to a third of the size (perimeter) of the bunker. The floor in the specified range will be covered with steel rails welded to the console, which will be fixed by gluing anchors in the rock mass. Open space under the rails will be filled with concrete. Restoration of the prismatic part of the bunker consisted of closing the damaged space existing between circular bunker and the rectangular unloading bunker for the belt conveyor. It was recommend that the linking of both bunkers be technically resolved within the scope of the width of the circular bunker in the axial direction of the sloping bunker (direction of the flow of ore), so the other structures be out of the trajectory of the movement of ore [5]. The connection of the lower rectangular

bunker and the vertical part of the circular bunker was resolved with vertical walls. Tangential walls are attached to the reinforcing lining of the bunker and ended in the plane of the walls of the lower bunker. For restoration of the bunker unloading station on horizon 950 were also involved the companies Výstavba dolů - Ostrava (VDO) and Banske projekty - Ostrava.

4 REPLACEMENT OF THE OLD SKIP-CAGE AND HOISTING MACHINE

Within the activities of extending the life of the hoisting system in the shaft "Golema Reka", underwent a replacement of the old hoisting skip-cage with a new one purchased from the German company MAN GHH. With this were improved the conditions for transportation of workers in the cage and also the hoisting of ore in an 8-tonne skip. The replacement of the old hoisting machine was also purchased from the German company MAN GHH.

5 REPLACEMENT OF RIGID GUIDES WITH ROPE GUIDES

If we take into account that the deformations of the shaft will not stop, and they will manifest themselves in the future, it will be necessary the replacement of rigid guides conveyance with elastic guides with steel ropes [4], to be extended the life of the hoisting system. The system of guides with steel ropes is the least susceptible to the influences of deformation of the shaft, because the guidance of conveyance system is not transferred to the lining of the shaft and the surrounding rock mass [3].

The steel ropes guidance of conveyance system involves replacing the steel guide rails type S49, with steel ropes with a diameter of F29 mm, four guiding ropes to skip-cage and two lead ropes for the counterweight object (Fig.4). The steel ropes are mounted on frames embedded in the head of the shaft and fastened with weights that are placed in the depth of the shaft. Furthermore, this decision means the dismantling of all existing steel guide profiles S49, dismantling of cross sections and replacement of existing wheels to guide the skip-cage and the counterweight object, with appropriate slithers for guiding the stell ropes in the hoisting system.

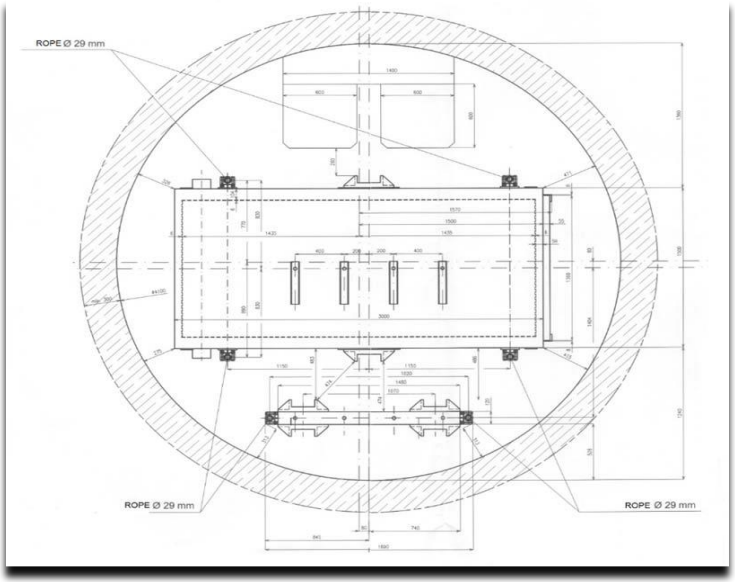

Fig.4 *Cross-section of the shaft with steel ropes guides of the skip-cage and the counterweight object*

6 CONCLUSION

With proper and successful implementation of the activities listed in this manuscript, can extend the life span of the hoisting system in the blind shaft "Golema Reka", and with this to provide reliable, economical and safe hoisting of ore in the underground lead and zinc mine "SASA". These examples of solutions can help to many mining enterprises to reduce their costs for operations, repairs, servicing, etc.

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