



Opponent's review of the Doctoral Thesis

Candidate Petr Hála

Title of the doctoral thesis Development of high-load-bearing energy-absorbing system with controlled deformation

Branch of study Civil Engineering

Tutor Assoc. Prof. Radoslav Sovj'ak

Opponent Univ.-Prof. Dr.-Ing. Dr.-Ing. E.h. Manfred Curbach

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Topicality of the doctoral thesis theme

Commentary: I is a very important and actual topic, it is highly useful to increase safety during car accidents and save lives, and it is of high social relevance

excellent above average average below average poor

Fulfilment of the doctoral thesis objectives

Commentary: The candidate set high goals for himself at the beginning of his work. He wanted to achieve nothing less than to develop a system in which, in the event of a collision, so much energy is destroyed during large deformations that the occupants of a vehicle are no longer exposed to any fatal danger. It can be stated that the candidate has achieved these goals excellently. The objectives and their fulfillment are at a very high level and are appropriate for a dissertation.

excellent above average average below average poor

Research methods and procedures

Commentary: The candidate has used both experimental and numerical methods in his dissertation. For both methods it can be stated that they are highly sophisticated. Impact experiments are generally much more difficult to perform and evaluate in relation to quasi-static ones. Short-time dynamic calculations are also among the most demanding tasks available in civil engineering

excellent above average average below average poor

Results of the doctoral thesis – dissertant's concrete achievements

Commentary: The dissertant tested two different materials and numerous geometries to achieve an efficient and durable solution. Numerous results were obtained from the tests with fired clay on the mode of action as well as of open structures generally. The high-strength concrete used in the next step builds on this experience and improves the overall solution, especially by adding durability. With the help of the numerical investigations, he also succeeds in describing the experiments theoretically, so that he has a model with which further developments can also be investigated numerically.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> above average	<input type="checkbox"/> average	<input type="checkbox"/> below average	<input type="checkbox"/> poor
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Importance for practice and for development within a branch of science

Commentary: The results of the thesis are directly applicable. This is also clearly shown by the great interest of a practice partner who participated in the work. Also overall, the results clearly advance the knowledge in the field of impact research. The dissertant has made a very important contribution to this field of research

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> above average	<input type="checkbox"/> average	<input type="checkbox"/> below average	<input type="checkbox"/> poor
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Formal layout of the doctoral thesis and the level of language used

Commentary: The thesis meets the high requirements of a dissertation in terms of language, content and structure.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> above average	<input type="checkbox"/> average	<input type="checkbox"/> below average	<input type="checkbox"/> poor
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Remarks

On page 40 of the thesis in Figure 3.6. a very interesting phenomenon can be seen. Not only on the loaded side, but also on the side away from the load, a failure develops. Subsequently, the two destroyed areas converge. What hypothesis can you put forward to explain this behavior?

This behavior occurs only with fired clay. On page 64 of the thesis in Figure 4.7 the development of the failure in highstrenght concrete can be seen. Here there seems to be no destruction on the side away from the load. Do you have an explanation for this behaviour in comparison with the before mentioned failure of fired clay?

On p. 58 of the thesis in figure 4.6 it can be seen how the static strength tests are carried out on the components made of high-strength concrete. These results are important to prove the trafficability. However, to get a comparison to the impact loading, results on the strength parallel to the impact direction would also be interesting. Have you also carried out these tests?

The test specimens made of fired clay have rhombus-like openings, so that the impact load also travels through the component in part due to compressive-tensile forces like in a strut and tie model. The test specimens made of high-strength concrete, on the other hand, have rectangular openings, so that all impact forces are transmitted via bending. This appears to be less efficient. Why did you choose this different geometry?

These experimental results are also new to me, as far as elements from the construction industry are concerned. Do you know similar cases of energy dissipation or reduction from other disciplines beyond those mentioned in the state of the art, such as from nature?

Final assessment of the doctoral thesis

The thesis is of fundamental importance for further research in the field of impact research.

With this thesis the dissertant has proven that he is able to work scientifically independently in the field of impact research and that he has made an extraordinarily important contribution to the research in the field of impact research.

The thesis fulfills in an excellent way and in its entirety the requirements for a dissertation to obtain the academic degree of Doctor of Engineering.

I recommend to the Faculty of Civil Engineering of the Czech Technical University in Prague to accept it as a dissertation.

Following a successful defence of the doctoral thesis I recommend the granting of the Ph.D. degree

yes no

Date: 12.12.2020

Opponent's signature: 