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EXPERIMENTAL AND NUMERICAL DETERMINATION OF THE STRESS MADE IN THE AUTOBASCULE LONGERON

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ABSTRACT
The paper is propose to determine the stresses in the autobascule longeron by photoelastic and by finite elements procedures. Is proposes the best shape of strength structure by comparing f the results.
Keywords: stresses, strains, chassis, longeron, photoelasticity, finite element.

1. INTRODUCTION
The paper intends to analyse the stress state from the longerons of the AB55 t dump truk, through the method of photoelasticity and throungh numerical analysis, comparing these results for a constructive optimization of the chassis. The chassis of dump trucks are important elements of the strength structure of these heavy vehicles, which need to sustain both the dynamic loads of the charge and the loading produced by denivelation of the roads. The initial desing of this structure has been made by analogy with other similar vehicles, without taking into account the changes in the connection positions of indigenous subassemblies.

2. THE PHOTOELASTICITY METHOD
The longerons of the chassis support the main loadings which produce plane stress states and plane strain states, respectively, which can be analyses through the photoelasticity method. For this purpose, there have been realised photoelastic models equivalent to the real longeron, at a 1:20 scale of dimensions; these models were loaded with the equivalent stresses, at a scale of forces of 1:2000, using the loading device of the circular polariscope (figure 1).

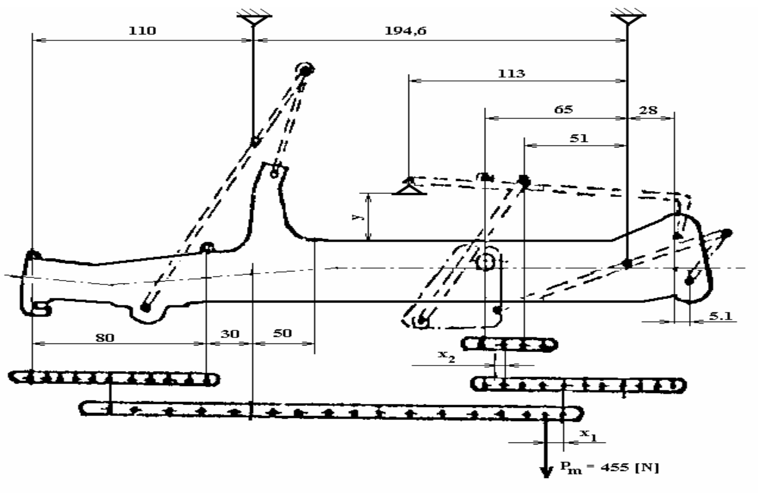

Figure. 1 The model and the loading of the longeron

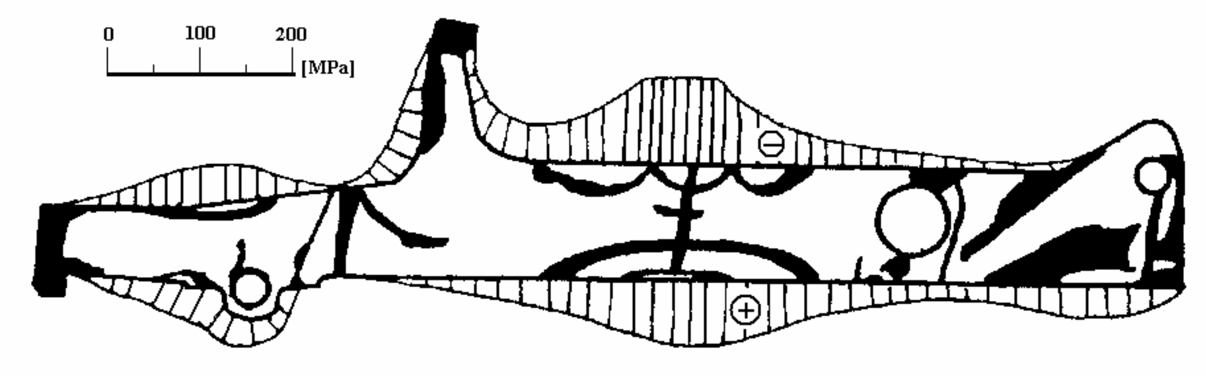

Figure.2 The isochromates and the variation of stresses normal to the longeron perimeter for the case of the leaned bucket, G_u, in the theoretical position

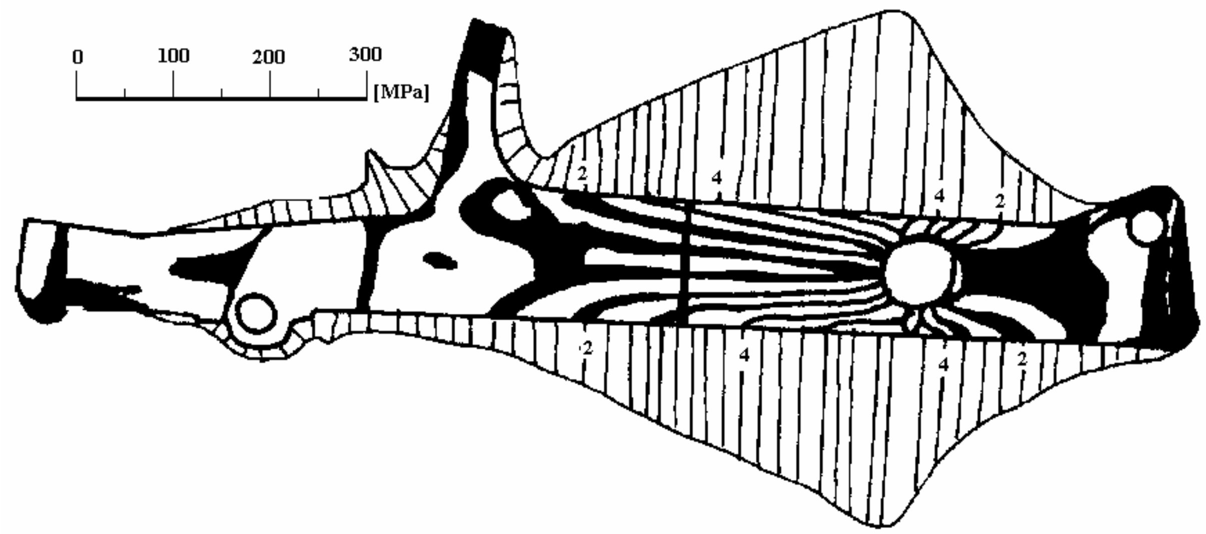

Figure.3 The isochromates and the variation of stresses normal to the longeron perimeter for the case of the reised bucket, with G_u, in the theoretical position

The analysis has been carried out for different loading cases: a) the loaded bucket, leaned on fhe chassis (Figure. 2); b) the loaded bucket, raised from the chassis (Figure. 3).
In both cases, the stress state has been analysed for variable positions of the useful load, G_u, in front and to the back of the theoretical position.

3. THE DETERMINATION OF THE STRESS STATE THROUGH THE FINITE ELEMENTS METHOD

There have been used elastic, isotrope 2D-type finite elements, with four nodes per element. The adapted discretisation has been done with a variable ratio, denser in the areas of interest. The limit conditions were imposed in such manner that the real way of assembling the longeron with the other subassemblies was respected.
Based on the analysis all components of the stress tensor and of the strain tensor have been calculated and there have been represented eight stress levels by dividing equivalent stresses into equal stages, between the maximum and the minimum value. The values of these stages, presented in Figure. 4 and 5, correspond to the same loading states as the ones used in the photoelasticity analysis in Figure 2 and 3.
In order to study the influence of the position of applying, the useful load, its gravity center has been moved in front and, respectively, to the back of its theoretical position. The

maximum and minimum values for the most unfavourable loading situation (the applying of the useful load at 400 mm in front of the theoretical position) are shown in Figure 6 and 7.

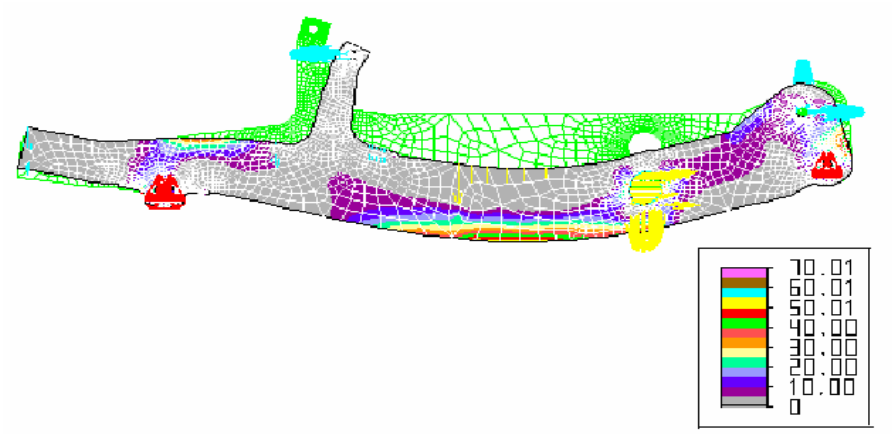

Figure.4. The stress state (Tresca) and the strain state in the longeron of the dump truck for the case of the leaned bucket, G_u, in the theoretical position

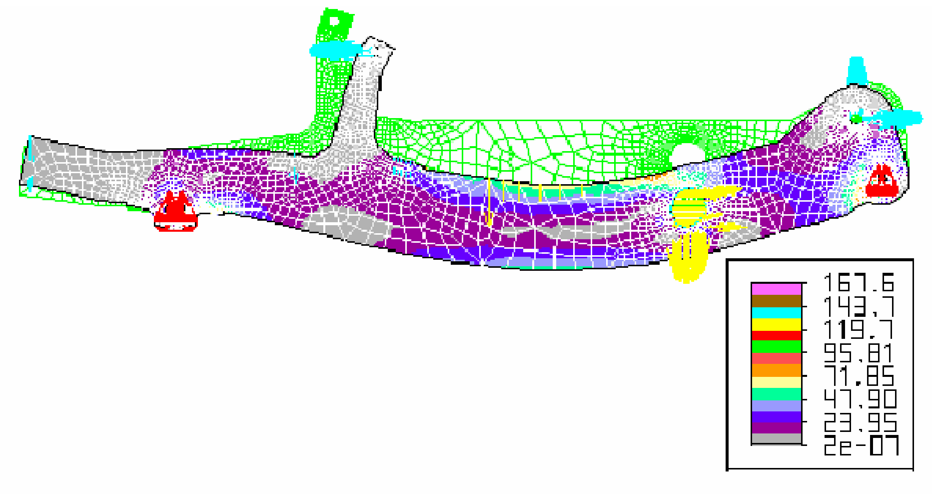

Figure.5. The stress state (Tresca) and the strain state in the longeron of the dump truck for the case of the reaised bucket, G_u, in the theoretical position

4. CONCLUSIONS

From the analysis of the stress state by the two methods, following can be concluded:

• the maximal stresses occur in the fastening area of the dumping cylinder, at the moment when the dumping of the load begins;

• their maximal values decrease with the increasing distance from this point;

• the front parts of the longeron and the cab support are but little solicited;

• the situation remains the same when the relative position of the gravity center of the useful load is modified;

• the movement of the load to the back leads to the decrease of the stresses in the dump truck longeron.

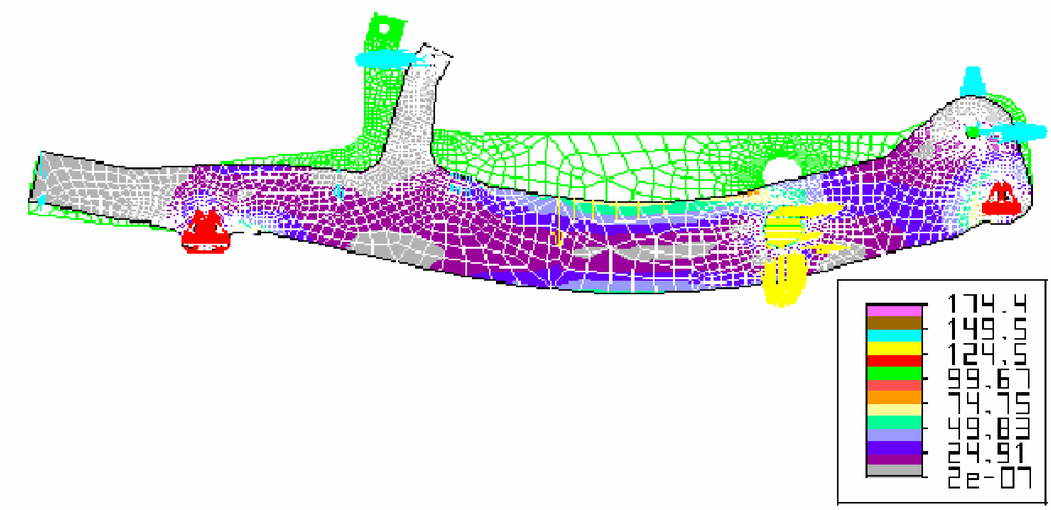

Figure.6. The stress state (Tresca) and the strain state in the longeron of the dump truck for the case of the reaised bucket, G_u, at 400 mm in front of the theoretical position

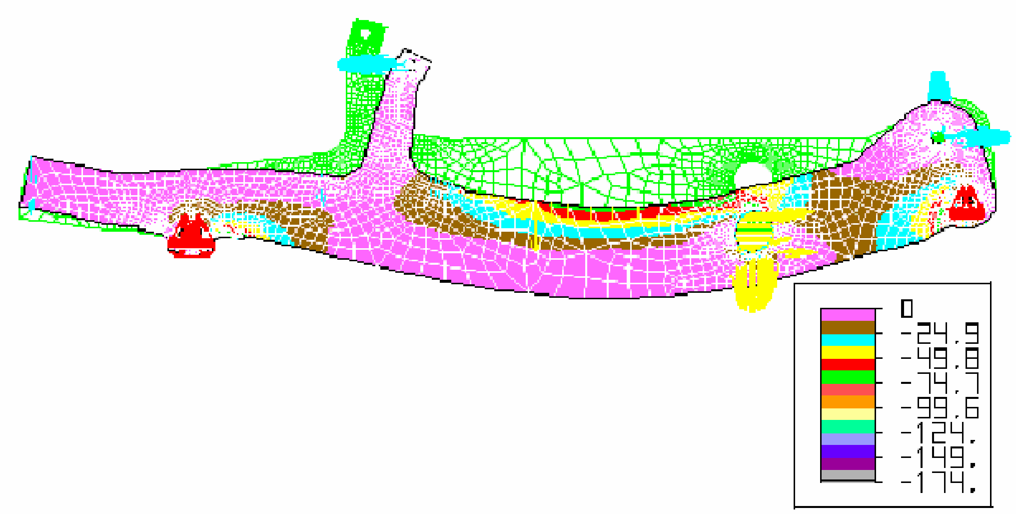

Figure.7. The stress state (Tresca) and the strain state in the longeron of the dump truck for the case of the leaned bucket, G_u, at 400 mm in front of the theoretical position

5 IMPROVEMENT PROPOSALS

• modifying of the position of the dumping strap, in order for in to have the same angle with the dumping cylinder in the moment when the dumping begins;

• strengthening of the longeron in the area of the support of the dumping cylinder.

The improvement proposals will be verified by electrical tensometry on the dump truck, in real conditions of loading and exploitation, in the test polygone of the beneficiary.

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