Density, form and performance

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Biography

Peter de Jong is a lecturer at Building Economics, Real Estate and Housing, Faculty of Architecture, Delft University of Technology. His teaching assignment consists of cost awareness in design for architects in the Bachelor, as well as viability of projects. One of the key electives in the Master is the High Rise Workshop, in which he is a consultant/advisor for over 10 years. To gain more in-depth knowledge in this area he has taken up a PhD High Rise Ability. A basic hypothesis of this study is the impact of local conditions on feasibility. His research field includes redefining sustainability in building economics and project development.

Abstract

A redefinition of building economics towards sustainability will include the spatial approach of green field investments and most of all necessary intensification of brown field development. For large parts of Western Europe and the US the latter will be, according to economic principles of concentration and revaluation of city life, the main focus in development. Like the rest of the world, the growth of cities seems irreversible and a continuous fight against sprawl. Other studies reveal that sustainable economics require focus and insight on building characteristics. So density is the focal point. Urban quality can be partly quantified in parameters like Floor Space Index (FSI - intensity), Ground Space Index (GSI compactness), Open Space Ratio (OSR - pressure on open space) and height. The density and the morphology of the urban fabric can be adequately described by these parameters, using plot charts where the different parameters are placed on the axis and the elements are plotted and analysed. The value of real estate property is determined by the building value and the land value. The building value is related to the location due to rent levels enabling building quality, urban quality and contextual (functional and economical quality). The land value should be almost equivalent to location value and, at least at the start of the process, is calculated using the looked-for Floor Space Index. It is expected that performance of real estate objects, categorised in different sets, defined by these urban parameters will show similar grouping, by which the density related behaviour can be forecasted. Used as a tool to analyse a portfolio it will give insight in the relation of this stock and density.

This tool and gained insight is especially needed for emphasising externalities of density to a project scope. The central question "Why Tall?" can be answered by these regional advantages. At the same time

urban planners, at least in Rotterdam, require tall buildings iconic by slenderness, an effect further stressed by regulation. This city is exemplary for a situation in which it is already hard to distinguish a need for going high. All externalities have to be taken into account. Even beyond economic viability, the fineness creates a setback on the performance by density. The original density plot charts are two-dimensional. By adding colour the performance is shown and by using marker styles the impact of building volume related to the financial indicators can be clarified.

Keywords: sustainability, urban quality, density, intensity, compactness.

Introduction: density

The Netherlands are often characterized as one of the denser countries. Meta Berghauser Pont and Per Haupt started their doctoral thesis Space, Density and Urban Form (2009, 19) with a description of the process of territorial growth of Amsterdam over the last 600 years. It reveals density dropped from 570 inhabitants per hectare in 1880 to 65 today. In that same period the urban area grew from 560 to 11,500 hectares (factor 20). The population grew from 317,000 to 727,100 inhabitants (factor 2.3). So, the downfall in density is a factor 9. This urban sprawl is for the larger part caused by the increased spatial demand per person. This guided Berghauser Pont and Haupt with their thesis to the development of new tools for quantifying density.



Figure 1. Territorial growth of Amsterdam (Berghauser Pont and Haupt 2009, 19)

In the Dutch context one of the risks is cities almost clustering together and losing spatial quality by doing so. National land use policy tries to prevent this such. Other (Western) European areas are experiencing the same effect related to relative slow growth. Although Amsterdam and Rotterdam may be exemplary in this 'luxury' effects, they are only small villages on a global scale. Megacities are effected by other aspects of sprawl. E.g. in São Paulo resistance is met in new extensions in the outskirts for squatters. Although the quality of houses is improved, this enforced relocation is not at all appreciated, because of the long distances to the city center. The center is also for many squatters the place to earn a living, due to this move outweighed by the travelling costs (Rocco, 2008).

At one hand the search for a proper balance between city and country side (in both a recreational as a sustainable perspective) and the other hand development of policy for megacities within an economic perspective, demands a shift towards density in research questions.

Introduction: High Rise Ability

The second scope is given by the 'tall order'. The broader context of our research program (HRA) is the economic viability of high rise, especially how it is determined by local conditions. One of its underlying subjects is the architectural value as a subset of the total value. In feasibility assessment these different values have to be balanced. The municipality of Rotterdam released an updated vision on high rise (2010) in which, based upon architectural and urban qualities, development is more or less restricted to very slender buildings. Dutch high rise is already slender as it is due building acts (conditional distance between working

place and windows). Previous modeling (De Jong, 2007, Van Oss, 2007) reveals that non-iconic buildings are limited in size and shape by local financial conditions. Additional demands on floor plans as stated in this updated vision will give an extra limitation to the height. Hereafter a feasible volume is even harder to get.

In this paper the graphical approach of Berghauser Pont and Haupt for quantifying density is adjusted for the visualization of performance based on floor plans, and used to bring financial and environmental arguments into the discussion about urban planning based upon urban quality.



Density characteristics

Figure 2. Clusters of building types in the Spacemate representation (Berghauser Pont and Haupt 2009, 120)

Central of the work of Berghauser Pont and Haupt is the understanding of the variation in density throughout the scales in which Spacematrix is the method and Spacemate the tool. Figure 2 gives an example of a representation in Spacemate of clusters of building types. The vertical axis represents the building intensity (Floor Space Index – FSI). The horizontal axis gives the coverage (Ground Space Index), where the Open Space Ratio is a dependent parameter.

In terms of urban quality FSI represents the building intensity while in land exploitation this intensity can be used for the calculation of expected revenues, so indicating the value of land.





Figure 3. Basic definitions of the elements of Spacemate (Berghauser Pont and Haupt 2009, 120)

Thus, a FSI, or floor area ratio (FAR) of 3 indicates that the total floor area of a building is three times the gross area of the plot on which it is constructed. Since most plots are not completely used for the multiplestory building, the number of floors will be three or more. The urban quality is also strongly related to the coverage or Ground Space Index. The required footprint of São Paulo if an intensity similar to the one of Amsterdam in the introduction with the same space per person is desired, is beyond imagination.

The other two important parameters are the spaciousness or Open Space Ratio and the Building height. The correlation between OSR and FSI is not only by definition but can also be witnessed in the field. E.g. the good performance of the Docklands in London goes hand in hand with a high intensity. The open space is limited but with the advantage of the many river views completely acceptable. The earning capacity of the high building blocks enables a high quality level for this limited open space.

A typical application of Spacemate, see <u>http://www.permeta.nl/spacemate/index2.html</u>, is the combination of these parameters, the urban elements responsible for such ratios and a specific image (visual representation), together illustrating the 'spatial logic of urban density'.



Figure 4. Spacemate

Performance

The original graphs are already rather complex. Using Excel the macro-language can be applied to plot (the lay-out of) such a graph automatically. The graphs could even be improved by adding additional layers of information. By assigning different colors to the points in the graph, representing a range of economic performance, in this case the rent level per area unit, the graph should reveal how a given performance correlates with certain urban characteristics. Another dimension can be visualized by the marker shape, or in this case by the marker size. In the example the radius of the marker represents the building mass (small points for small floor plates and wider points for larger floor plates).



Figure 5. Added information in the graph on performance and building mass

In one of our existing databases with real estate information (Koppels, 2010) the records are completed with gross floor area (already given in most cases), the area of aggregation, footprint and building height. Especially the area of aggregation is a time consuming variable, which can be retrieved using information of the land register, supported by Google maps. In order to surpass the need to visit all the objects.



Figure 6. Characteristics retrieved of the land register

One of the first remarkable observations is the scale of the graph. Where normally a range for the Floor Space Index between 0 and 3 is sufficient, the database with office buildings immediately requires an adjustment to an 8 or for some parts to 10. This draws the attention immediately to one of the methodological limitations. The results are completely depending on the quality of the database. Any database built upon a pre-selection, in our case Amsterdam office buildings within a certain time frame of transactions will deliver its specific limitations. Specific for our question: many of the objects are hardly optimised on this building mass. For a large part of the city there are all kind of limitations on height and volume (street grid).



Figure 7. Preliminary results: in this graph only performance is plotted, no buildings masses. Color selection should be improved with automated legend

Furthermore, it is almost impossible to have a sample meeting statistic boundaries, given the number of tall buildings in the Netherlands. In order to enable rigid conclusions, it is probably necessary to construct a new database under specific conditions, comparing more or less all tall buildings in the Netherlands, with e.g. the same volume in a set of low rise offices.

Results and conclusions

So, the results are not conclusive yet. Although the interpretation of the graphs do suggest that the hypothesis that buildings with large floor plates do perform better, the number of buildings in a certain area or time frame is too small to draw conclusions. Above that there are so many other conditions have a larger influence on the performance. This is illustrated by the research on apartment buildings in the Rotterdam area by Den Dekker (2009).



Figure 8. Sales of apartments in tall buildings in the central area of Rotterdam (den Dekker, 2009).

These sales of these dwellings are only for a small part related to the lay out and thus to the floor plate. One by one these results are explained by other circumstances like the moment of completion in relation to the economic conditions, in hindsight, the quality of branding and marketing, and distinct building properties. E.g. the view from the apartments is a main factor for success where architects do put more effort in the view to the apartments (buildings).

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At the other hand there are no black swans. Previous research on cost modeling of tall building (De Jong 2007) showed already the relation of the larger floor plates with good performance from the inside out. The urban perspective is not reversing this outcome.

Also before advocating the method of using these graphs in order to represent qualities and performance on an urban scale the rigor of the method should be improved and further investigated.



Figure 9. Future development Wilhelminapier Rotterdam. Note: the design of the Rotterdam building in the figure above, now under construction, is smart solution by combining three towers but still a very slender building, at least in one direction.

Nevertheless the desired statement that one should not focus too much on slender buildings within urban policy is still probable. It is at least not challenged with the underlying research, it is a logic consequence of previous research and, above all, it fits in with what most builders of high rise in other cities know and show.

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