

## Opponent's review of the Doctoral Thesis

Candidate Ing. Hana Najmanová

Title of the doctoral thesis Evacuation of Pre-school Children Aged from 3 to 6 Years

Study Programme Civil Engineering

Tutor doc. Ing. Václav Kupilík, CSc., Dr. Enrico Ronchi

Opponent doc. Ing. Vladimír Mózer, PhD.

e-mail vladimir.mozer@cvut.cz

### Topicality of the doctoral thesis theme

Commentary:

The topic of the thesis is a very actual and important one. The ability of self-rescue in pre-school children is an important aspect of fire safety for buildings used for pre-primary education. Pre-school children are a vulnerable population and their abilities are currently not fully reflected in fire safety standards and regulations. The thesis fills important gaps in the knowledge and contributes new information which should improve both fire-safe design as well as use of buildings for pre-primary education.

excellent     above average     average     below average     poor

### Fulfilment of the doctoral thesis objectives

Commentary:

Three main objectives of the thesis are defined in section 1.3 Research objectives. These objectives are correctly defined in terms of the research presented within the thesis. Following the objectives, 6 research questions are formulated, which specify the scope of the study further. The objectives of the thesis focus on gathering relevant existing knowledge on pre-school children evacuation, obtaining new data through experimental research and their appropriate presentation for further application in research, building design and education.

Overall it can be concluded that the doctoral thesis fulfils all defined objectives to a full extent. Each of the three main objectives is covered in a separate part of the thesis. Hence, it is possible to associate the presented outcomes with the defined objectives and answer formulated research questions.

excellent     above average     average     below average     poor

### Research methods and procedures

Commentary:

Research methods and procedures are appropriately selected and thoroughly described. There are two main methods used: evacuation experiments and questionnaire investigation.

The evacuation experiments are well thought through and designed. All investigated parameters, measurement techniques and important aspects are described in a great detail. Known limitations are also properly identified, hence boundaries of data interpretation are always clear.

The data analysis and statistical evaluation are appropriate. Due to the relatively scattered data

points it would be interesting to see envelope curves following the minimum and maximum trends.

The questionnaire is focused on important building parameters and operational aspects of fire safety in the pre-primary education providers. The questions are well structured.

excellent     above average     average     below average     poor

### **Results of the doctoral thesis – dissertant’s concrete achievements**

Commentary:

One of the main results of the research work is the extensive and thoroughly described data set characterising all components of pre-school children evacuation. It is compared and discussed against other research in this field. Along with the numerical data characterising the emergency egress movement of pre-school children, their behavioural patterns are also described. These two components are prerequisites for correct evacuation modelling and egress paths design.

Apart from the actual data, the organisational abilities of the Ph.D. student must be acknowledged, due to the great extent of the evacuation experiments. It should be also pointed out that these experiments were conducted with a sensitive population which added another layer of complexity to the whole process.

The questionnaire provides a very useful insight on the building stock for pre-primary education and operational procedures related to evacuation in case of a fire emergency. This represents the more practice-focused research aspect which complements the main evacuation experiments.

excellent     above average     average     below average     poor

### **Importance for practice and for development within a branch of science**

Commentary:

The research and its results presented in the thesis is valuable both for practice, as well as for the further progress of the branch of science.

For fire safety engineering and design purposes the data and findings have a great potential to improve fire safety in buildings for pre-primary education. Particularly for performance-based design the established movement and behavioural characteristics are very useful.

The contribution to the branch of science lies mainly in providing a detailed insight into pre-school children emergency egress. This includes the movement and behavioural aspects, both of which are described in a great detail. Among other findings, important age groups are identified for which the movement (e.g. walking speeds) and behavioural (e.g. comprehension of the situation) characteristics differ considerably.

excellent     above average     average     below average     poor

## Formal layout of the doctoral thesis and the level of language used

Commentary:

The main body of the thesis contains 239 pages and is divided into 8 chapters. There are further 5 appendices.

The layout of the thesis and its graphical presentation is of a very high level. Division into sections is logical and helps navigating through the thesis. All equations, tables and figures are properly numbered and the latter two appropriately captioned.

The language used is appropriate with correct terms and definitions from the particular research field. There are only very minor misspellings which do not affect the overall quality or readability of the thesis.

Citations are used correctly and the original and referenced parts of the materials are clearly identifiable.

excellent     above average     average     below average     poor

## Remarks

Questions for the defense:

1. Could you, please, elaborate on the limitations and appropriateness of the density expression in  $m^2 \cdot m^{-2}$ ? How does the body shape projection affect the maximum achievable density?
2. The pre-evacuation times are established for awake children (to avoid undue stress during experiments). Do you see any way to adapt pre-evacuation times for children asleep from other occupancies such as hotels or other premises where occupants may be asleep?
3. Would you consider running instead of walking in the corridors a cause or an effect of the lower densities recorded there?
4. Given the significant reduction of walking speeds on the stairs, especially for the youngest children, what design recommendations/restrictions would you propose?
5. Do you consider makeshift fire alarm raising, such as pot banging, appropriate for this specific environment? In addition, if there are no means of automatic fire detection, this could considerably prolong the RSET due to the delays in raising alarm.
6. In the light of your findings, how appropriate and sufficient do you consider the current design requirements for pre-primary care buildings in the Czech Republic? In which areas, if any, the changes should be made most urgently?

## Final assessment of the doctoral thesis

The submitted thesis and associated publications of the Ph.D. candidate clearly demonstrate her ability to conduct independent research and derive relevant conclusions. The level of rigour is very high and so is critical evaluation of obtained results.

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

yes     no

Date: 18-02-2020

Opponent's signature:  .....