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Effect of Operating Stresses on Elements of Shovel Swing Bearings

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Keywords: shovel, excavator, swing bearing, operating stress, construction stresses, center pin.

Abstract. Calculations of operating stresses in elements of the shovel swing bearing are submitted and assessment of their impact is presented. Recommendations for reducing the impact of the calculated operating stresses on construction stresses are given.

Introduction

Shovels are leading elements of mineral extraction in open cast mining being operated under complex environment. Unscheduled downtimes, which inevitably arise during operation, have a negative impact on the entire enterprise efficiency.

Unscheduled downtimes of shovels of JSC "Kuzbassrazrezugol", the largest open coal mining company, have been analyzed. It was revealed that breakages of swing bearing elements are the most common, while the number of center pin failures is almost one third of all failures. Average repair time is up to 48 hours, due to the availability of spare parts, mechanization of repairs and so on.

The expertise has examined excavators with various service lives and found, that a very common defect is cracking of the center pin tops resulting in breakages. For a more complete study of causes of destruction a fracture-graphic analysis of the surface has been made. As a result, the direction of cracks development is revealed and conditions of its formation are supposed namely the impact of operational and accidental stresses.

It is also found that the front part of the upper rail is exposed to the greatest wear (rolling). This indicates that the greatest operating stress arises when the shovel operates in an inclined position.

Analysis of the reference [1] and design [2] documentation shows that the design of the excavator EKG-10 swing bearings does not take into account the dynamic stresses resulting of movement and filling the shovel bucket with rock during digging as well as a slope of the excavator and its rotary platform, although it affects the increase of stresses.

Taking the above into account, the formula for calculating operating stresses or service loads are derived [3, 4] to evaluate the impact both of cutting and pressure forces and a tilt of the rotary platform on the swing bearings of the shovel EKG-10.

A Mathcad-based trajectory of the rotary platform mass center shows that if the platform is tilted at 12 degrees, coordinates of the point of intersection of weight G action line with the support surface with R_{SB} = 1900 mm vary from 0.27 to 2.41 m, resulting to loss in platform stability. Thus, if the excavator is tilted in the longitudinal direction this coordinate point over the front roller displaces to 4 degrees at the completion of digging. [4]

Basic constraint reactions in the swing bearing [4] (see Fig. 1 and 2) are determined using the Theorem on changing of linear momentum resultant vector of the mechanical system. Mathcad-based values of the maximum stresses are shown in Table 1.

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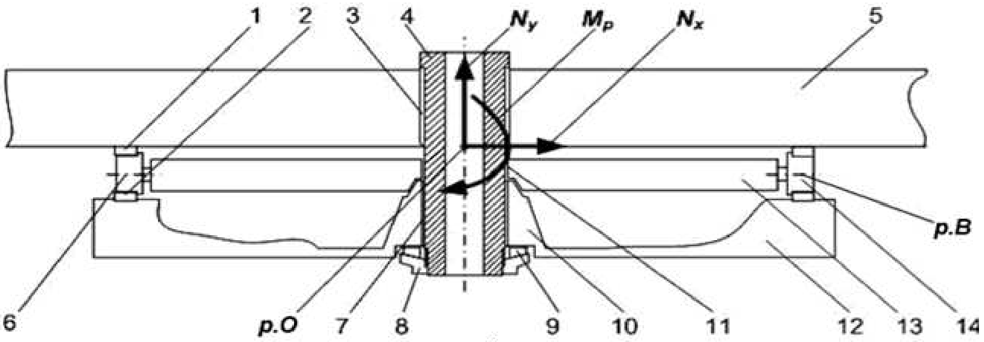

Fig. 1. Schematic of the overall design swing bearing and location of constraint reactions:
1 - top rail, 2 - bottom rail, 3 - rotary platform bushing (upper and lower collars),
4 – center pin, 5 - rotary platform, 6 - roller circle, 7 - bottom frame bushing,
8 - center pin nut, 9 - spherical washer, 10 - lower frame casting, 11 - roller circle separator bushing, 12 - bottom frame, 13 - roller circle separator,14 - front roller (point B),
N_X - horizontal stress component, N_Y - vertical stress component, M_p - reactive (bending) moment.

Table 1. Value of maximum stresses in swing bearings of shovel EKG-10

№	Parameter	Horizontal position		Tilt angle 12 degrees	
		digging start	digging completion	digging start	digging completion
1.	Pull force, кН	-624	2376	-542	2494
2.	Horizontal force, кН	334,9	90,9	867,4	674,2
3.	Reactive moment, кН*м	-1758,8	9050	-28,1	11122
4.	Vertical force , кН	2472	3154	2406	3082

Analysis of the data shows that impact of external forces (operating stresses or service loads) causes stress alteration in the swing bearing, which negatively affects its elements, since a change in stresses accelerates wear of elements and leads to the equipment failure.

For integrated assessment of operating stress impact on the swing bearing a SolidWorks Simulation-based calculation of stress-strain state is made [4-6]. The geometric model of the excavator EKG-10 swing bearing (in section) shows the location of maximum design stresses (see Fig. 3).

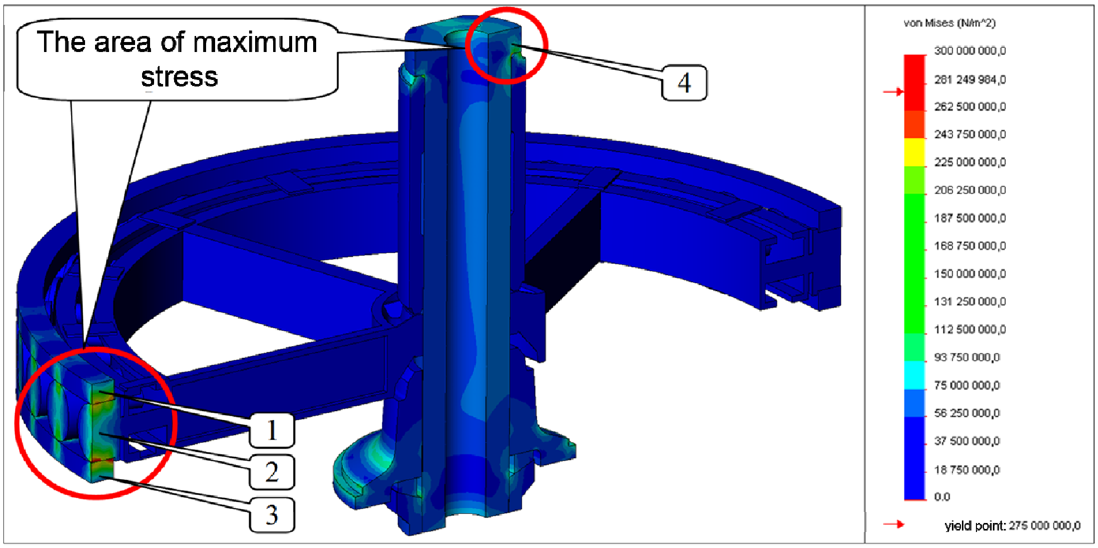

Fig. 2. Distribution of equivalent stresses in swing bearing according to Mises criterion: 1 - top rail, 2 - front roller, 3 - bottom rail, 4 – center pin

It is found that the center pin is the most stressed element of the swing bearing. Maximum stress on the pin is located in the fillet area; a hole for the eyebolt open to the vertical pin wall is an additional stress concentrator. Fig. 4 shows the center pin area where stresses exceed the material yield strength (275 MPa for the steel 40).

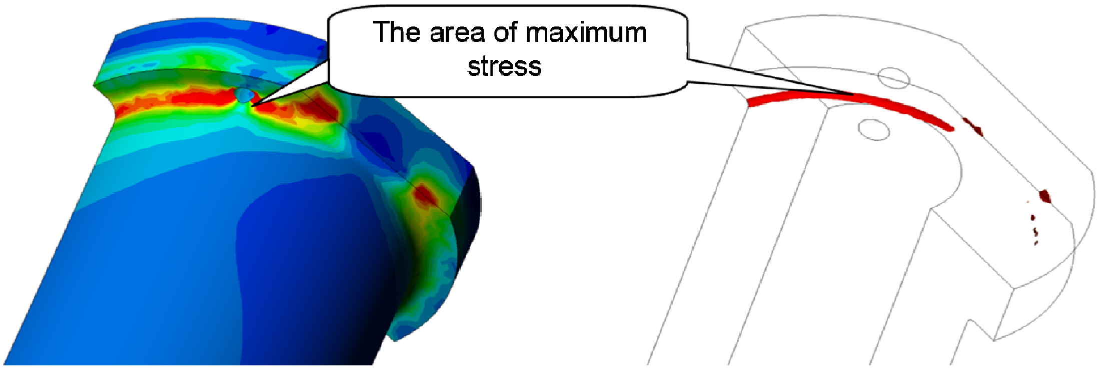

Fig. 3. Center pin area where stresses exceed yield strength (0.4% of the calculated structure)

Finite Element Method-based results prove the causes of center pin breakdowns and swing bearing top rail wear.

Maximum stresses on the center pin exceed the material yield stress and, therefore, are the cause of destruction. Also it is proved that the hole for the eyebolt is the additional stress concentrator.

Nature of stresses at the point of engagement of the upper rail and the roller circle confirms that seven front rollers are the most stressed; the front roller undergoes maximum stress.

To reduce the impact of operating stresses on the center pin structure, placement of the holes for eyebolts closer to the axis (formerly distance 230 mm, proposed distance of 165 mm) and increasing the fillet radius (from 10 mm to 25 mm) are proposed. Change in design of other (conjugate) elements of the swing bearing is not required. Fig. 5 shows stress-strain state of the swing bearing with the improved center pin.

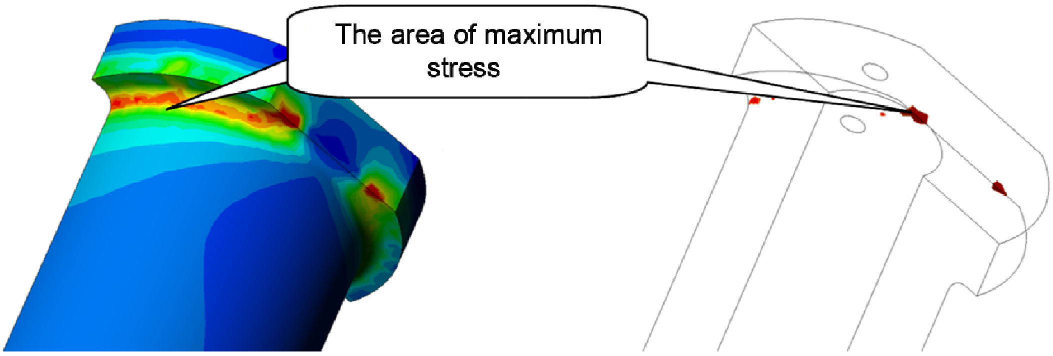

Fig. 4. Improved center pin area where stresses exceed yield strength (0.4% of the calculated structure)

The findings suggest that there is a tenfold decrease in operating stresses in the swing bearing elements. Corresponding reduction of unscheduled failures and improvement of coefficient of shovel technical readiness are expected.

Conclusion

The most stressed elements of the swing bearing are revealed. Areas of maximum stresses are found. Causes of center pin breakages and swing bearing top rail wear are proved. Design modification of the center pin is proposed that will reduce the area of maximum stresses.

References

[1] R.Yu. Poderni, Mechanical equipment of quarries: textbook for high schools. 6th ed. MGGU, 2007.

[2] "Zhdanov Izhorsky Zavod" "Calculation of inertia moments for excavator EKG-10. 3532.00.00.000 PP1 "(1983)

[3] A.A. Horeshok, E.K. Sokolova, P.V. Buyankin, Investigation on causes of excavator rotating platform tilting and evaluation of its impact on swing bearing operating stresses. J. Mining Machinery and Electro-mechanics. 3 (2014) 11-14.

[4] A.A. Horeshok, I.D. Bogomolov, P.V. Buyankin, A.V Vorobiev, Calculation of operating stresses in swing bearings of shovels, J. Mining Equipment and Electro-mechanics. 6 (2014) 43-46.

[5] V.V. Aksenov, A.B. Efremenkov, V.Yu. Beglyakov, Influence of relative distance between ledges on stress-strain state of rock face, J. Applied Mechanics and Materials. 379 (2013) 16-19.

[6] V.V. Aksenov, A.A. Khoreshok, V.Yu. Beglyakov, Justification of design of external propulsor for multipurpose shield-type heading machine, GEOKHOD, J. Applied Mechanics and Materials. 379 (2013) 20-23.

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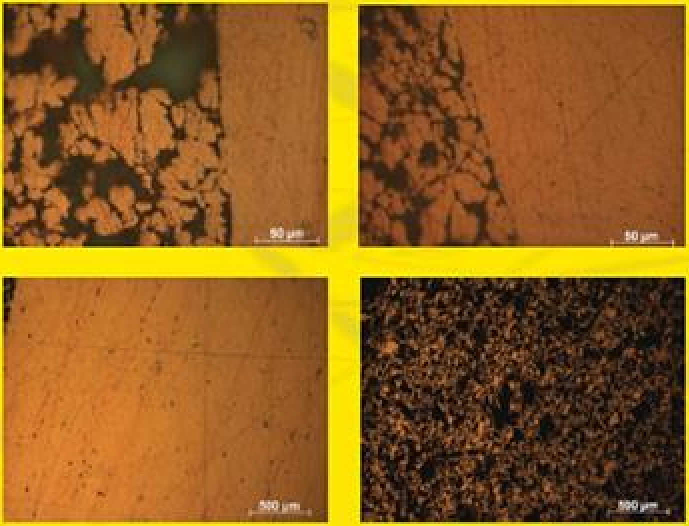

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