A Study of Concept Design Massing Generator for Urban Houses in Jakarta

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Abstract. This paper presents the study of application massing configuration in typical urban houses in Jakarta. The study is aimed to present architectural project examples by architectural firm Studio Arsitektropis based on operative and conditional design strategies. The results showed that the operative and conditional design strategies could facilitate and become a quick design tools to produce the massing design concept, which emphasizes the sustainable aspect of natural lighting and air circulation; stack effect ventilation. The steps of study are as follows: (1) to study spatial verbs of massing design concept, (2) to study conditional design of architectural elements, and (3) to apply these studies into the conceptual design process within the practice of Studio Arsitektropis housing works in Jakarta.

Keywords: urban houses, design concept, massing

1. Introduction
This paper was raised based on United Nations Sustainable Development program that focused to make human settlement sustainable. The world’s population resumes to flourish, though at a slower speed than at any period since 1950 The world’s population reached 7.7 billion in mid- 2019, taking added one billion people since 2007 and two billion since 1994. The world population is estimated to get 8.5 billion in 2030, 9.7 billion in 2050 and 10.9 billion in 2100 [1]. Therefore, the needs of inclusive, safe, resilient, and sustainable infrastructure and settlements are important. These issues need to be taken seriously to create healthy human settlements that could face the huge challenge for our cities and communities. It is important for government, developer, architects, and designers to plan accordingly within their practices to respond and act to these challenges. Studio Arsitektropis is an architectural firm based in Jakarta, Indonesia, was founded in 2014. The practice has been focussing to design two storeys houses emphasizing the important of sustainable approach such as natural lighting and cross ventilation. These two aspects are some of the sustainable design strategies that could be easily applied into architectural projects, such as housing projects here in Jakarta.

Operative design and conditional design written by Anthony Di Mari and Nora Yoo expressed and stated design verbs and architectural elements strategies that can be used to develop and building masses during the design concept stage. In operative design, they identified that the verbs are organized within
a systematic framework to begin to characterise how they work as a three-dimensional volume. The categories and the chosen verbs are meant to initiate spatial creation rather than to limit them. The operative design strategies introduce the possibility of understanding spatial formation as a process that can derived from fundamental actions, which become the starting points of the space or form creation during the early design process [2]. Operative design gave opportunities to study volumetric relationship during the design process. In order to further understand these volumetric studies, it is essential to give the volumetric form a scale using the operations selected as design verbs to craft spatial characters. The type of operation (single, multiple, add, displace, or subtract) determines to catalogue how these various operations can create the iterative process that can produce initial design forms. In operative design, designers or architects presented to manipulate volumes with operative verbs, and different spatial conditions, and volumetric shapes begin to emerge. From this stage or process, the study can continue towards conditional design stage where it can activate broaden analysis on how the original operations can develop or produce new conditions, which can lead into new refine massing form. In conditional design, there are four main elements of stairs, apertures, ground, and base volume as the informative devices. The applications through point of view of conditional design allows one to appreciate the thorough handling of spatial connections, openings, and site considerations unique to each project [3].

Essentially, this paper presents the initial study and it contains the study of (1) spatial verbs of massing design concept through operative design process, (2) to study conditional design of architectural elements, and (3) to apply these studies into the conceptual design process within the practice of Studio Arsitektropis in Jakarta. These studies and strategies will definitely reduce the time frame of the design stages. This study also can give the implementations how to solve the initial massing design concept of the two storeys houses, especially in typical site of urban houses in Jakarta, Indonesia.

2. The methodology

2.1. The method of study
The diagram below shows the methodology applied in this study (Fig.1). The study is basically a literature review of the chosen operative design verbs, and the conditional design strategies within the chosen site of the two storeys houses projects of Studio Arsitektropis in Jakarta. The results of the study are concept design massing generator that could be chosen to determine several massing strategies for urban houses in Jakarta.

![Diagram of methodology](image)

**Figure 1.** The diagram of methodology

2.2. The case study
The case studies are selected from four houses (Jelambar House, Nangka House, Cempaka Putih House, Utan Kayu House, Ozone House) by Studio Arsitektropis in Jakarta. These projects are located within the Jakarta area, and they have similarities through the climate aspects and site dimensions.
Table 1. Project’s Data

| No | Projects       | Location     | Site Dimensions      |
|----|----------------|--------------|----------------------|
| 1  | Jelambar House | West Jakarta | 8 meters x 15 meters |
| 2  | Nangka House   | South Jakarta| 10 meters x 18 meters|
| 3  | Cempaka Putih House | Central Jakarta | 10 meters x 16.5 meters |
| 4  | Utan Kayu House| Central Jakarta| 9 meters x 21 meters |
| 5  | Ozone House    | South Jakarta | 6.3 meters x 18 meters |

3. Result and Discussion

3.1. Operative Design Verbs

Based on the Operative Design A Catalogue of Spatial Verbs there are three type of operations; Add, displace, dan subtract (Fig.2). It shows that there are many possibilities to create initial massing form from these design verbs. The typical form or site dimensions within greater Jakarta are varies between...
Six to ten meters width, and fifteen to twenty meters long, which determines the initial massing or bases is the rectangular shape or volumes. Other aspect that defines the base volumes are the maximum of floor area ratio, which can add up into two or three storeys building height. From these limitations, the three operations of add, displace, subtract, and single or multiple volumes can be used to generate the initial building massing. From the limitations of rectangular base volumes and optimization of the floor area ratio, the operation of add would work with expand, extrude, merge, nest and offset design verbs. The operation of displace would work with skew, split, interlock, intersect, lodge, overlap, rotate, and shift design verbs. Finally, the operation of subtract would also work with carve, fracture, notch, shear, embed, extract, inscribe, and puncture. The figure three and figure four below show the most effective operation within the site boundaries and building regulations. The add, and displace operation are chosen to respond towards ground area ratio regulations, and multiple volumes are chosen to show the optimization of the floor area ratio. While merge, and overlap design verb would give the opportunities to design open spaces, and openings, that would lead into the optimization of natural lighting and air circulation.

3.2. Conditional Design

![Figure 3 and Figure 4](image)

Figure 3. Add operation using merge as the design verb. Figure 4. Displace operation using overlap as the design verb.

![Figure 5](image)

Figure 5. The chosen elements (stair and opening) to develop further the concept building mass.
There are three conditions based on the Conditional Design An Introduction to Elemental Architecture; connect, ground, and opening. The site context for two storeys urban houses in Jakarta are similar to one another. They are relatively having flat topography, and minimum contour. They have one main access from the main road, and surrounded by one to two storeys neighbouring houses. From these conditions, the ground element would not be included as the main aspect or condition to determine the further development of the building mass (Fig.5). Therefore, there are two other conditions, connect and open, as the main aspects to develop the concept of the building mass. The element of connection will be represented as stair, and the opening would present to maximise natural lighting, air circulation, and views. These elements became tools to generate massing form that would allow certain configurations that would be the initial concept design massing ideas.

3.3. Implementations Operative & Conditional Design for Concept Design Building Mass for Studio Arsitektropis’ Projects

| No | Projects      | Location     | Site Dimensions | Operations                      | Conditions         | Concept Design Building Mass |
|----|---------------|--------------|-----------------|---------------------------------|--------------------|------------------------------|
| 1  | Jelambar House | West Jakarta | 8 meters x15 meters | Displace – Multi Volume – Lift. | Connect – Nest. Open – Carve. |                              |
The table above shows that the site’s width less than eight meters the base volume would have the single volume. It also shows that the rectangular sites for urban houses in Jakarta, displace and subtract are effective as the operative tools to generate the initial massing concept design. The conditional elements of connect (stair) and open (openings/ windows), would further define the initial concept design building mass. Therefore, this process would enhance form finding process during the concept design stage, and it can be used to improve design responses towards sustainable aspects such as natural lighting and natural air circulation within the settlements. The diagram (Fig.8) shows the process of concept design massing generator based on the site context (rectangular form), the operations of subtract, then continue by the conditions of connecting (carve), and openings (lift).
4. Conclusion
The study of concept design massing generator for urban houses in Jakarta has been conducted, and the remarks can be concluded as follows:

- The operative design tools can generate lots of massing possibilities that will create attractive design form.
- Conditional design which add elemental aspects, in this case, stair and openings, will emphasize sustainable design responses such as natural lighting, and air ventilation.
- The width of the sites will be an important factor to decide whether the basic massing volume will be single volume or multi volumes.
- The application of this studies and strategies will definitely reduce the time frame of the design stages.

References

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