

STRENGTH CALCULATIONS, TRACTION AND STEERING FORCE MEASUREMENTS OF ELEMENTS OF CHASSIS OF OPEN CAST MINING MACHINES

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1. Introduction

The aim of the research was to identify the loads on multicaterpillar track chassis and calculate the strength of elements of chassis. The measurements were taken on open cast mine machine: mobile transfer conveyor, shown on figure 1. The biggest problem in such kind of machines is to properly diagnosis the state of machine and remove from usage before any dangerous, for people and machine, accident would have take place [1,2].



Fig. 1: Open cast mine machine

2. Boundary conditions

The chassis of open cast machines like mobile transfer conveyor consists of up to 12 caterpillar track connected into sets of 2 or 4, of which some are steered. The scheme of chassis that is the aim of research is shown in figure 2.

The typical scheme of loads are shown on figure 4. The boundary conditions for the drawbar are connected with the most adverse work conditions - steering the steered caterpillar track set. The Loads on the caterpillar track are more complicated than the loads on drawbar. The boundary conditions are related to the ride of the entire machine. During the turning the forces try to break the caterpillar track [5, 6]. During the forward ride the most endanger elements are axis of caterpillar track. Nowadays norm and engineering practice shows that factor of the friction is held at the value of 0.6. Interaction

ground and caterpillar is also included in loads on caterpillar.

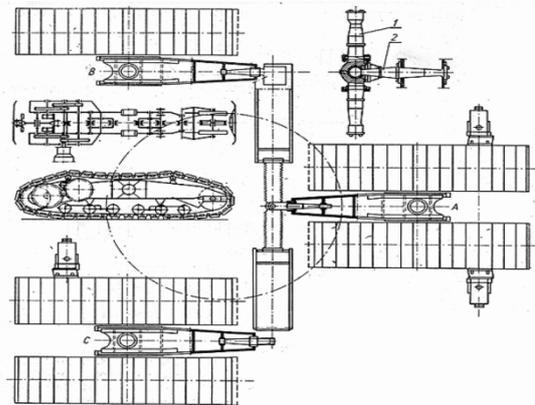


Fig. 2: Scheme of chassis of open cast machine

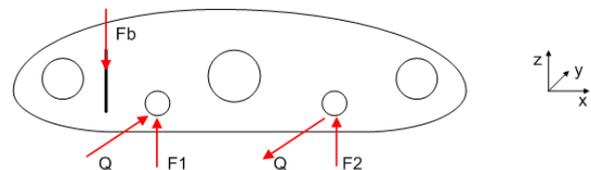


Fig. 3: Scheme of load on caterpillar track

3. Numerical measurements

Numerical analysis were done using the Finite Element Methods. Calculations were done for 5 different schemes of loads on caterpillar track and for 2 different schemes of load on drivebar.

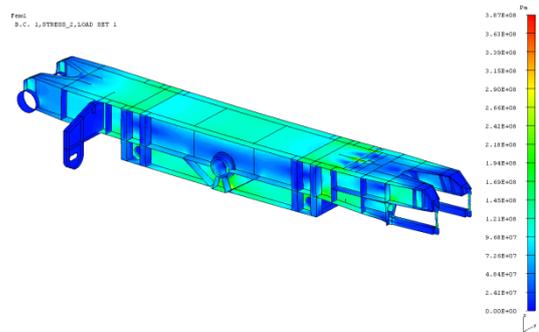


Fig. 4: Results of numerical analysis

During the calculations nonlinear material model was used. Some results of the calculations

are shown in figure 4 and 5. Indication of the most endangered places were based on results of analysis.

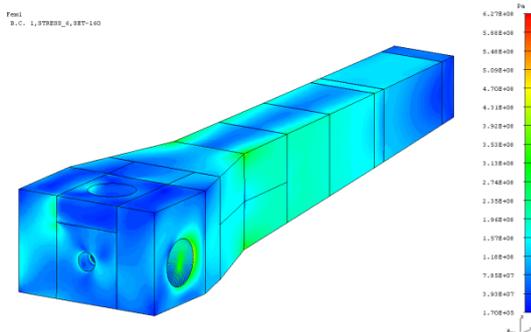


Fig. 5: Results of numerical analysis

4. Strain gauges measurements

Strain gauges measurements were performed in 9 measuring points: 6 points on track's supports, 2 on caterpillar's track support and one on drivebar [3]. Scheme of measurements points is shown in figure 6. The measurements were taken by multichannel registrar during the riding the conveyor. The measurements were taken for many settings of body and chassis with different angle of steering set.

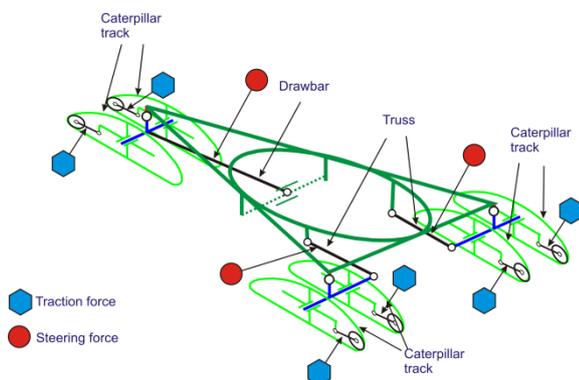


Fig. 6: Scheme of strain gauges measurements

5. Results of strain gauges measurements

After examination the results from measurements there were shown some figures, that shows tubing of caterpillar sets, increasing and decreasing steering force and track force on caterpillar during riding and turning. The results of measuring the steering force is shown in figure 7. Those measurements are from trusses and were

done during the ride forward, backward and turning right from angle 0° until 13°.

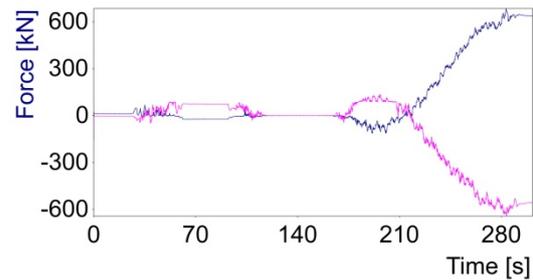


Fig. 7: Results of multichannel registration

6. Summary

Nowadays there is lack of guidelines to take the appropriate boundary conditions and exploitation loads. It is necessary to take more research on open cast mining machines to more properly define the loads on multicaterpillar track chassis.

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