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Experimental Stress Analysis

REDUCTION OF THE VIBRATION EFFECTS ACTUATING IN GENERAL DIRECTION ON COLLIERY MACHINE

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Abstract: The aim of this paper is driver seat suspension in general direction of colliery machine Shrs 1320. Especially authors focus on measurement of current vibration level and design of new cabin and driver seat mounting.

1. Introduction

While mining colliery machines are exposed to general vibration effects. Vibrations are transferred both to whole machine and to cabin and driver seat also. It is endeavor to minimize this vibration effects by proper cabin and seat support. During new cabin and seat support projection it is necessary to respect general direction of vibrations especially. This brings increased attention to support construction.

2. Colliery machine Schrs 1320 description

Colliery machine Schrs 1320 is product of PRODECO, a.s. company and it´s used to remove clay uncovering in Doly Nástup Tušimice. Theoretical load of machine is 5500 m^3 of clay per 1 hour and maximal high of cutting is 30 meters. Figure 1 describe this machine. The place of cabin and driver seat is marked by red ellipse. Cabin is placed behind of outrigger.

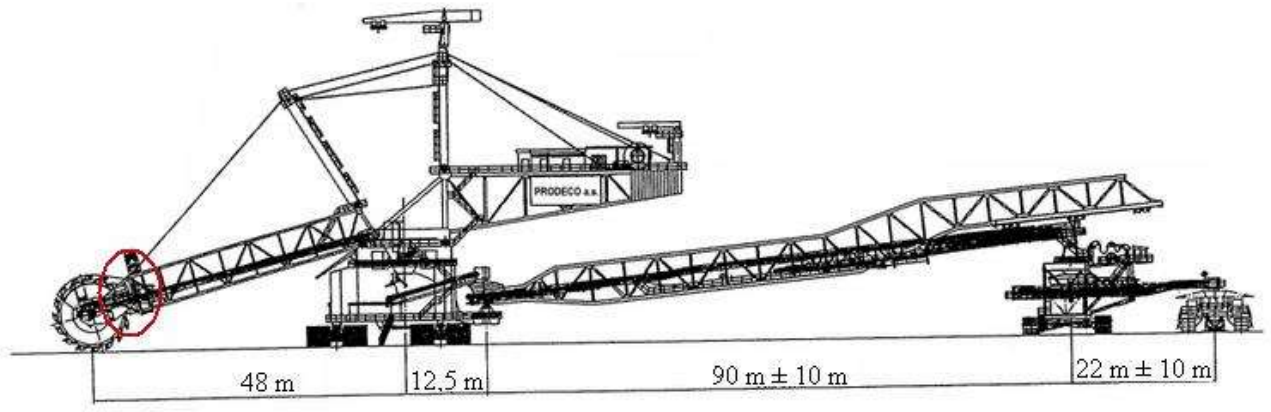

Figure 1: *Colliery machine Schrs 1320.*

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3. Current support of cabin and driver seat

At now, cabin is mounted in frame by springs. Frame is mounted to console in three points - by two rotational joints and one stability rod, which realized horizontal position of cabin considering to ground. Console can move in vertical direction in slide-way. This direction is perpendicular to direction of outrigger.
Current cabin mounting in frame is realized in four points by air springs under cabin. In each point are two springs - one in vertical direction and another in one of the horizontal direction. Two springs are placed in longitudinal direction and two springs in lateral direction. Each couple in opposite corners of cabin. Together with springs is placed a couple of dampers in each of points. The first one provide damper in vertical and longitudinal direction and the second one in vertical and lateral direction. Cabin stability is provided by two spring between frame and roof of cabin (in longitudinal and lateral direction).

1 - vertical slide-way,

2 - console,

3 - stability rod,

4 - mounting points of frame,

5 - frame of cabin.

6 - cabin.

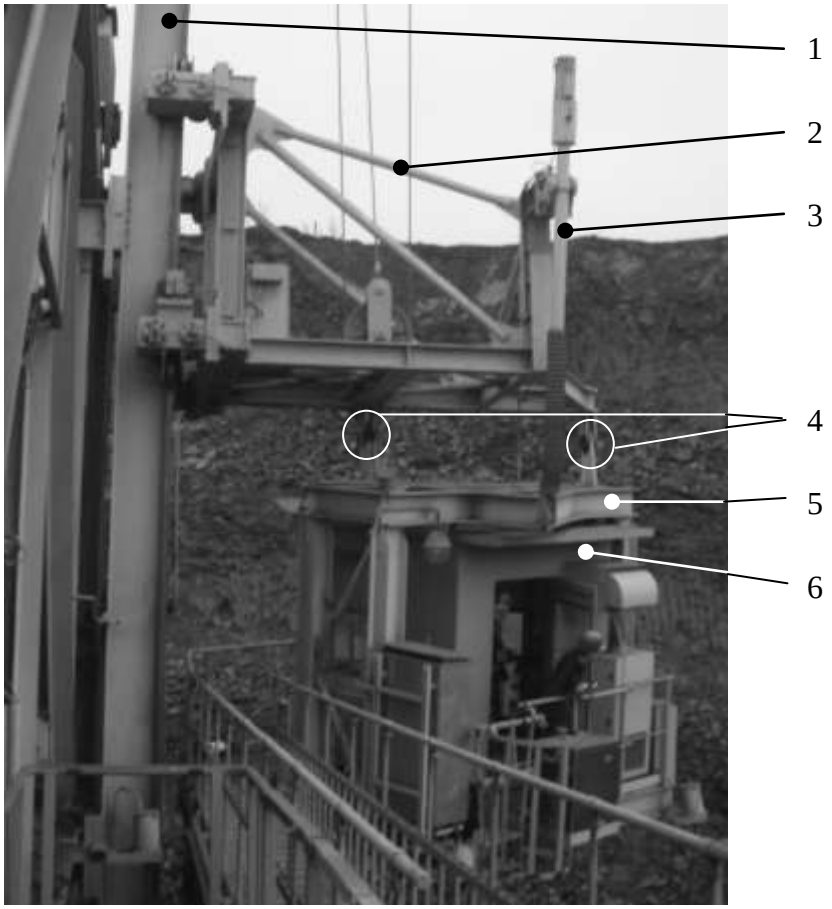

Figure 2: *Cabin mounting of Schrs 1320.*

Driver seat is placed in cabin by usual parallelogram mechanism which provide movement in vertical direction. Inside of this mechanism is placed spring and damper.

4. Measurement

We realized measurement at two parts of Schrs 1320 to check character of vibrations during mining - console and the floor of the cabin. Vibrations of console were measured in cooperation with the Brown Coal Research Institute, j.s.c.

a) measurement of console

Vibration measurement was realized in three points where the frame of cabin is mounted. At each point we measured three components of acceleration (except point 1 as shown in figure 3).

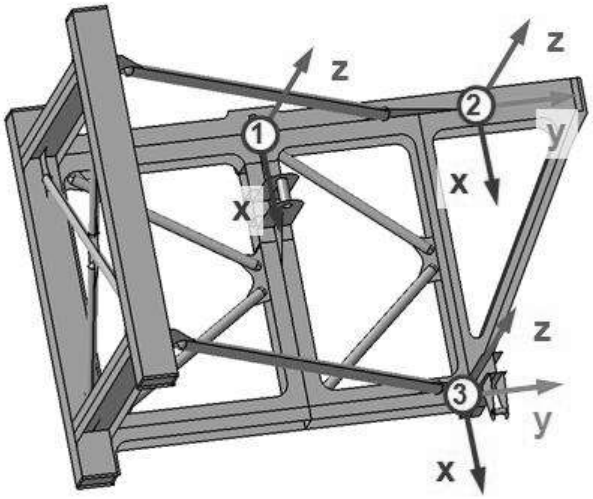

Figure 3: *Measurement of console.*

b) measurement of cabin floor

Vibrations measurement inside of cabin was realized in four points with six sensors of accelerations ADXL203EB (±1.7g, by Analog Devices) and one gyroscopic sensor MTi (by Xsens Technologies). Detail of this measurement is presented in [1].

5. Measurement results

The most important findings of measure can be summed to the next points:

- Absolute value of the biggest acceleration component wasn´t bigger than 3.5 $m.s^{-2}$. It means, we can expect maximal values of acceleration below 8 $m.s^{-2}$ approximately for extreme mining.
- All vibrations components (*x*, *y* and *z*) in measured points are of the same intensity, but with different phase.
- Absolute values of vibrations in stationary state are about 12 mm.
- Cabin does not so much incline about lateral direction (perpendicular to outrigger), but about longitudinal and vertical direction is inclination during vibrations much bigger.
- The dominant frequency was 2.3 Hz for low vibration level, but for intense vibrations dominant frequencies were also 1.8 Hz and 2.7 Hz. Also frequency about 0.5 Hz is very important for next computation. This frequency correspond with outrigger hunting about its mounting points.

6. A new concepts of cabin mounting

From measurement results and experiences from the other project were proposed two variations of cabine and seat support (also in [2]):

- Cabin will be hang on three rigid sticks (or four flexible sticks) like parallelogram. This should reduce vibration in horizontal direction. Vertical vibration will be reduced by spring in driver seat.
- Horizontal vibrations will be reduced by special platform (two desks can move each other in two perpendicular direction, optimal spring and damper are mounted in each direction). Vertical direction will be reduced by spring in driver seat also.

For purpose of new cabin and seat support proposal, simulation model in MSC.ADAMS/View software was created. This model is shown on figure 4.

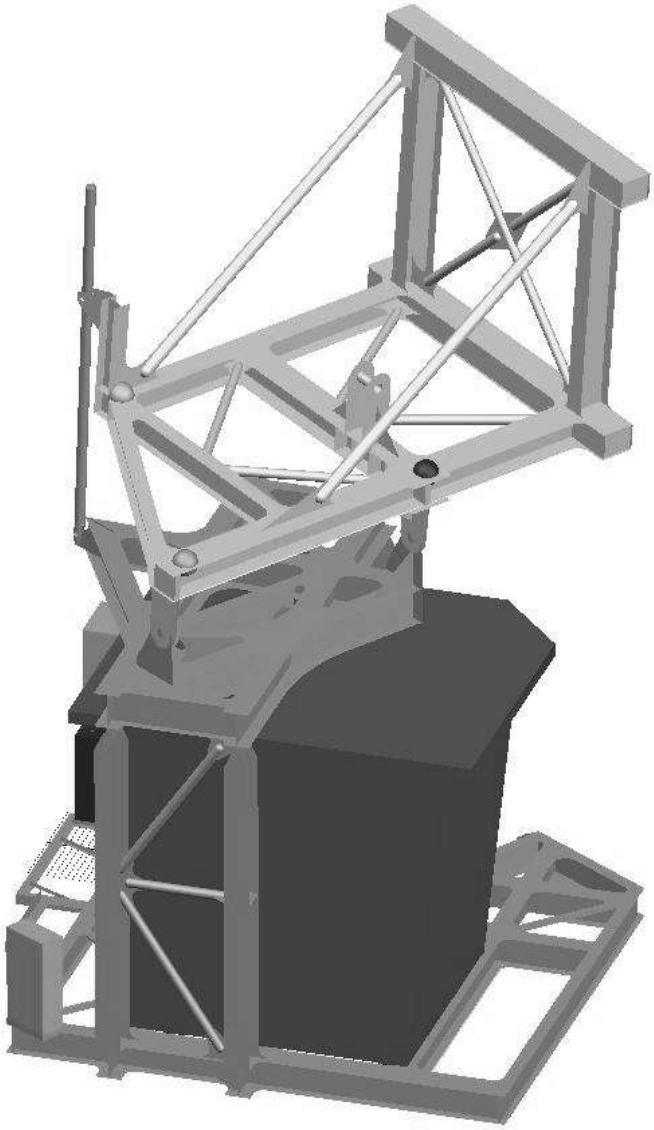

Figure 4: *Model of cabine in MSC.ADAMS/View software*.

7. Conclusions

The aim of this part of project was to get detail information of vibration of colliery machine Schr 1320 and to propose some variations of new cabin and seat support. Now, we will simulate proposed variations to identify, what cabin and seat support is the best and what parameters of used components (spring, dampers, sticks) will be optimal.

Acknowledgement

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References

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