

University of Pardubice

Faculty of Transport Engineering

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## PhD Thesis Review

Candidate: Ing. Eren Balaban

PhD Thesis:

### **ANALYSIS OF MECHANICALLY STABILIZED EARTH WALL, REINFORCED EARTH STRUCTURES**

Overall dissertation extent is 164 pages. Dissertation is divided into several parts. First part addresses generally to the introduction of studied problems. In the second part literature review and current state of knowledge are described. Third part dissertation objectives are described. The fourth part contains the methods and methodology. Fifth part deals experiment results with laboratory and finite element model. Sixth part deals with design of models walls and laboratory tests with finite element modelling of experiments. The seventh chapter part contains the state of effect of backfill and foundation soil to behaviour of reinforced earth wall. The final part is the conclusion.

#### **A) TOPICALITY OF THE THESIS**

There is currently a great development the new way of reinforced earth structures for transport engineering design and performance with respect to sustainable construction. Design and construction of Reinforced Earth wall are effective and proven retaining structures. The soil mass relies on the tensioned membrane effect and the soil arching effect to maintain the stability and reduce the surface subsidence. The presented work is thus a contribution to a wide range of research results in this field. I consider of dissertation to be very up-to-date.

#### **B) SELECTED METHODS OF WRITING**

Formal adjustment, clarity and language level of the text parts fit well with the requirements. The work is well organized and thesis is well written and the technical language is always appropriate.

### **C) FULFILLING THE OBJECTIVES**

The main goal of the dissertation was to strength parameters of soil without and with tyre chip content, determine differences in mixtures are prepared containing low and high percentages of fine particles. Next task was to realize a physical models in the laboratory and verify the numerical models in the software. Others objective was analyze to effect of tyre crumbs which have smaller grains to behaviour of reinforced earth wall. Effect of tyre crumbs to clay backfill was also evaluated at the laboratory. To conclude, the objectives of the dissertation were successfully fulfilled in all respects.

### **D) THE RESULTS OF THE DISSERTATION THESIS**

The candidate declares the objectives of the work at the beginning of the thesis. They are absolutely in line with the current stage of the international research. The experiments have been rigorously designed and accurately carried out. Procedures and tools have been selected in order to guarantee the experiments repeatability and reliability as possible. The methodological approach under the research progressing is very appreciable and absolutely correct from a scientific point of view. The work is up-to-date and the list of the main references demonstrates that the candidate has considered all the important scientific contributions at the state of the art. In general the contribution of the work is perfectly in line with the international research and the objectives have been well fulfilled.

### **E) SIGNIFICANCE FOR SCIENTIFIC DEVELOPMENT**

This thesis provides useful information for both researchers and practitioners. Very important for scientific development is contribution of the cohesion into design, force transfer mechanism between soil and reinforcement. In general the contribution of the work is implementation the shear tests and numerical models of verification. The expected impact at the professional level it could be really impressive.

### **F) THE EXTEND AND QUALITY OF THE PUBLISHED WORKS RELATED TO THE DISSERTATION THESIS**

Published papers on conferences and articles meet with the requirements of the obligation to publish the results of the dissertation. The candidate during the PhD study period has published an adequate number of papers for example in International Journal Geomechanics and Geoengineering, Anadolu University Journal of Science and Technology and International Conference on Information Technology in Geo-Engineering, etc.

### **G) FULFILLING THE REQUIREMENTS FOR SCIENTIFIC WORK**

Dissertation thesis meets the requirements for scientific work for getting Ph.D. title.

**H) OWN ASSESSMENT OF DISSERTATION, REMARKS TO THE INDIVIDUAL PARTS OF DISSERTATION**

I have questions for the candidate:

- Why was used only one type of sand from local supplier Cemex?
- Shear-box test is the most commonly used apparatus for the direct shear test. What are the limitation of direct shear test?
- Why there is a difference between experiment and finite element model results, for example 20% Sand + 80% Clay and 100% Sand? The settlement of clay and sand are different. (Table 5.9. Maximum shear stress values from experiment and finite element model and difference).
- Graph Figure 6.10 and Figure 6.11 presented figures have low resolution.
- Why is the difference between 2 000 kN/m and 4 000 kN/m reinforcement stiffness factor of safety? (Figure 6.35 Factor of Safety Against Slope Stability with Respect to Reinforcement Stiffness).
- What is the difference between design methods FHWA and Eurocode 7: Geotechnical design.
- Why they are not listed a screenshot of results of FEM model, it's would be very interesting, of the FEM modeling comparing to the experiments.

Laboratory and numerical tests are very interesting. The majority of the text is well written and the facts described in the text are explained very clearly.

Finally I evaluate the dissertation as good and i consider that the dissertation addressed all objectives and I recommend it for the defense. The comments stated above do not significantly reduce its positive contribution.

Sincerely..

Doc. Ing. Vladimír Doležel, CSc.

V Praze, dne 22. 8. 19 .....