SUPERVISOR'S OPINION OF FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Thermomechanical Analysis of Ancient Roman Seawater Concrete**
Author's name:	**Torin Nicolas McCue**
Type of thesis :	Diploma Thesis
Faculty/Institute:	Faculty of Civil Engineering
Department:	Department of Mechanics
Thesis supervisor:	Doc. Ing. Vít Šmilauer, Ph.D., DSc.
Supervisor's department:	Department of Mechanics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment **More difficult topic**

Evaluation of thesis difficulty of assignment.

The thesis aimed at reconstructing origin and performance of ancient Roman seawater concrete, particularly analyzing temperature and stress development during hardening. Since the concrete was placed more than 2000 years ago, it took considerable effort obtaining relevant data from ancient literature and also from articles/studies carried out recently.

Satisfaction of assignment **Satisfied**

Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.

The thesis successfully met assignment. It simulated temperature field during concrete hardening. In addition, isothermal calorimetry was carried out for identifying released heat on various lime binders. Stress analysis used viscoelastic ageing material law derived from lean concrete and quantified locations of crack development due to high tensile stresses. Although several input data were derived from similar materials, the results show consistently temperatures above 80°C and necessary crack development.

Activity and independence when creating final thesis **A-excellent**

Assess that student had positive approach, time limits were met, conception was regularly consulted and was well prepared for consultations. Assess student's ability to work independently.

Net time for thesis was three months only. During that time, the student had to perform several experiments, learn thermo-mechanical software OOFEM, run analysis and interpret the results. We have met regularly at least once a week for discussions. I appreciate student's independence in conducting literature review, finding answers to difficult questions and engineering pragmatic approach for various problems emerging on the way.

Technical level **A-excellent**

Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.

The thesis addresses multidisciplinary field, spanning from ancient literature, chemistry of binders, physical experiments and numerical simulations. The list of 50+ references proves that the topic of ancient Roman seawater concrete drew attention of many researchers, mainly from cement chemistry. Surprisingly, several assumptions from literature were proved highly inaccurate/incorrect and correction were proposed, having impact on results and conclusions. The student learned significant amount of information from all involved disciplines.

Formal and language level, scope of thesis **A-excellent**

Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.

English is a mother tongue of the student. The thesis is written typographically well.

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Selection of sources, citation correctness **A-excellent**
Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.
Citations are used correctly throughout the thesis, clearly separating others ideas from own work. The only comment is a mixed style, combining different order of first and family names in references.

Additional commentary and evaluation
Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.
The goals were successfully achieved within three months period. New data were measured and revealed the effect of dissolved salts on early-age reactions. Simulations are consistent with literature findings, additional information about stress development contributes to new results we now have about ancient Roman concrete structures.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation.

The student proved independence in scientific work, orientation in involved disciplines and ability to apply gained information for his research.

Question for the defense: What can we learn from ancient long-lasting massive structures for similar concrete structures built today?

I evaluate handed thesis with classification grade **A-excellent.**

Date: **July 16, 2019** Signature: