THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**The assessment of the water transport in the masonry-soil complex of the 18th century churches.**
Author's name:	**Joe Chalhoub**
Type of thesis :	
Faculty/Institute:	
Department:	Department of Landscape Water Conservation
Thesis reviewer:	Mgr. Martin Lanzendörfer, PhD.
Reviewer's department:	Charles University, Faculty of Science, IHEGAG.

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment

How demanding was the assigned project?

Concerning the methodology, the scope of the project was **very flexible**, ranging from easy up to any difficulty. It is fair to say that the problem assigned is rather **broad**, involving a variety of non-trivial aspects, and that the main goals stated in the assignment require a sound understanding of the related concepts.

Fulfilment of assignment

How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

Despite the quantity of the text, the overall added value is not clear to me. While the form and the structure of the text seems satisfactory, the **actual substance is somewhat missing** after careful reading. The contents of individual chapters are unconnected one to another, the work is rather superficial, author's own invention is sparse. The core of the work should be, I believe, contained in Chapters 7 and 8, where the available experimental data and/or the results of the numerical simulations were supposed to be analyzed and synthesized in order to *assess water migration paths from soil to masonry*. Instead, the experimental data are merely commented upon. **To my opinion, the link between the soil moisture and the moisture present in the walls has not been established.**

It is positive that the author performs a numerical simulation using Hydrus in Chapter 8. However, even this task was performed rather mechanically, basically restating the previously published results in a simplified setting (and adding the case of St. Anna church via modifying the parameters), and again: not attempting to establish any link to the soil moisture. **The real crime is, however, present in Chapters 9 and 10, see the final comments of this report.**

Methodology

Comment on the correctness of the approach and/or the solution methods.

If I understood correctly, the experimental data were already available. I believe that the data are more than rich enough to allow the assigned analysis, in fact they seem quite interesting for further research.

The methodology of the data "analysis" presented in Chapter 7 is not satisfactory, however: the data are just presented in a number of graphs (vs. time) and discussed on 7 pages of comments; some of them useful, some of them wrong (see the additional comments of this report). The author does not analyze the statistical correlation, does not mention the gradients in the potential, does not attempt for any quantitative link or model, etc. Not even a comparison of the soil and masonry water content data on the same graph is presented.

The numerical model in Hydrus is performed for the two sites' models, in a simplified setting. The role of different boundary conditions, or the effect of the parameters on the results, are not discussed. **Importantly, the role of soil moisture with respect to the results of the simulations is not discussed**, which makes the simulations a bit pointless with respect to the assigned goals.

Technical level

Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?

The description of the measurement devices is good (with some imperfections), same as the description of the site, the positioning of the devices etc. The author performed simulations in Hydrus and prepared the experimental data for presentation.

It seems that some effort has been invested in the presentation of the experimental results in Chapter 7. What is very positive, **the provided discussion seems authentic** and displays the ability of the author to critically contemplate the given experimental data. There are some mistakes, and some comments are formulated in such a way that it is not clear what they mean (espec. for St. Anna church). To give some examples:

- on page 62, Sec. 7.1.2, the comments on how the fall season starts: regarding station A, the comment is only true for years 2016, 2018, while 2017, 2019 are ignored; the second next sentence, "… once the rainfall intensity increases,…" is not consistent with the data;
- the text is often confusing about the relation of the moisture and temperature, which is mentioned in various ways, without specifying any related concept;
- in Sec. 7.1.4, the author concludes that "…the sensors… at 10cm weren't functioning correctly in the summer of 2017…", but it is not clearly explained how this is implicated by the data;
- the data curves presented in Annex 9,10 and 12 seem to be confused one with another (probably the red with the green), which has lead to some confusion in Sec. 7.2.

Concerning the numerical, e.g.

- the presented results for St. Anna church seem to contradict the boundary conditions briefly stated in the text: "… the saturation is assumed at the ground surface";
- in Sec 8.4., and even in the concluding Chapter 10, the author compares that "…steady state occurred after 8,000 days…" vs. "…after 15,000 days…", which refers to the unsteady simulations used as a numerical algorithm in order to compute the steady equilibrium (which is not explained in the text whatsoever). This is meaningless, both physically and numerically.

Formal and language level, scope of thesis

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The thesis is organized very nicely. It has 47 full text pages plus the graphs in annexes (note that it starts on page 17 and many pages are blank). The space used is not always used to the advantage and the reader is not given a compact message: the overall picture seems fragmented while incomplete in each of the many aspects that do not link one to each other. The language is not perfect, some mistakes are repeated systematically, but mostly it is very good (except Chapter 7). The technical terms and notations, in particular in Chapter 4, are not unified: the term once defined is soon replaced by another (eg., volumetric water content, soil moisture, humidity, moisture content). The scope of Chapter 4 is rather basic, so that many of the important concepts or terms used in subsequent chapters are never introduced (e.g., while Table 9 in Sec. 8.1. gives the parameters of van Genuchten's formula, the formula is not stated anywhere; or e.g., while the second stage of evaporation is discussed in Sec 8.3., and the evaporation is indeed important to the goals, it is not introduced at all; the relation of moisture to temperature is not mentioned). The style used for the precipitation in the graphs is not suitable, the author should have taken inspiration in ref. 23.

Selection of sources, citation correctness

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

Here I am not sure about the standards in this study branch, regarding the quantity of the literature used. The "core" Chapters 4-8 refer to 13 scientific papers and 4 books. Citations 9,10,11,12,14,30,31 are written incorrectly.

Most often, instead of supporting the individual statements by references, whole paragraphs or even several paragraphs of the text are simply concluded by one or two references. This is suitable in some places, but more often it is not. Few times the author misinterprets the source or shifts the meaning, e.g. in Sec. 5.3, when introducing the "near surface drainage system near the building", the author claims that "…the idea is to reduce the level of the groundwater table…" while citing 13, 19, where such interpretation cannot be found. The claim in Chapter 8 that "The modeling done in this study is similar to the one done in [23]" is exaggerating, since the setting was simplified a lot.

Additional commentary and evaluation (optional)
Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.
The overall feeling, when reading the text up to Chapter 9, is that the assigned topic and the available data provided an opportunity for a very nice thesis, the opportunity which was exploited only very partially. However, while the student did not achieve the main goal – to assess the transport of the water from soil to masonry – the result may have still provided a satisfactory diploma thesis. **The major flow of the text comes in Chapters 9 and 10**, unfortunately. Those two chapters represent an example of what an **expert should never do**:   Chapter 9 "Recommendations" is introduced by "Based on the data … and on the modeling … it is clear that several measures will be needed to improve the current situation." After this statement, the actual recommendations follow, but **none of them is directly supported by the previous data analysis or modeling.** I do not criticize the actual recommendations, but they are simply not grounded by, or addressed in, the previous text. For example, the influence of the groundwater level (repeatedly mentioned here) on the water content in the masonry was not discussed in the numerical models at all.   The final sentence of the concluding Chapter 10 "The water migration paths from the soil to the masonry are well known after the analysis of the data from the monitoring system and the water transport simulations" is **either a lie or a complete misunderstanding** of one's own work. The migration paths are only vaguely hypothesized in the introductory chapters and not really analyzed, not to say quantified, from the data. There are no "water transport simulations" in the text at all ! Only a steady equilibrium water content is computed in Chapter 8, not even reporting the resulting steady water flux from the soil.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

The grade that I award for the thesis is ⬚ , although the last two chapters really deteriorate the whole work.

It is fair to point out that I have no prior experience with the students in this particular study branch, esp. what concerns the usual *quantity* of the material dealt with.

Questions for the presentation:

- Please comment in more detail on: which data from the sensors have been decided to be incorrect and why, in particular in St. Anna church.
- What do you think can be the process responsible for the lowered moisture values appearing after each winter in Annex 4, on 60 cm lines?
- The red and green curves on Annex 9,10,12 seem quite confusing, do they not? Please comment.
- What is the meaning of the reported "steady state occurred after 8,000 days of running the analysis"? Could you specify the stopping criterion used in the simulations? Does it have any physical meaning?

Date: 24th of July, 2020   Signature: