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UTILIZATION OF MONGOLIAN TRADITIONAL GER'S SPATIAL CONFIGURATION IN MODERN HOUSINGS

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Abstract

This study investigates the possibilities of utilization and adjustment of architectural characteristics and spatial configuration of Mongolian GER houses for the modern housing settlements . The GER, a Mongolian traditional housing is a portable, round tent with cone-like roofing and covered by skin or felt under canvas and used for the thousands of years as a dwelling by nomads in the steppes of the country. An ongoing migration (began in 1990s) from rural areas to Ulaanbaatar, the capital city of Mongolia formed a GER settlement area which causes the over half of an air and a soil pollution existing according to its urban infrustructureless state. Design concept of a space that has been formed over the centuries provides data for building types such as mass housing for single living people, small families, students, rural to capital migrants of Mongolia, emergency housing for natural disaster victims.

1. INTRODUCTION

The objective of the study is to provide some relationships between design concepts of traditional and modern housing with necessary analysis. The GER and its design characteristics such as internal organization and its directions, function, compact furnishing and ergonomic design in minimum space could be design inputs for modern housing design A literature review of GER housing is being conducted. Moreover, potentials of the modern housing design inputs will be investigated with the data obtained from the analysis of the GER. Optimal design ideas on both internal organization and mass housing design based on the collected data are considered as result of the study.

It was hypothesized that it is necessary to learn from the GER and maintain the features of traditional accommodation design by developing and adjusting the GER internal configuration into modern housing design for further contribution to sustainable development of Ulaanbaatar and other cities in Mongolia. Moreover, it is seen that GER has a concept potential not only for Mongolian housing development, as well as for emergency housing design.

A living environment made by human being has been developing, up to dating, improving or maybe even getting worse in some cases either by sustaining its past tradition and history or removing the existing culture pursuing "new" style of living environment through the history of architecture and urban planning. Cities in Mongolia, generally has composition of 2 different types of settlement. As in case of Ulaanbaatar, the capital city of Mongolia, centrally located duly planned apartment areas are surrounded by "GER district", so called semi-formal, spontaneous settlement area which has been developing under the circumstance of rapid rural to capital migration of Mongolia (Figure 1.1). "GER settlement" areas which called "GER district", consists of both self-built detached houses and the Mongolian traditional GER. In GER settlement, household parcels usually consists of one or more detached houses or GERs enclosed by two-meter high wooden fences (Figure 1.2). Anderson, R. et al. described the GER districts in Ulaanbaatar as "...the site of numerous plans for large scale urban transformation. Ger districts are rapidly growing areas

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named for the felt tents that are considered their typical housing mode" [1]. Households in the area are commonly not connected to infrastructure such as running water, plumbing
and central heating systems.

Figure 1.1. Part of Ulaanbaatar city (URL-1)

Figure 1.2. Household parcels (URL-2)

Almost half of 3 million Mongolian population live in Ulaanbaatar city. "The population of the ger areas is now estimated to make up about 60 percent of the total population of UB (Ulaanbaatar).… nearly 85 percent of ger residents use wood or coal-burning stoves for heating…" to survive in the world's coldest capital, Ulaanbaatar with temperatures frequently drops to -40°C in the winter [2]. Hence the migration and the infrastructural problems related to the "GER settlement" cause environmental degradation, including pollution of air, water, soil and other natural resources. "Air pollution levels of 3,320 μg/m³ (at Baruun 4 zam) were reported - this is 133 times the World Health Organization guideline for the 24-hour mean concentration which is set at 25 μg/m^3, on January 30, 2018, at 05:00 am" [3]. Almost 90 % of the air pollution in Ulaanbaatar city caused by the "GER settlement". Moreover, increasing number of crime and accidents because of lacking basic urban services and health risks and threats, such as respiratory diseases and hepatitis are the urban problems related with the "GER district".

2. TRADITIONAL HOUSING TYPE OF MONGOLIA: "GER"

One of the main constituents of this thesis is a Mongolian traditional GER which has been developed for thousands of years. About evolution of GER, Ch. Ariunaa et al. mentioned that "...the current form of ger had taken shape somewhere between 4 to 3 thousand years ago, in the time of the Khunny" [4]. "The inhabitants of the yurts (from the Turkic languages) are nomad peoples (primarily herdsmen) from Central Asia. As they need to move with their herds from pasture to pasture almost all year around, they developed a typology of house that permits them easy assembling, disassembling and transport" [5]. "Yurt (or GER in Mongolian) has a large tradition. Mongolian yurt, for example, developed from 5th to 19th century", said Oliver, P. [6]. GER, refers "home" in Mongolian, is a Mongolian traditional housing which originally has portable, easy to build up and build down function derived from nomadic lifestyle of nomads in wide steppes of the country (Figure 1.3). It is a circular tent-like dwelling, consisting from cylindrical enclosed area with circular cross section and a cone-like roofing as structure. Roofing has 64-192 poles or rafters (named "uni" in Mongolian) depending on capacity or size of a GER, which connect lattice wall sections ("khana") and roof-ring ("toono") together, and it enables the load of the GER to be landed through the pillars ("bagana") located in the center. Number of latticed wall sections indicate the size of the GER and there are GER types with 4-12 pieces of "khana". The most common used one is GER with 5 "khana"s. Skin or felt envelope which is loaded on poles and lattice wall under canvas is an insulation material of the traditional GER. (Figure 1.4)

Figure 1.3. GER in the steppe (URL-3)

Figure 1.4. Mongol empires setting up camp (URL-4)

2.1. "GER structure"

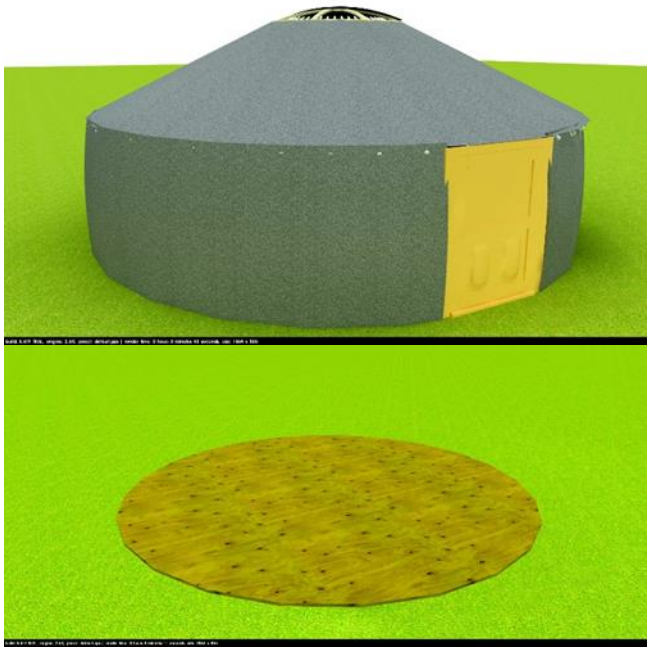


Figure 2. "Shal" (floor)

Its structure divides into several pieces according to the easy transportable characteristic (Picture 3.). Floor area nearly same with area of a GER depends on the number of wall sections or size of a GER.

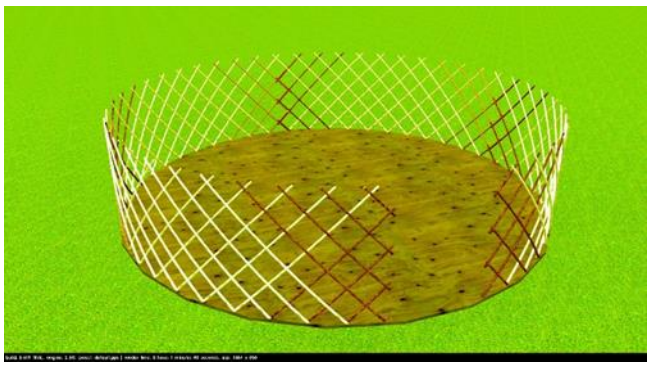
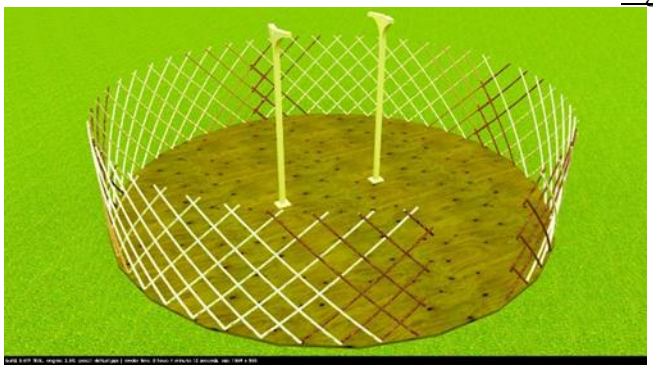


Figure 3. "Khana" (Lattice walls)

GER's circular wall is divided into 4 to 12 sections depending on its size and capacity. Each section is a flexible lattice work. The lattice wall sections of the GER is foldable. During movement it is being squeezed to transport safely on the back of the horse or camel in the past (Figure 3. And Figure 3.). Each section of a "khana" is jointed altogether with straps handmade leather or animal fur (Figure 3.). The lattice wall is classified as "Baga khana" or "Ikh khana" according to its number of heads of each wall sections where poles ("uni") are laid on. "Baga khana" or "Ikh khana" lattice wall sections receive either 13 or 15 poles respectively [8]. "A standard size yurt has five khanas with a diameter of 5.80m, a maximum height of 2.30m and a minimum one of 1.50m, a surface area of 25–28m2, and can accommodate a family of 3–4 members" [8].

Figure 4. "Bagana" (Pillars)



There are 2 or 4 pillars in GER. The most common 5 wall section GER has 2 pillars supporting the roof ring. It traditionally symbolizes equal balance of wife and husband of the family.

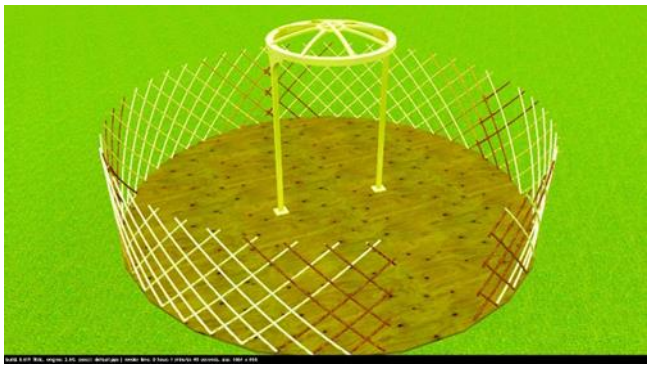


Figure 5. ''Toono" (Roof ring)

This is the top part of the GER which allows chimney to discharge the smoke and to let the sunlight into the interior. "Toono" has a structure which symbolizes sun and surrounded by roof poles as its sun rays. (Figure 3.11.b) Morevoer it laid on centrical pillars below it.

Figure 6. ''Uni" (Rafters)

This is the part connects roof ring with the lattice walls sections. (Figure 3.12) Number of rafters determined depending on the number of wall sections and its size. For example, 5 wall section GER which is a common among folk, there are 81 rafter pieces by multiplying 5 "khana"s with 15 "uni"s and adding 6 "uni"s which lays on the door of the GER.

Figure 7. "Khaalga" (Door)
Mongolian GER door directs to the south traditionally. It receives 6 rafters on it.

Figure 8. "Deever" (Roof covering)
After building up the GER structure, the felt is put above the rafters like shown in the figure 3.

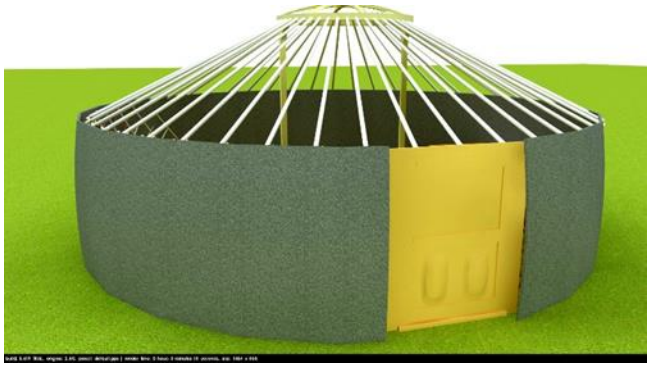


Figure 9. 'Tuurga" (Wall cover)
It is felt, covers the wall.

3. UTILIZATION OF MONGOLIAN GER'S SPATIAL CONFIGURATION IN MODERN HOUSING

Original "GER" houses have all necessary housing functions except only wet area in it and in minimum floor area as presented in the 3rd chapter. In addition to that, constructional characteristics are being suitable for transformable and demountable prefabricated housing which is commonly used structure type for temporary or short term stay. The modernized functional data of "GER" can be used in housing types for disaster (which are earthquake, flood, fire etc.…) victims, refugees, migrants, homeless and low-income people, young couples and families as well as students (dormitory).

Modern houses inspired by GER can be designed in different plan shapes by redesigning the original circular plan of GER into modern houses with a floor plan shape such as square, hexagonal, octagonal etc.(Figue 10.) The circular plan can also be used unless it is not suitable to connect to each other in areas with weather conditions as like as in Mongolia. Moreover, the most important design phase is choosing appropriate plan type of house within its suitable connection to each household units. For example, it is hypothesized that circular plans can be used for singular houses but not in vertical and horizontal developed

planning. In opposite, the other plan shapes can easily articulate to each other in order to obtain mass housing composition.

3.1. Design Proposals of Polygon Plan Types with Inner Furnitures

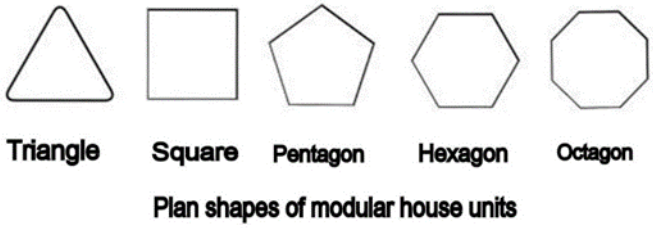


Figure 10.

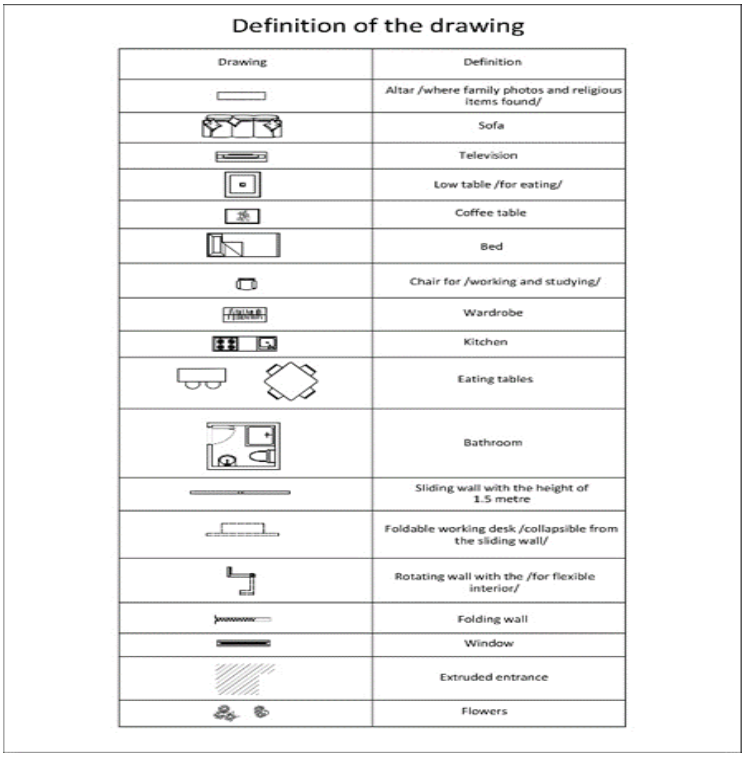


Figure 11.

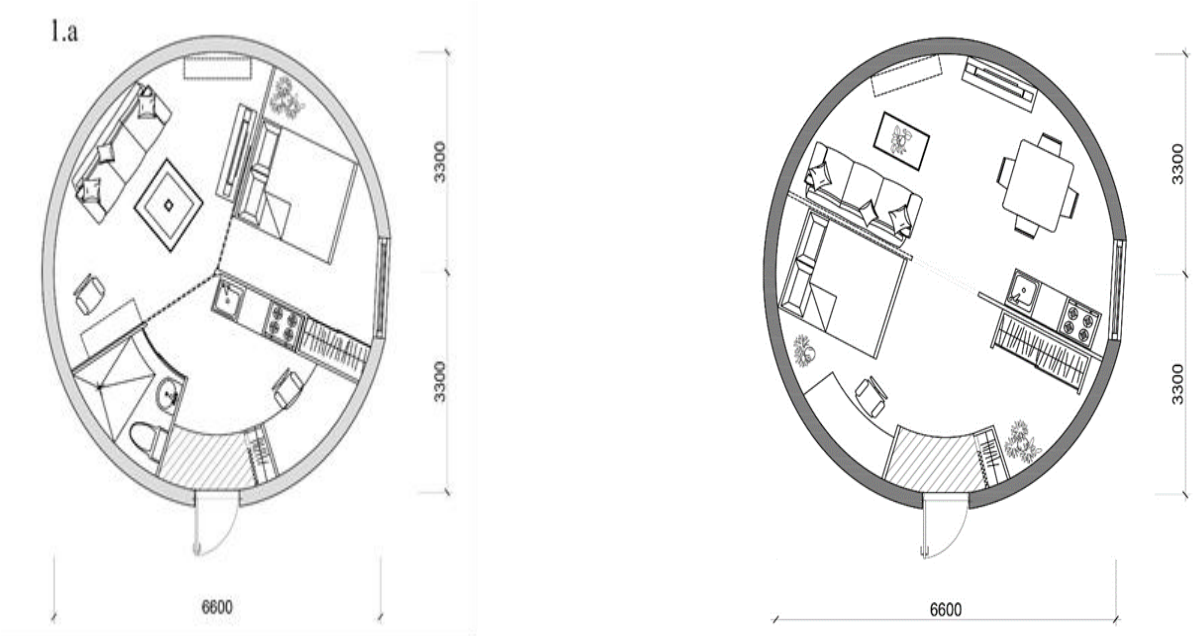


Figure 12. Circular plan type
a. With wet area
b. Without wet area

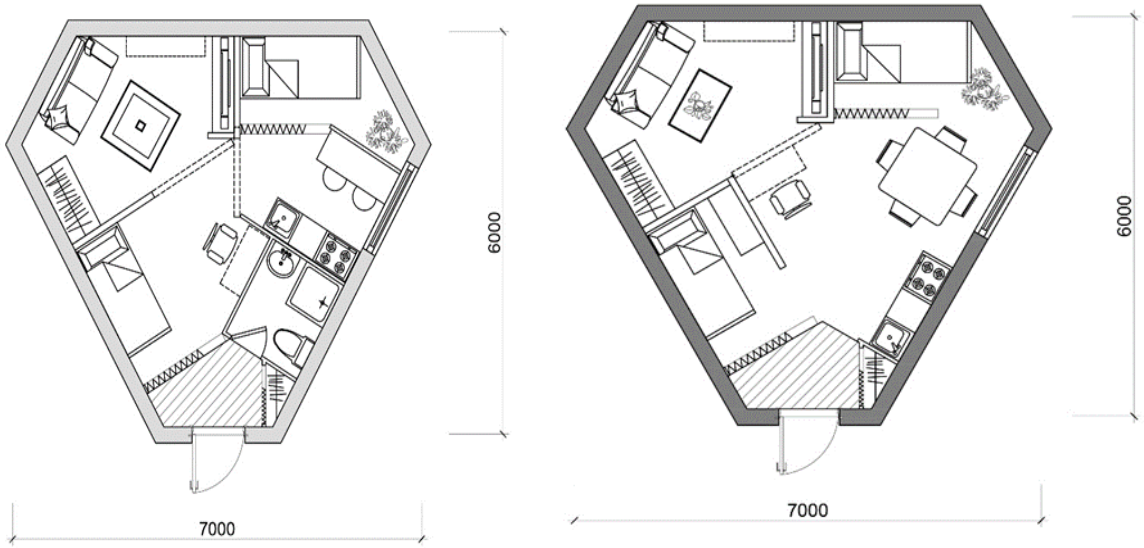


Figure 13. Triangle plan type
a. With wet area
b. Without wet area

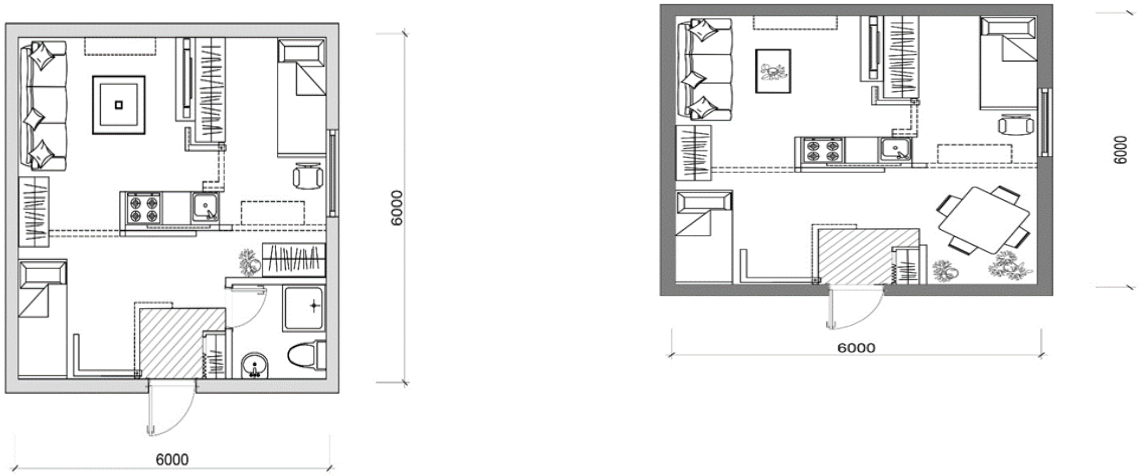


Figure 14.Square plan type
a. With wet area
b. Without wet area

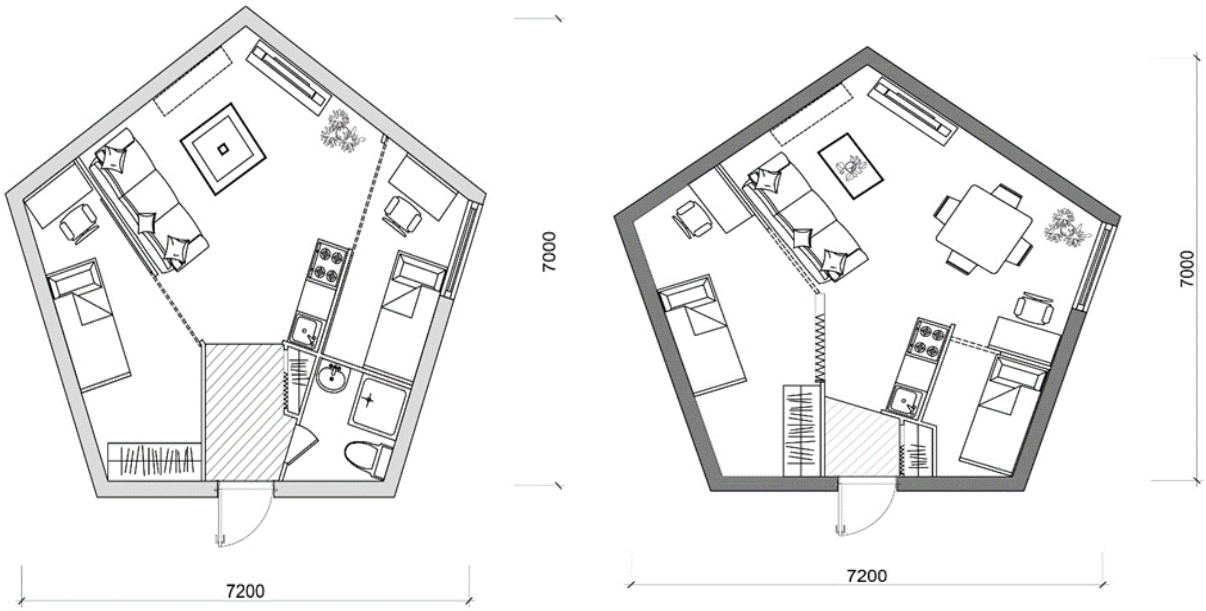


Figure 15. Pentagonal plan type
a. With wet area
b. Without wet area

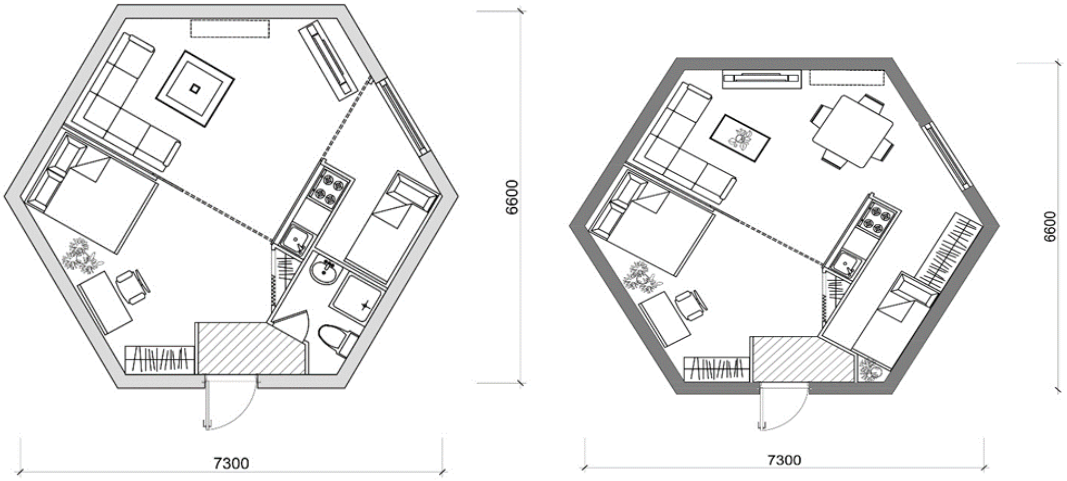


Figure 16. Hexagonal plan type
a. With wet area
b. Without wet area

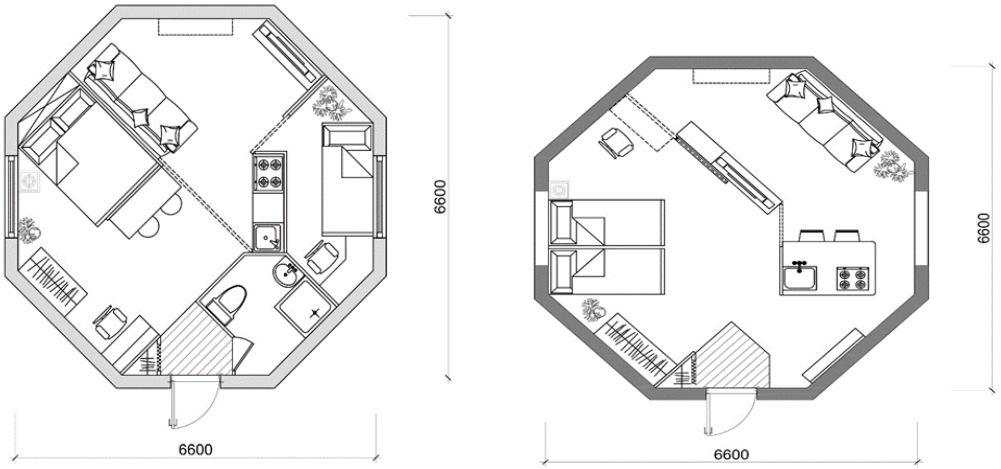


Figure 17. Octagonal plan type
a. With wet area
b. Without wet area

3.2. Vertical and Horizontal Development of the GER Inspired Housing Units

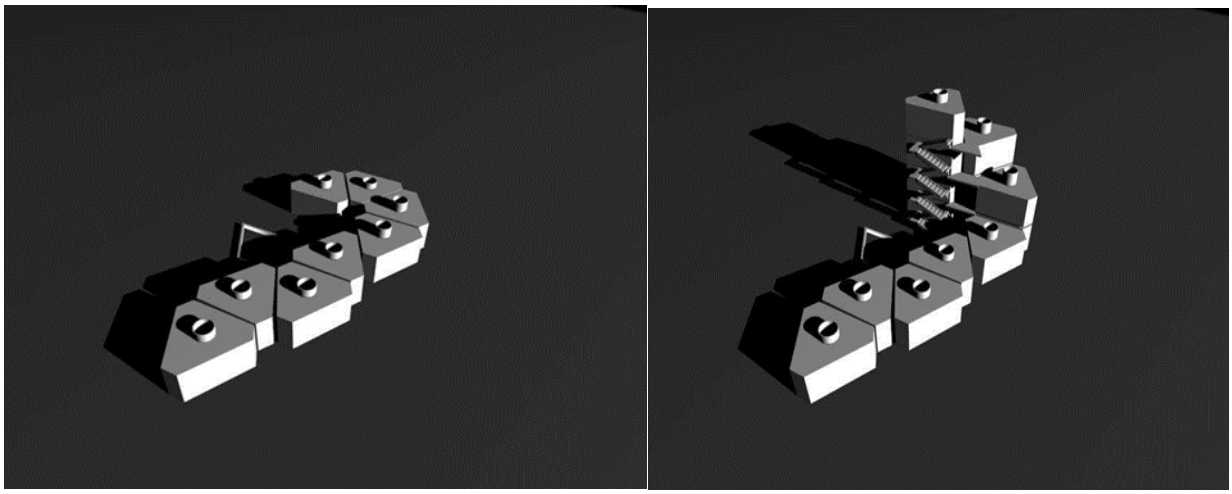


Figure 18. Single and multi storey composition of triangle units

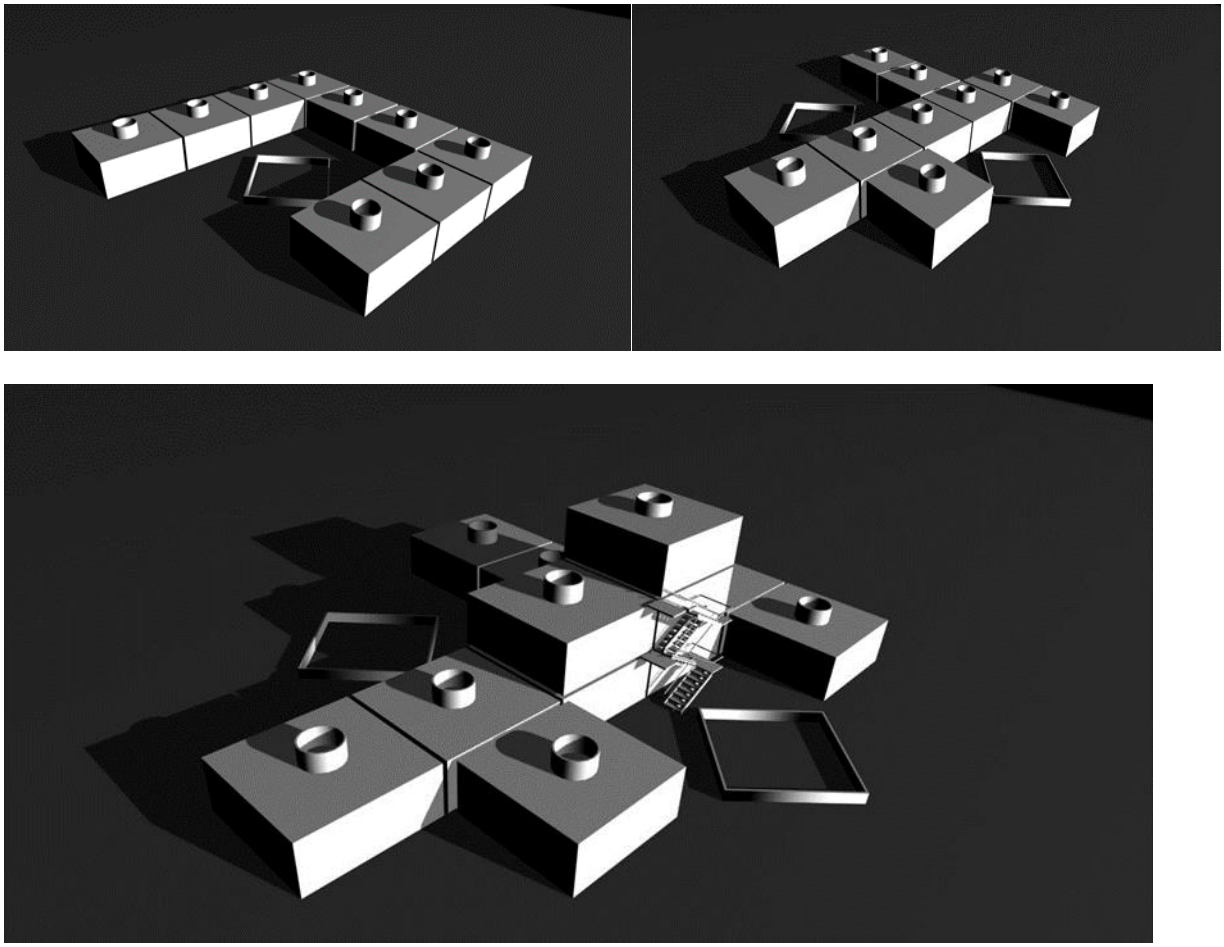


Figure 19. Single and multi storey composition of square units

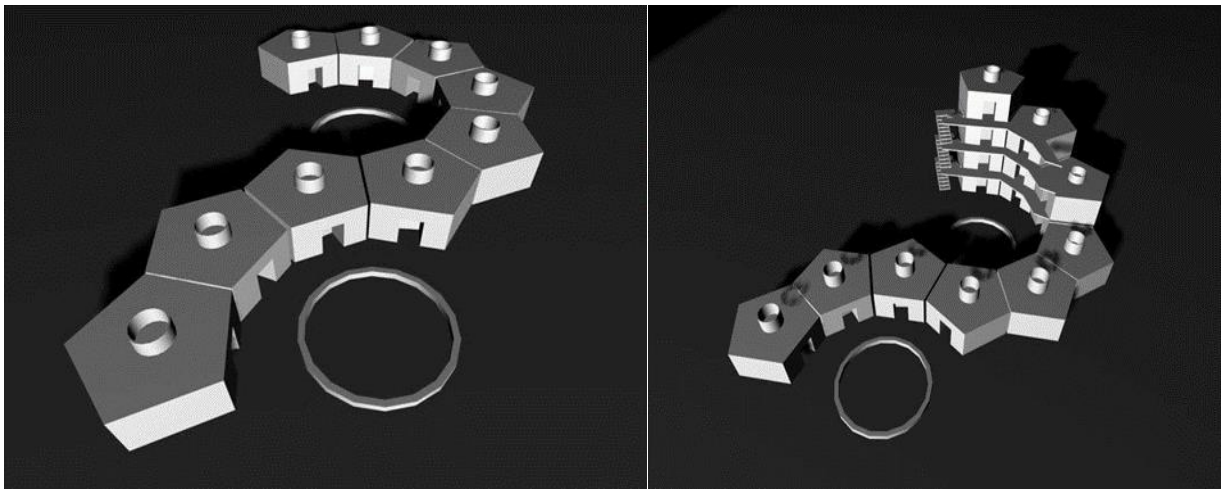


Figure 20. Single and multi storey composition of pentagonal units

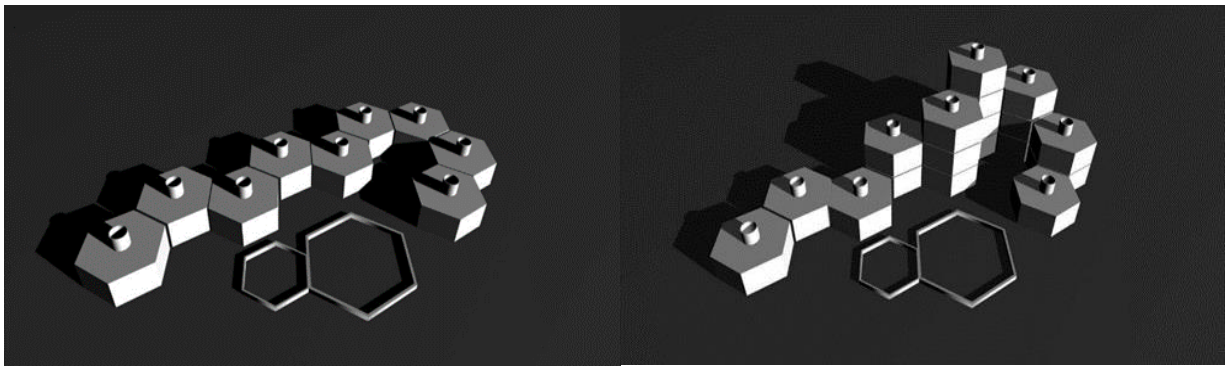


Fıgure 21. Single and multi storey composition of hexagonal unit

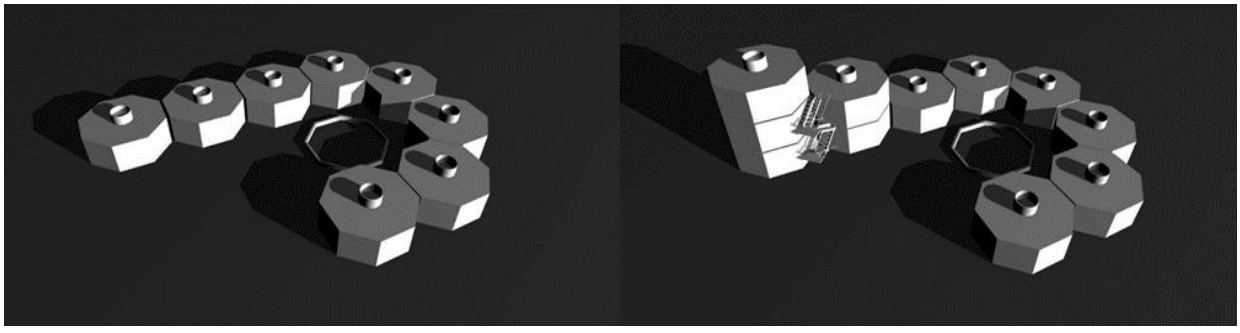


Fıgure 22. Single and multi storey composition of octagonal units

4. Results and Conclusion

The traditional gers are sustainable structures very well adapted for a nomadic society but, when they are located in high-density, unplanned, informal settlements they create many issues. These informal urban areas lack sanitation, adequate vehicular access and other basic services. This research investigates suitability of GER settlement in the capital city, where GER itself is originally harmonious in the vast steppe of Mongolian nomadic lifestyle. Moreover, the most important and main characteristic of Mongolian GER is the breathable, natural insulation material for the shell. Could GER remain this characteristic and other advantages in a urban city or could it have the most developed version in its evolution in 21st century. The architectural issue of this portable dwelling still remains as one of the challenges to be addressed for researchers. Today, Ulaanbaatar appears to be air polluted, condensed, stuck in traffic due to untidy and disorganized urban planning. GERs in the settlements of Ulaanbaatar are struggling to fit into a base surrounded by four sacred mountains instead of moving across potential land of Mongolia like they used to.

This study introduces the knowledge and description of GER as Mongolian architectural heritage and symbol of the nation's tradition, not GER as tent and "GER settlement area" as slum or informal settlement type.

GER houses are commonly used dwelling in Mongolia for thousands of years. The main characteristics of a GER are:

Mobile and demountable feature of the dwelling. The GER consists of structural parts - timber lattice wall structure, timber roof beams and textiles such as leather, felt or canvas are used for the purpose of outer shell. Mongolians can carry the parts of GER in vehicles or on back of horses or camels and then reattach the parts in order to establish their houses after their movement from pastur to pasture.

Next main characteristic is that GER contains all housing functions in it. Living, resting, sleeping, hosting guests, preparation of food, cooking, dining, washing the dishes, taking shower, entertaining and working functions are being held in a single space.

In this study, the above mentioned characteristics of GERs are examined. After analysis of the GER, it was considered that these characteristics can be used in contemporary buildings. For example, emergency housings (for immagrants, earthquake, storm, tsunami victims), social housing for single living people or small families, student dormitories and Mongolian rural to capital migrants etc...

For the above mentioned purposes, deformation and adjustment were held based on the analysis of the functional, structural and urban community study of the GER, in third chapter. GER internal function and space configuration adjusted into 6 varies geometrical plan shapes which are circle, triangle, square, pentagon, octagon and hexagon. Each plan type designed in two alternatives (including wet area and excluding the wet area), in original proposal of this thesis in fourth chapter. According to the mobile structure of GER, it hypothesized that prefabricative modular panels can be used for the further mass production of the design. It is not only for migrants of Mongolian rural to capital, it is considered that it can accommodate natural disaster victims which is a worldwide architectural issue.

In addition to that, it studied that the repitation of these units of geometrical plans in order to obtain house clusters (community/neighbourhood settlements). It was seen that utilization of GER's spatial configuration into modern housing types is possible and has potential to provide new design hints and guidance in new mass housing concepts, to students and architects who regarding the GER in Mongolia and all around the world.

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