

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Personal information	
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Studio		
Name / Theme	Sustainable Design Graduation Studio	
Main mentor	Dr. R.M.J. Bokel	Building Physics and Services
Second mentor	Dr. M. Turrin	Design Informatics
Argumentation of choice of the studio	Being involved in the MOR team and competing in the Solar Decathlon 2019, I have already learned a lot. For the MOR prototype to function at maximum capacity in the Netherlands some more research and adjustments are needed.	

Graduation project	
Title of the graduation project	Extending the passive periods in smart buildings
Goal	
Location:	MOR prototype, The Green Village, Delft, the Netherlands
The posed problem,	Buildings are responsible for approximately 40% of energy consumption in the EU (European Commission, 2019). Designing more efficient buildings and systems is only the first step. In order to limit the performance gap between the design and the operating building, it is important to make sure these systems are used as designed. The behaviour of the residents can impact the energy consumption of the building (Hong, Yan, D'Oca, & Chen, 2017). The Energy Performance of Buildings Directive (EPBD) of the European Commission encourages the use of smarter buildings in order to make them operate more efficiently (European Commission, 2019).
research questions and	To what extent can the building management system help extend the passive period to have a positive impact on the energy efficiency? <ul style="list-style-type: none"> - Which parameters have the biggest influence? - What are the comfort conditions that the building management system has to reach? - How is the building management system programmed? - Can simulations optimize these setpoints?
design assignment in which these result.	Propose an intervention in the building management system of the MOR prototype so that it will be able to operate more energy efficiently. This intervention is based on measurements of different settings for the building management system and the systems it is

controlling. These measurements will be used in simulations in order to run optimizations of the energy usage.

Process

Method description

This research is divided into three research parts: literature study, research and conclusion. An overview can be found in figure 1.

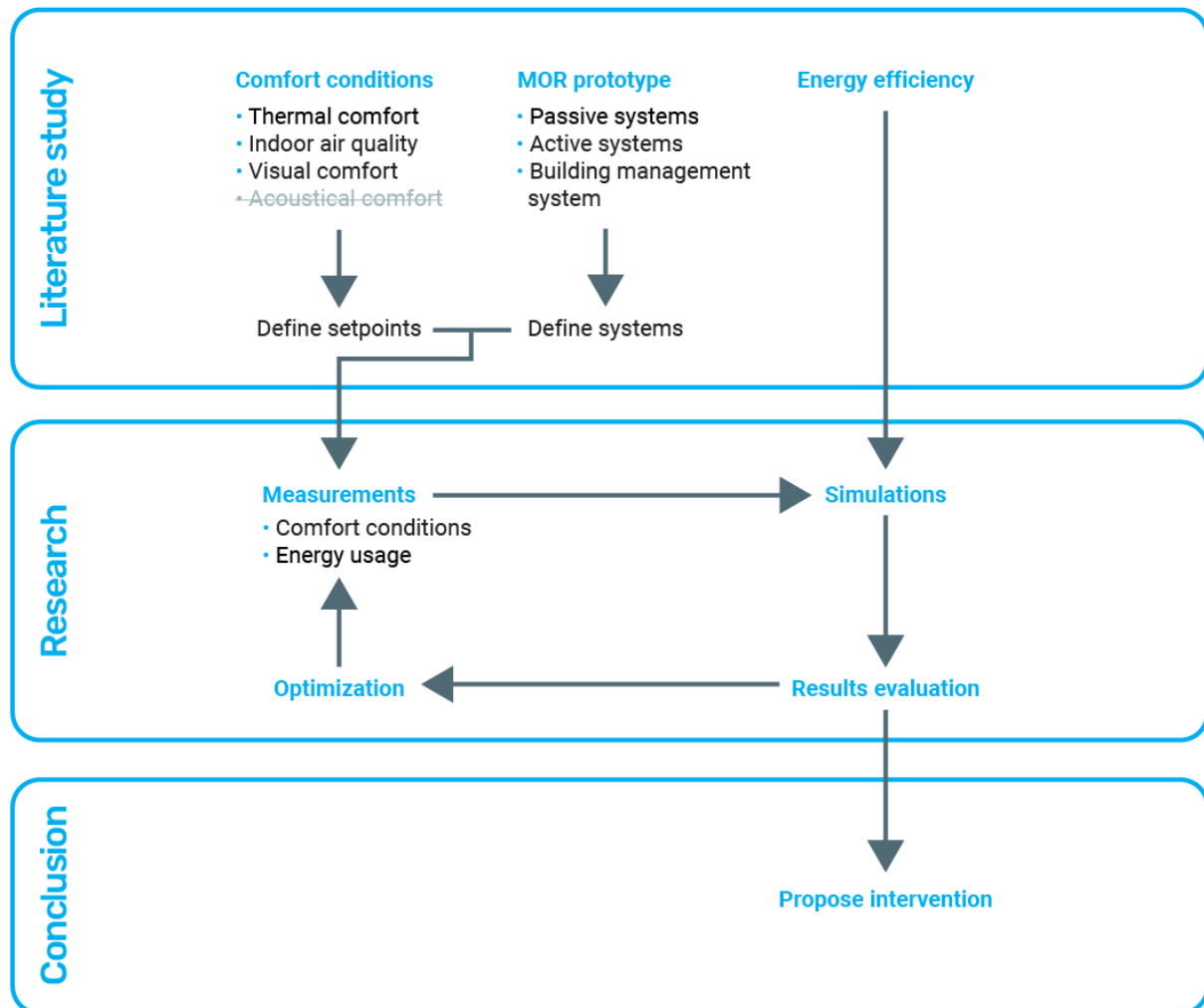


Figure 1: Methodology scheme

1. Literature study

During the literature study the different systems of the MOR prototype that are controlled by the building management system are researched. These systems are programmed in order to improve comfort conditions and energy efficiency. In order to find the most efficient operation settings the set points of this system can be changed. The literature study will also provide limits for these setpoints.

2. Research

Per parameter (system) a couple of different setpoints will be chosen to be set during the measurements. Comfort conditions and energy usage will be measured and

exported from the building management system and its software. Each time measurements end, the results will be entered into a simulation, using DesignBuilder, Matlab or Grasshopper (TBD), to see the effect it has on the energy efficiency. After the simulation, optimizations for energy usage will be run per parameter in ModeFrontier. Repeating this cycle will provide a complete picture of the influence every parameter has on the energy efficiency.

3. Conclusion

Considering all the results an intervention for the MOR prototype will be proposed.

Literature and general practical preference

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Reflection

Relevance

The MOR project is a smart passive building with a central building management system to control and optimize the operation of the active and passive building systems and therefore reduce the energy consumption of the building and improve the users comfort conditions (MOR Team, 2019).

During the competition the systems in the prototype were set to function in the Hungarian climate (Warm-summer humid continental climate according to the Köppen climate classification) whereas the Netherlands has a Temperate oceanic climate (MOR Team, 2019). Showing that it is possible for the MOR prototype to function efficiently in both Hungarian and Dutch climates with only changing the settings of the building management system can prove that it will also be able to function efficiently when the local climate will change.

Another part of the MOR project is to show the adaptability of buildings. The prototype is based on a section of the Marconi towers, which are three office towers located in Rotterdam. The prototype shows how these towers can be transformed into apartments with the possibility to transform back to offices if the demand from the market changes. Because the building management system can be used in residential buildings as well as offices or other functions, this can also show that the building could change its function and still perform at the most efficient level for that function (Priva, 2019).

Time planning

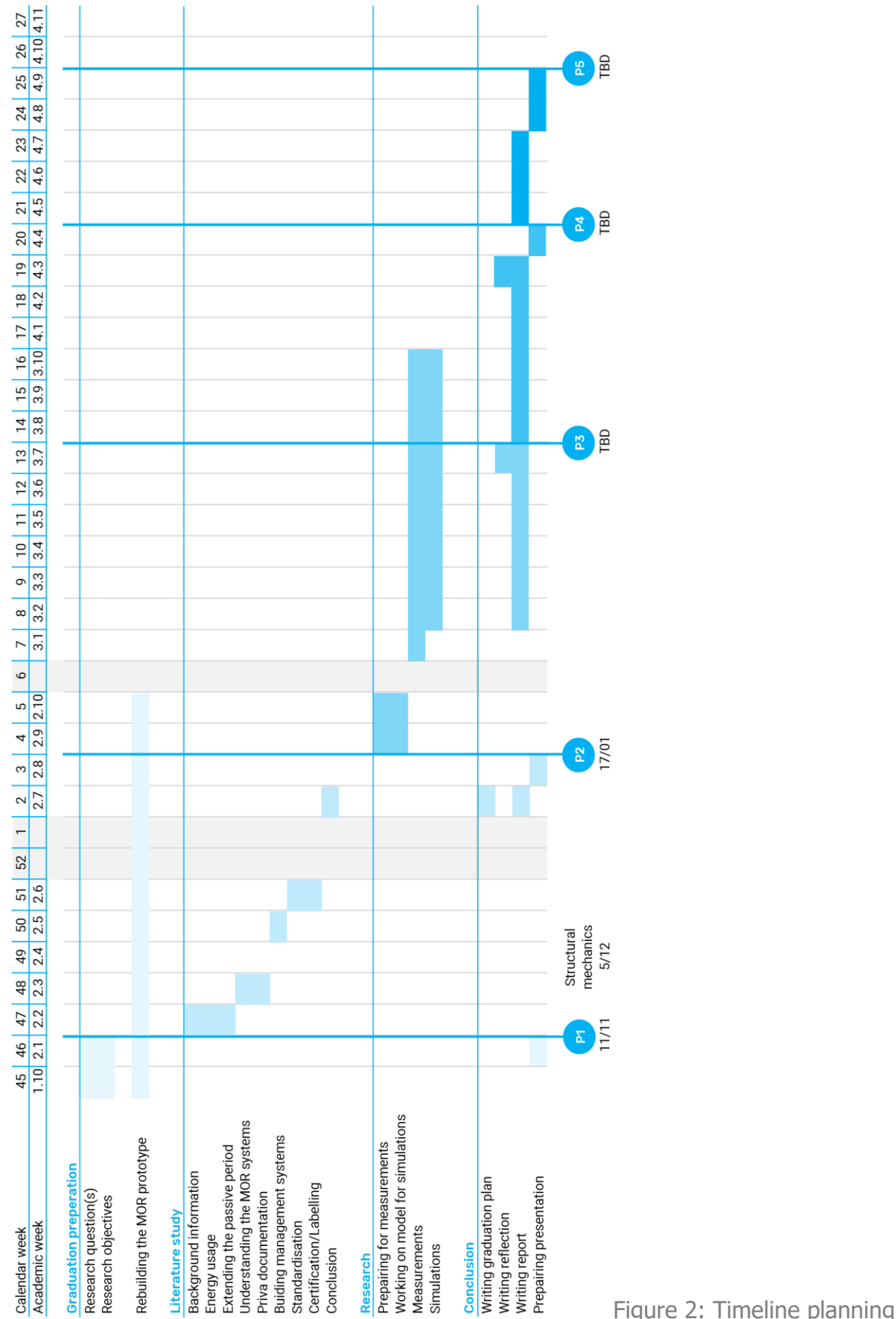


Figure 2: Timeline planning

