

DISERTATION THESIS – TUTOR’S REVIEW

TITLE: Energy Efficiency in the Urban Scale
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The following tutor’s review is an up-date of the previous review from May, 15th, 2018 of the version submitted for previous defense and is therefore concentrating only on changes made in the work.

Up-to-datedness of the theme and the work
Relevance and up-to-datedness of the work’s topic remains the same, i.e. high.

Methodology

The work basically consists of the following steps:

- On the basis of analysis of relevant sources, it attempts to determine decisive factors of energy efficiency of build environment (Chapter 2 – Theoretical Foundation and Terminology).
- It than attempts to form a set of parametric models of urban patterns (Chapter 3 Methodology of the Research) in order to study the relation between these criteria and such urban patterns (Chapter 4 and 5 – Analysis of the generated Urban Patterns and Optimization of the dimension of the Urban Pattern).
- These findings and methods are then confronted with the real life urban patterns (Chapter 6 – Evaluation of the Energy Performance of typical Urban Structures of Prague).

The above mentioned basic structure of the work remained similar.

This logical framework, however, suffers in the actual work several critical shortcomings:

- The choice of parameters followed on the models which have some relevance to the urban efficiency (surface-to-volume ration, passive zone, sun exposure – passive radiation, density, air movement = wind speed¹) if to be taken seriously would need some hard proof (calculated or empirical) which would later allow to work with these parameters in a more exact form and compare their effects mutually.

Remark valid. But such claim probably exceeds possibilities of a single doctoral work.

- As the above mentioned criteria are often in mutual conflict (i.e. the increased efficiency stemming from one of them has a decreasing effect on the efficiency connected to other criterion – for example the passive zone and the surface-to-volume ratio) a clear link between these parameters needs either to be established or it needs to be explained why we are resigning on finding such relation algorithm. Ideally this “link” should have some quantitative expression (for instance $W/m^2/year$ figure), however hypothetical it might be within the frame of the work.

Remark valid. But actual calculation of such parameters would – even if done - probably remain extremely hypothetical.

- Clearer criteria for the construction of the abstract models needed to be established. It is not clear if these are idealized or abstracted real urban patterns or if they represent general “ideal” forms which are created to demonstrate certain parameters or qualities?

Remark valid.

- The abstraction of certain parameters of the real life models is also unclear. For the parameter of density, the site footprint is critical. It is not clear from the work, how the footprint is constructed for the open forms (L-Shape, U-Shape, Bar-Shape).

Remark valid.

- Also it would be useful to mention, despite briefly, what is the relation of these abstract models to certain important qualities of urban patterns (public/private spaces, plot division, their organization, system of scale levels of built environment etc.).

Remark valid.

- In the evaluation process perhaps more attention should have been payed to comparisons of the theoretical models and the real-life examples. Without this connection it is not clear sufficiently what is gained by the comparison.

Remark valid.

¹ The study is based on the principle that wind pressure or speed means temperature exchange in the facades.

- Further questions also come to mind which the work either was to take into account or deliberately state it does not count with:
 - o For what time of climate are the abstract urban patterns tested?

Answered (Prague).

- o Some models are susceptible to position of cardinal points some are not – how is it reflected in the work?

Partly catered for in the up-dated version.

- o What typology and use of the buildings is taken into account? Are we talking about housing or buildings for other uses as-well? It seems that the work is about housing typology, but it is not mentioned explicitly.

Answered (housing), though slightly vaguely.

- o Theory of scale levels of build environment should have been implemented more rigorously. Sometimes it is not clear enough when speaking about the abstract models if what is discussed are patterns on the level of urban – block or on the level of locality – the patterns on each of these levels are being created slightly differently and have therefore different spatial logic. The real-life patterns are on the other hand practically exclusively of the scale level of an urban block.

Results and Contributions

The study seems to answer with a certain degree of authority the RQ1 on the factors affecting the energy efficiency of the urban patterns. A modeling method to verify these factors was then developed. The method seems promising, however, to achieve really convincing and consistent results more focus needed to be devoted to how the models are constructed, to the orientation of the sites (role of cardinal point) and also to cross-examining the influences of different criteria.

Formal fitness

- Sometimes quotations are not build organically into the arguments of the text. That makes it often difficult to follow the logic of the text.

Remark valid.

- The text is highly + functionally repetitive and it's structure makes it often difficult to read and follow the main line of thought.

Remark valid.

- The names of the models are sometimes un-apt or are not using the same vocabulary. (see page 63 model with „trapezoidal“ block).
- The terminology is often not exact or not consistent:

- o Temperature exchange is not energy exchange.
- o Morphological types of buildings are for instance tower-block, slab-block, point-block etc. Urban block is something different and perimeter block is one type of urban typology which corresponds to the urban block.

Improved even though not entirely consistently. See for instance captions of figures.

- The „packaging“ of the work is highly unintuitive and difficult to read. Some figures lack descriptions or numbers and it is unclear to what part of the text they belong (see pages 165-169 and the following).

Improved somewhat.

- Energy efficiency is a broad topic closely connected to many other issues. For a better understanding of the work it would be useful, if the work would clearly differentiate its own borders - clear separation between things which the work deals with and those which perhaps also have influence on the topic but the work does not deal with them (for instance see description of Density page 30).

Notes

The work contains a lot of theory about computer modelling in general with little direct connection to energy efficiency of urban patterns. This information appears naturally mostly in Chapter 2 (2.4.1 Manuel DeLanda, Search for form, 2.4.3 Genetic algorithms and computer generation etc.), but it seems to be scattered around the whole work (see for instance also 3.6.1 or 3.6.2 etc.). The topic of computer modeling, however, is in respect to the presented work, only a tool not the subject of the work and these parts are therefore redundant.

Improved with some of the computer modeling detours being omitted.

Conclusion

The submitted dissertation represents an improved version of the older work. I recommend the work to be defended and to award the candidate with the Ph.D. title.

Prague, 31th of May, 2019

prof. Ing. arch. Michal Kohout

