

RISe-UP: A prototype of neo-architectonic house

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Abstract

This research is looking for an opportunity to develop building materials modules that unite architectural and structural components as an initial stage of understanding building material modules, considering be first known and developed. Explore knowledge about architectonics as a basis for the development of the modular design of building materials as part of architectural design. Perform a graphical simulation, analyze the enclave as a perfect spatial shape by providing a combination of openings, and then be able to vary the possible of and sub-space formed. It follows the properties of enclosed space where there are 8 points, 12 lines, and 6 planes as the main architectonic elements of RISe-UP. Lines and Points are part of the building elements to be developed in this study. In responding to disaster events with stages; Emergency Response Phase, Rehabilitation Phase, and Reconstruction Phase, and RISe-UP can follow these conditions. RISe-UP at the disaster response stage after entering the rehabilitation and reconstruction stage, the RISe-UP can be adjusted to permanent.

Keywords

Neo-architectonic house, RISe-UP, building materials modules

Introduction

Indonesia is a country with a landscape located between the Pacific Circum and the Mediterranean Circum. The landscape terrain formation known as Geomorphology is process-based and describes forces acting on Earth's surface to produce landforms and landform change as a morphotectonics, the relation between Geomorphology and tectonics is fundamental to the understanding of landscape evolution as shown in **Figure 1**. Morfotectonika of how earth surface or landscape formed. The landscape, directly and indirectly, influences socio-cultural forms, especially architectural structures. The architectural form that appears is in the form of structural element connections known popularly as architectonics. Kenneth Frampton, reviews architectonics in depth and relates it to natural and cultural conditions, the forms of connection between the elements that form and build buildings which are connected and mutually reinforcing. From the other side, Esther Rivas Adrover provides another view on architectonic form and it can be seen as a mixture of architectonics and mechanics.

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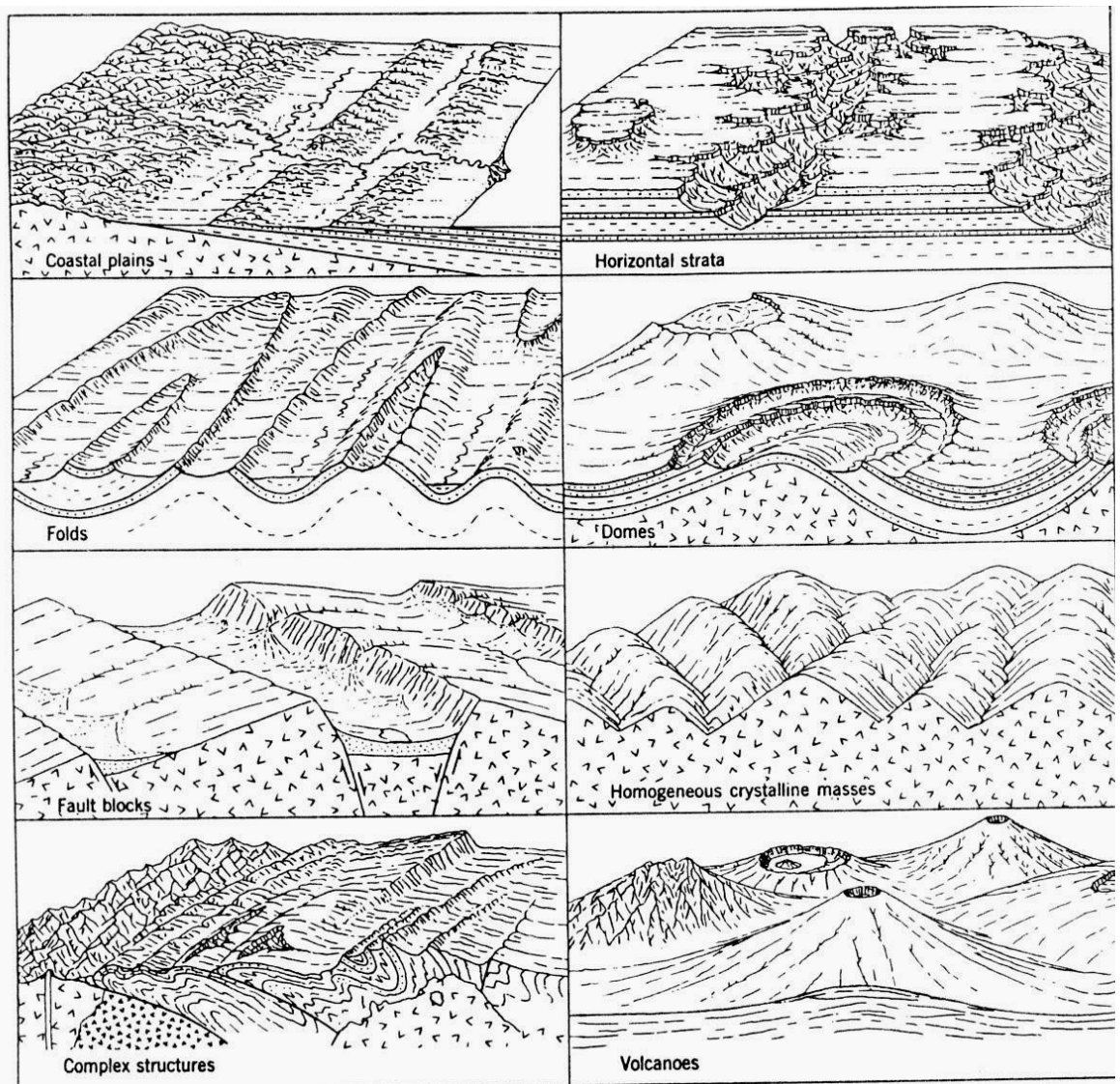


Figure 1. Morfotectonica by Carlos Costa, 2016

In terms of geographical position, Indonesia is the fourth country in terms of earthquakes based on the 2015 Indonesia Historical Earthquakes report, Indonesia always improves its earthquake map to become a reference in carrying out physical development. Even though disasters cannot be avoided, knowing the conditions of the construction site can reduce the risk of loss. RISE-UP is an effort to answer and see the gaps after a disaster, humans need shelter that can be immediately built and inhabited. Deeper into the development of RISE-UP research, is there still an opportunity to develop a module that combines architecture and structure, and is related to the deployable proposed at the beginning?

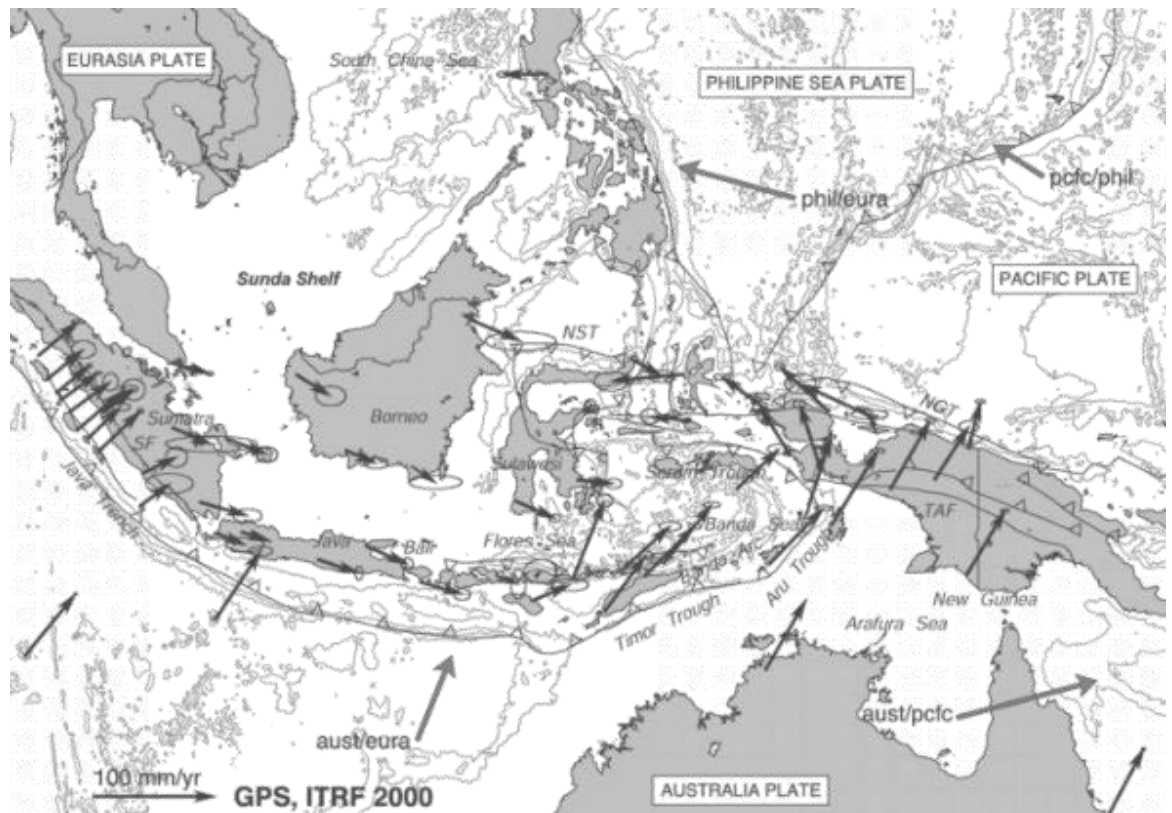


Figure 2. Summary of the 2010 Indonesian Earthquake Map

Methods

In architecture, the classical proportion often shown is the proportion following the Golden Rule, (Messner & Araujo, 2018) discusses the golden rule and its application in the form of golden proportions in various architectural works of ancient and classical buildings. The golden rule is one of humans' efforts to understand nature and follow nature in design. Many old architectural works are discussed and understood using the golden rule approach revealing many of the secrets of the beauty of these old buildings. Le Corbusier's Modulor is one of effort to find solutions to human proportions and their application in architecture. Modulor applied in the Unite-d'Habitation design of an apartment in the city center. The proportions offered by Le Corbusier are an answer to Leonardo da Vinci's Vitruvius-man in 1487, da Vinci and Le Corbusier took a geometric and mathematical approach.

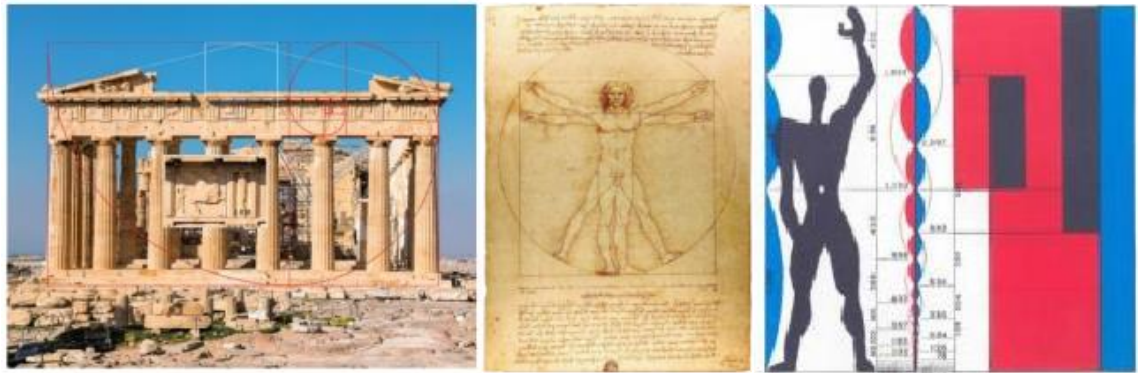


Figure 3. a. Golden proportions are apparent in the remaining structure of the nearly 2,500-year-old Parthenon. (Messner & Araujo, 2018) b. Vitruvian Man, 1487 oleh Leonardo da Vinci (Italian, 1452–1519) c. Le Corbusier settled on a six-foot-tall (1.828m) English male body with one arm upraised, Ostwald 2001

Meanwhile, the effort to use the proportions and modularity of the human body as a basis for architectural spatial planning in Indonesia is still sustainable today is the traditional proportion in Bali which is generally known as Asta Kosala Kosali. Even in the era of modern architecture, this proportion is still the basis for research on ancient traditional buildings in Bali and is also a reference for modern buildings in Bali today. In general, this traditional method is similar to Ernest Neufert's method but is different in application.

In performing a graphical simulation, analyze the enclave as a perfect spatial shape by providing a combination of openings, and then be able to vary the possible of and sub-space formed. In arranging the layout of geometric objects, Wucius Wong created eight ways of placing objects, namely; detachment, touching, overlapping, penetration, union, subtraction, intersection, and coinciding. Meanwhile, Stiny then emphasized that it is a shape grammar in the form of initial shapes and rules, by making an analogy; shape grammar: designs: generative grammar: sentences, then simplified by Terry Knight into operational-realization by carrying out translation, rotation, reflection, and scale as well as operational connectivity in the form of union, intersection, and subtraction. Then Anthony Di Mari and Nora Yoo also created Operational Design so that there were lots of design operations for the volume form.

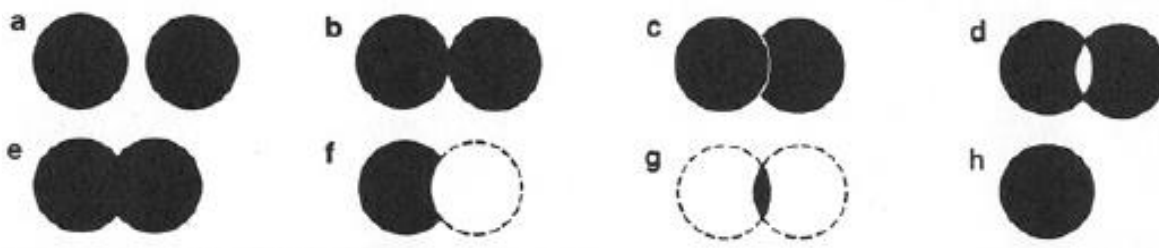


Figure 4. Wong operations; detachment, touching, overlapping, penetration, union, subtraction, intersection, coinciding.

Results and Discussion

The Pancasila University Simple Instant House (RISe-UP), has a basic module of 9 M², as the first stage which functions as a shelter, this area is sufficient as an initial shelter (shelter) for one family during the emergency response stage. Following the properties of a perfect space where there are 12 edges and 8 points forming the space, the edges and points are the main components or elements of RISe-UP. Ribs and Points as fasteners or Gussets are designed to be as few as possible but can be used for many functions. The ribs are planned to use channel steel and the gusset uses specially formed steel.

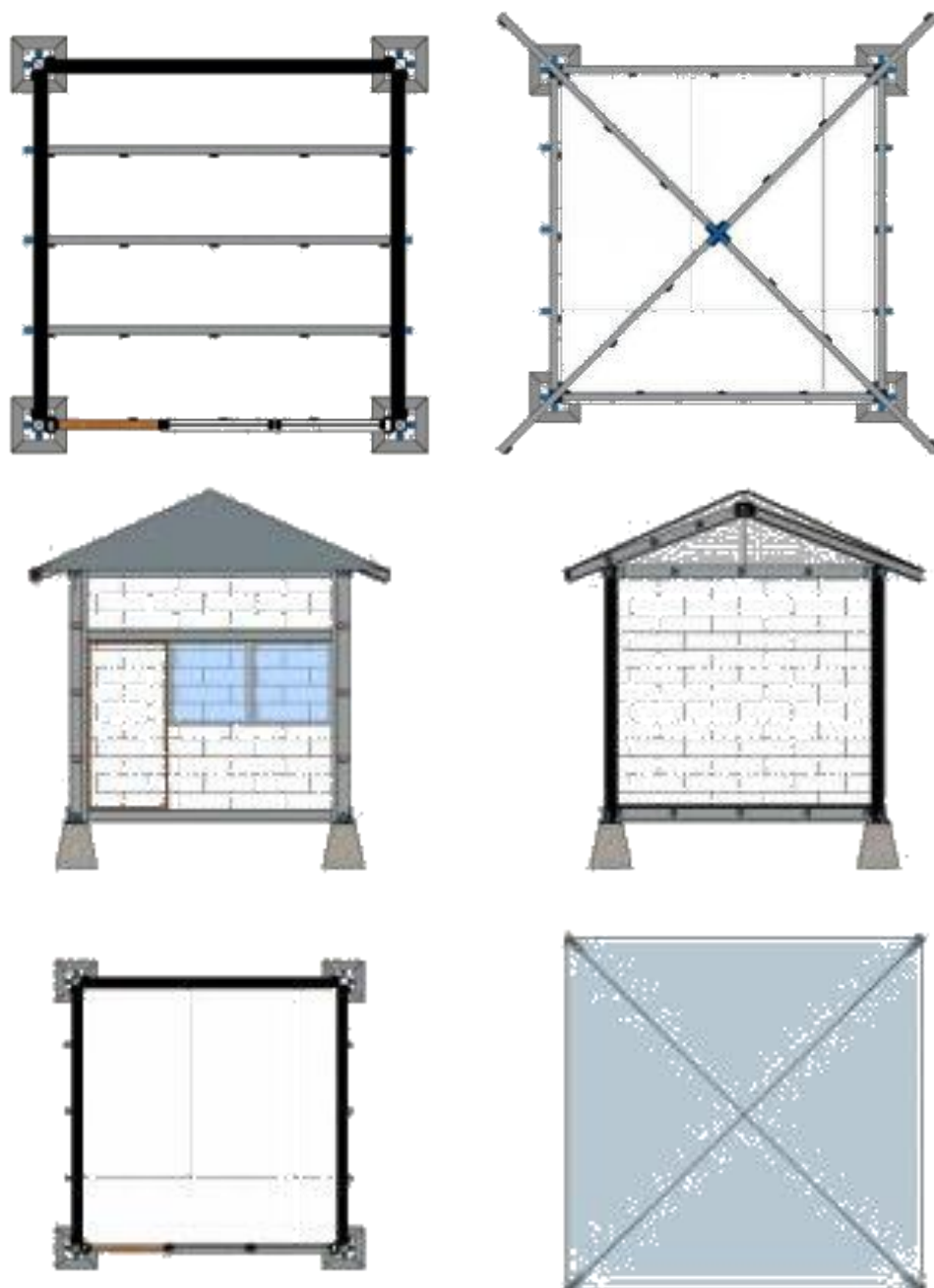
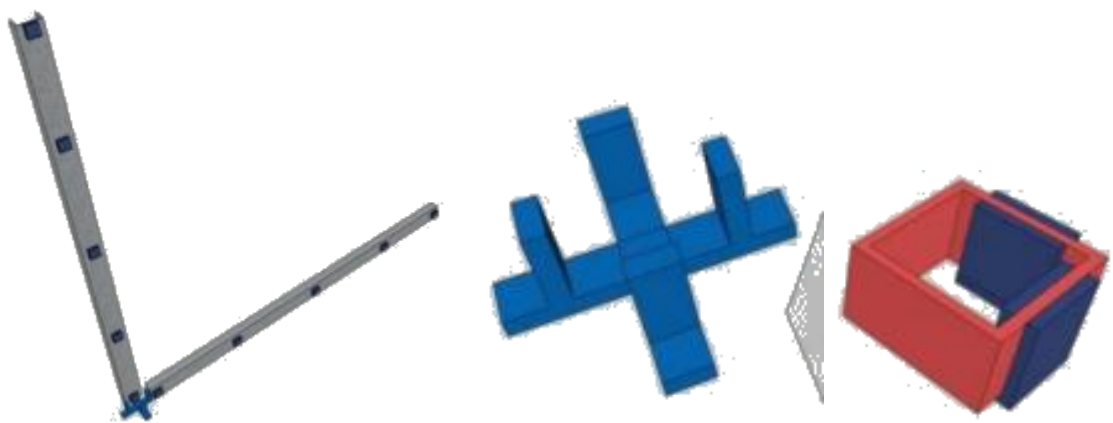


Figure 5. Plans, Views and Sections Principles of RISe-UP design.

The upright side plane cover can adjust to the situation, if in disaster response conditions light materials can be used but if it has entered the reconstruction stage light materials can be replaced with more permanent materials.

The use of rib components, even though they have the same dimensions, can be used for various structural parts. In [Figure 5](#), the image on the right shows the surface covering material using lightweight bricks, which apart from making implementation easier and faster, also does not place an excessive load on the structure. On the lower side, it also uses rib elements and can adjust to the situation. If you are in a disaster response situation, lightweight materials can be used, but if you have entered the reconstruction phase, lightweight materials can be replaced with more permanent materials.



[Figure 6](#). Rib Elements and two node Elements

The Rib Element is the most important in the building structure system of this RISE-Up module unit ([Figure 6](#)), it is the most frequently used element and covers various positions, including; pillars and beams, floor supports, and roof supports. Thus, the use of the modular method is very appropriate in determining this element. By only consisting of one dimension and the addition of hook accessories that are attached at a certain distance, the Rib element is effective.

As a representation of Points as a binder of lines in a volumetric space, in RISE-UP the Gusset element was developed as a binder for the Rib elements. Node Elements consist of 2 types, namely;

1. Buhul-01 functions apart from binding between elements, it can also bind between RISE-UP modular units. The form of Buhul-01 is a special form that adapts the binding ability between elements and between units.
2. Buhul-02 functions to tie together the rib elements in a form that is easy to attach with a hook attached to the rib element.

[Figure 7](#) shows Two RISE-UP Module units combined.



Figure 7. Two RISE-UP Module units combined

Conclusion

RISe-UP can fit at all disaster response stage (Emergency Response Phase, Rehabilitation Phase and Reconstruction Phase) and RISe-UP can be adjusted to permanent house. The development of elements from space forming knowledge is Points and Lines and with the basic idea that one element can be used for several functions, then as an initial stage of research, RISe-UP has produced three main elements that can support modular unit spaces, these findings can be a basis for use development and addition of other appropriate elements. The three are Rib Elements and two node Elements (Buhul-01 and Buhul-02) which are representations of Points and Lines in space. These three elements are still prototype elements that still need to be further explored for function and strength because they will be positioned with various functions that will receive different loads. Modular elements are simple and easy to assemble to minimize installation errors in the field built directly by the general public.

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